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Changing the scientific approach to fast transitions to a sustainable world

Improving knowledge production for sustainable policy and practice

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Summary

The 2015 agreement setting forth the UN Agenda 2030 for Sustainable Development Goals (SDGs) is an important achievement that poses complex and demanding challenges. To adequately address them, judgments must determine contextually and culturally appropriate balances between independently valuable, but often conflicting targets (Singh et al. 2018). Simultaneously, a global coherence across local and regional actions must be ensured, so that local efforts do not destructively interfere with each other, nor overstep limitations in the resources of the planet (Randers et al. 2018).

The Global Sustainability Strategy Forum (GSSF) responds to the fact that, after some 40 years sustainability science has produced many insights, but has not really affected our collective behavior with respect to its impact on the environment. Generally, that is deemed to be the result of lack of communication between scientists and the outside world. But might it be that the present practice of science is in itself deficient in producing results that are useful to implement the changes called for?

The Forum was established in 2018 with funding from the VW Foundation to identify and address sustainability challenges at the global to regional scales by bringing together, in week-long workshops, renowned experts in sustainable development and thought leaders in business, government, and civil society from around the world.

Under the patronage of Prof. Dr Rita Süßmuth, former President of the German Bundestag, the first Forum was coordinated by Solène Droy with assistance from Paul Skaloud. Moderated by Ilan Chabay (IASS), Sander van der Leeuw (Arizona State University), Ortwin Renn (IASS), 14 panelists¹ convened in Potsdam (Germany) 4-8 March 2019.

Eight main lessons emerged from in-depth discussions and reflections towards the end of the forum. They capture some of the main approaches deemed as necessary for science and society to counter patterns and trends of unsustainability and are outlined in this paper.

The results were subsequently discussed at the Inland Department of the Office of the German Federal President, addressing fundamental challenges rarely discussed directly at such a high political level. Discussion ranged from tensions between the complexity of the issues and the urgency of the challenges, such as societal acceptance of change, and on the emerging role for compelling plausible visions to inspire and guide sustainability transformation.

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The expert panel will expand to include decision-makers from business, politics, and civil society to consider strategies for implementation within regional and sectoral contexts.

The approach the GSSF develops draws upon indicators and other information to create evidence-informed expert judgments on strategies for implementation of socially just transitions toward sustainable futures at multiple spatial and temporal scales. Of course, the changes required include strengthening and expanding dialogues between scientists, policy makers, business, and civil society; unbiased consideration of diverse sources of knowledge; the substantial refocus of education in an effort to make the central ideas accessible across all ages and segments of society. But that is not enough – the focus of sustainability science itself must be changed to deal with the core issues regarding our current societies’ impact on the environment.

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1. Introduction

Humanity has entered a stage where the integrity of our global environment and our own existence are in clear and present danger. The world currently experiences the simultaneous unfolding of two major transformative trends – globalization and digitalization - and the aspiration for a third: sustainabilization. These are in different stages of their development. The interaction of these three global trends as well as major counter trends has the ability to profoundly change the socio-economic and environmental systems upon which our survival depends.

Consequently, the scientific community (broadly encompassing social science, natural science, and humanities) is faced with a fundamental responsibility that has both an internal and an outward-facing aspect. The internal aspect concerns the conception, organization and reward structures of research and education to facilitate effective interdisciplinarity and the capacity for addressing complex system issues. The external aspect is a substantive engagement in mutual learning with policy-makers and practitioners in business and civil society as well as the broad public. The evidence-informed dimension is critical in such mutual learning. The science community must engage with other parts of society in comprehending these processes of change, in designing strategies for change and in catalyzing pathways to far-reaching and fundamental transformations at global to local scales. An important part of that process is understanding and supporting transitions from current, partially long-standing, unsustainable practices to more sustainable pathways. For example, this means understanding the impacts on the planet and society of the enormous physical and economic infrastructure related to fossil fuel use and developing comprehensive and contextually appropriate ways to phase out fossil fuels and incorporate renewable energy systems. This requires a profound change to integrative research methods so as to make them well suited for understanding, predicting and modifying complex systems to address issues such as posed by the UN Sustainable Development Goals (SDGs), and simultaneously building up the requisite educational programs and institutions to prepare scientists and scholars to address the complex systemic challenges of the future.

To address these challenges, the Institute for Advanced Sustainability Studies (IASS) and Arizona State University launched the “Global Sustainability Strategy Forum” (GSSF) with financial support from the VW Foundation. It is a three-year project that may be extended, aiming to develop evidence-informed judgments on challenges and solutions. It views attaining sustainability as a set of closely-coupled societal and environmental challenges and opportunities that require integration of multiple disciplines, new research methods, and new knowledge sources with sensitivity to regional and cultural diversities. The project is designed to produce innovative insights and strategies to support effective governance of transitions to sustainability of our complex global social-ecological system within its inherent resource limitations, and to develop sustainable lifestyles that are practical and appealing in the different regions and cultures of the world.

The present paper is the product of the reflections of the kick-off forum that took place from 4 to 8 March in Potsdam, Germany. It has been prepared by the forum conveners, the project manager and project assistant and was enriched by the feedbacks and comments from the invited members of the forum.

1.1 GSSF Objectives

The GSSF pursues five main objectives:

- To promote evidence-informed judgments for an effective, efficient, timely and socially just transformation toward sustainable futures;
- To contribute sufficiently robust knowledge for decision-making and for initiating informed actions on sustainability, including recognizing and acknowledging the challenges and then assessing, weighing, deciding, and monitoring the implementation of policy and practice; the implementation of policy and large-scale action has to be left to the stakeholder community;
- To provide regional distinctions, taking into account political, economic, and cultural contexts;
- To think creatively beyond the indicators and targets defined by the SDGs to improve implementation of policy and practice and to learn to design for change, rather than for maintaining the status quo;
- To catalyze self-reflection by scientists on changes needed in the role and process of science and of scientific expertise in transformative processes. What changes are needed in our scientific approaches to improve both our understanding of the conundrum and the scientific contribution to the sustainability transition?

The immediate outputs of the first GSSF are this Synthesis Report and a White Paper. Both are science-policy-practice papers gathering the most important results from the first forum, as well as implications for sustainability science and recommendations for action.

1.2 GSSF Process

For its kick-off meeting, from 4 to 8 March 2019 in Potsdam, Germany, the forum has brought together 17 eminent academics from all continents and a wide range of disciplines to lay the groundwork for this ambitious effort:

- Xuemei Bai - Professor, Australian National University, Fenner School of Environment and Society, Australia
- Belay Begashaw - Director General, Sustainable Development Goals Centre for Africa, Rwanda
- Marcel Bursztyn - Professor, University of Brasilia, Brazil
- Carl Folke - Scientific Director of the Stockholm Resilience Center, Stockholm University and Director, Beijer Institute of the Royal Swedish Academy of Sciences, Sweden
- Kensuke Fukushi - Professor and Vice Director, Institute for Future Initiatives, The University of Tokyo, Japan
- Joyeeta Gupta - Professor of Environment and Development in the Global South at the Amsterdam Institute for Social Science Research, University of Amsterdam and IHE Institute for Water Education in Delft, the Netherlands
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- George Safonov - Director, Centre for Environmental and Natural Resource Economics, Russia
- Peter Schlosser - Vice President and Vice Provost of Global Futures, Arizona State University, USA
- Coleen Vogel - Professor, Global Change Institute, University of the Witwatersrand, South Africa
- Yongsheng Zhang - Senior Research Fellow and Chief Expert on Green Development at Development Research Center of the State Council (DRC), People's Republic of China
- Professors Ortwin Renn (Institute for Advanced Sustainability Studies (IASS)), Potsdam, Germany, Ilan Chabay (also IASS), Sander van der Leeuw (Arizona State University) are the conveners of the forum.
- Solène Droy (IASS) is the GSSF Project Manager. Paul Skaloud (IASS) supported the organization of the forum.
- The patron of the event is Prof. Dr. Rita Süßmuth, former President of the German Parliament (the Bundestag).

Throughout the forum's activities, the experts seek evidence-informed insights, normative reflections, and strategic recommendations that will constitute elements of a white paper on sustainability trends and implementation pathways for both global and (macro-) regional levels.

The first forum consisted of 5 days of deliberations. It was organized as a sequential construction, each day corresponding to a further step of an elaboration process. The first day focused on finding a common understanding among the experts on the purpose of the first forum and of the entire project. The second and third days focused on the current status of efforts to implement sustainability, looking at trends and challenges that hinder sustainability or lead to unsustainable pathways, as well as the potential of trends and levers to overcome barriers to sustainable development. The fourth day involved an effort to locate the expert group's discourse particularly on generating a better understanding of the need for new approaches in the sciences and humanities to address sustainability issues more holistically and effectively. The last day was dedicated to articulating the need for and approaches to improving the dialog between science, policy, and practice and to formulating the group's main messages. Professor Rita Süßmuth provided valuable reflections on creating an effective platform and process for stakeholder dialogs for transformative solutions.

The second forum in October 2020 will expand the circle of scientific experts to actors from the policy, business and the civil society. The organizers engaged with different political institutions in Germany, including the Office of the Federal President in Berlin. The latter invited the GSSF conveners and project manager to a meeting to present the output of the first forum (see section on impacts).

1.3 Interdisciplinarity and inclusiveness

One of the essential features of the forum was the inclusion of many scientific disciplines and traditions. The natural, technical, economic and social sciences were well represented. One representative of the humanities was also present. During the forum, small working groups were composed such that each group had more than two disciplines represented. The interdisciplinary nature of the group compositions left its mark in the groups' reports, reflecting multiple perspectives. Inclusion of younger and early-stage researchers was also one of the major criteria when recruiting the members of the forum, as well as a good gender and regional balance.

1.4 Innovative approaches

At the core of the project is a novel process of bringing evidence-informed judgments of strategies and trends in sustainable development on regional to global scales into extended expert dialog. GSSF is also innovative in considering not only the challenges of understanding and implementing transitions to sustainability, but also the profound changes needed in the methods, practice, integral relationship to society, and education in science to be able to address effectively the complex systemic transformations of society.

GSSF seeks to facilitate and strengthen connections between scientists and policy-makers and practitioners in order to make scientific knowledge and understanding accessible and useful in the development of policy and practice for sustainability. To foster transformative change to sustainability, interdisciplinary and transdisciplinary science methods for co-design and co-production with societal stakeholders of policy- and practice-relevant and accessible knowledge are essential. In addition to scientific knowledge, there are other concerns and viewpoints, in particular values, preferences and interests, which play a legitimate role to play in policy-making. This is captured by the term “transdisciplinarity”, which brings together multiple forms and sources of knowledge, including non-formal knowledge (e.g., local, cultural/traditional, tacit, procedural) in an integral contribution to decision-making.

However, even with the best available science and humanities knowledge, there are inescapable lacunae, uncertainties, and ambiguities in the available knowledge. The incompleteness and uncertainty of knowledge can be addressed (but not eliminated) by the use of expert judgment and interpretation of existing knowledge. This is a central aspect of the GSSF approach, because judgment or interpretation transforms a generic piece of information into knowledge of specific relevance and value to its context. Science advice should inform the process of balancing arguments, identifying conflicting values and exploring possible trade-offs. This is closer to the needs of decision makers when preparing their policies. This focus on judgment also necessitates different uses of evidence, including causal inference, value orientation, strategy and catalytic impetus for change.

Yet these methods for moving toward sustainable futures in the complex socio-ecological systems of the world are not represented in the work of most scientists and scholars. This raises the question which changes are needed in learning across people’s lifespan, and in education in universities, to better prepare society and nascent scientists and scholars for an effective engagement in inter- and transdisciplinary research and actions.

The forum is developing sustainability strategies based on evidence-informed judgment in an integral process of designing for change. Though indicators and development targets are very important and useful, they have no normative power. They can only be used to inform the discussion on sustainable development. This clearly implies that scientists need to interpret the information available in the light of the challenges and that indicators and targets, including the SDGs and integrated assessment models, must be used with careful attention to their scope and limitations. The following two points on indicators are emphasized:

- An important common quality of indicators is that they provide aggregate statistical snapshots at particular times. However, they are unable to address the social, political, and environmental or ecological bifurcations of societal processes underlying these indicators, which sometimes occur dramatically over short-time periods. That is, most indicators are snapshots of a "state" of the system at some time. They do not contain information directly about process dynamics. Indicators of system dynamics may become available and would be valuable in further elucidating how strategies for implementing the SDGs are progressing.

- Indicators provide measurements between a benchmark on a specific criterion and the measured performance with respect to this benchmark. This measurement does not include contextual conditions such as the necessity to navigate between conflicting goals, to take into account physical, social and cultural constraints or interactive effects between a variety of parallel activities. Furthermore, the indicators often reflect goals that were set from an abstract, global perspective, disregarding the local circumstances in which changes have to take place.
- The differences among sustainability indicators for different regions and countries forms a major challenge in assessment, as certain indicators are carrying more weight in some locations than in others.

The GSSF is not about competing on how to formulate even more ambitious goals surrounding the future of sustainable development, but about making the effort to commit to these goals and the necessary step-by-step changes that they require. Otherwise, they remain empty rhetoric.

The GSSF also considers different strategies for differentiated social and cultural contexts:

- It is not about delivering quick, “off the shelf” practical solutions, it is in the process of co-developing transformative solutions within a multi-actor perspective, emphasizing processes and pathways that lead to sustainability solutions.
- This needs to be done at multiple scales. Those scales are not seen as dependent on each other. Specifically, the experts look at global scales that can be instantiated at sub-global scales at which differentiated solutions can be designed, all the while maintaining coherence at a global scale.

Ultimately, the GSSF proposes an enhanced way to comprehend change and tries to answer the question: how can the link between science, policy and practice be made effective to be used to design for change? Usually, one tries to control change to obtain stability. Instead, change should be taken as a given. It should be recognized that change offers opportunities, not just challenges. With the rapid, accelerating, and critical changes in the social and planetary conditions, continual and persistent change is and will be the basic challenge confronting humanity. Learning to anticipate, recognize and accept changes is essential. This allows us to learn how to design for change with new conceptual and operational methods, including complex systems approaches, inter- and transdisciplinary research, and commensurate changes in educational institutions and processes across ages and societies.

1.5 Observations and results

A main purpose of the forum has been to move beyond the indicators of sustainable development and to focus on the context and the specific challenges in each region for developing effective and fair strategies for the desired transformations. This includes a process for identifying the specific circumstances and side effects of human interventions in different environments.

For this, the group was asked to identify the most important trends globally and regionally, to analyze the opportunities and barriers to sustainable transformations, and to suggest potential strategies to find better solutions.

2. Trends and challenges that hinder progress toward sustainability

The forum identified and discussed a number of ongoing trends, some already well-recognized, that individually or collectively seem to hinder efforts at reaching a more sustainable state of the Earth system. These trends manifest themselves in many different sectors of society and at multiple scales.

2.1 Increase in inequality

Much attention has been paid in recent years to the wide (and in many places increasing) economic gap between the rich and the poor in societies, particularly since the 1980s. This gap in income and in wealth, as measured in GINI coefficients, could well be termed a major contributor to a societal “planetary boundary”. If the processes driving it are allowed to proceed, in due time there will be major societal convulsions as a result. The wealth discrepancy currently gives more and more concentrated power to very small groups in society who can block progress toward sustainability, which they view as leading to a reduction of their power.

An important corollary of this process in many societies is the restriction of upward social mobility. This is caused not just by economic inequality, but by the way in which the environment is altered by the wealthy and powerful to a degree that it affects the climate, land, and water quality for the poorest.

2.2 Unsustainable consumption and production

Stimulated by the competitive ideology that is at the root of the “free market” philosophy, the last century and a half has seen an almost universal drive toward benefit maximization by increasing efficiency and productivity, reducing cost, globalizing markets and a host of related shifts in production and consumption. This trend inevitably provokes a growing instrumentalization of nature (seen as “natural resources”), inevitably leading to environmental degradation.

There is a counterproductive focus on efficiency and benefit maximization at the expense of seeking comparative advantage through long-term strategic thinking or differentiation. In the process, people and societies have increasingly become focused on “wealth” as the only dimension along which they can be compared, to the detriment of other, social and environmental, dimensions of human existence. Over the last fifty years, both the economic cycle and the news cycle have become very short-time focused. Possibly due to the impact of unintended consequences that make planning more difficult, but also due to structural changes (for example three-monthly reporting for business and the ICT-driven 24-hour news cycle). This has shifted much decision-making from strategic to tactical, and has therefore reduced the importance, in many people’s minds, of the long-term vision that is necessary to attain sustainability.

2.3 Loss of collective and cultural identities

In reaction to the growing tendency toward homogenization of societies across the world, there is an emergent trend that resists its globalizing effects. Whether labeled “extremism”, “populism”, “parochialism” or “nationalism”, this trend aims to strengthen values other than “wealth” and its manifestations. In many cases, it manifests itself as an emphasis on actual or imagined earlier, more local, values and a disconnect from the values of globalization. This can be seen either as a step back from ongoing economic and technological progress and the values that come with it, or it can be seen as the emergence of a multi-polar world that can offer different forms of sustainability, based on different values, at different spatial scales.

Most of societies’ institutions and values, as well as their ways to interact with the environment have evolved over long-term time, as it takes a substantive amount of time for populations to be aligned around specific values and norms or to function around any set of institutions. Hence, institutions and values have a tendency to maintain the status quo unless forced otherwise, and it is difficult to change them at a pace commensurate with the rapidity of global change. In our globalizing society the concept of good life is based on mass consumption. That dominant culture, its world views, beliefs and values shape trends, in this case toward unsustainability.

2.4 Inadequate capacity for strategic complex systems thinking

The massive information overload that is currently flooding our minds and our societal institutions and systems, and the multiplication of independent sources that are producing information, in effect are fuzzing, at the scale of societies, the distinction between signal and noise, and making it difficult to design and implement widely acceptable policies. This is leading to the incapacity, among many institutions, of making strategic decisions as they can no longer evaluate risks as they used to. In many cases, this leads to either indecision or the adoption of traditional, conservative policies.

Added to this, the increasing complexity and interactivity between different sectors of society, and rapid changes in and around all societies (due in part to extremely rapid technological evolutions), are making it more and more difficult to comprehend and assess the dynamics in which our societies are involved. Change is often so rapid that there is not enough time to understand the dynamics, the forward and backward linkages and feed-back and feed-forward loops in systems, and a chance to be critically reflexive, let alone to design effective solutions.

Those trends all have the potential to prevent, hinder or delay transformations toward sustainability.

3. Countering patterns and trends of unsustainability

The first major task is to better understand the impact and interaction between globalization, digitalization and sustainabilization:

- The forum offered a number of suggestions on how to characterize or classify current transformation processes. From our point of view, the current developments in politics, society and the economy can be linked to three major globally effective processes: globalization, digitalization and "sustainabilization". These three dimensions of global change run parallel to each other and reflect almost everything that shapes the current global trends. In contrast to earlier periods of major transformation, current major changes are characterized by their global scale and rapidity, as well as by the synergies and contradictory trends that are occurring simultaneously.
- These three waves of transformation cause fractures, contradictions and, above all, conflicts among themselves and with each other. This is particularly the case for the transformation toward sustainability, as called for by the Sustainable Development Goals (SDGs). Although many of the goals of sustainability are focused on environmental impacts, such as the protection against harmful and climate-damaging emissions or the protection of ecological diversity on land and in the water. In many instances, these face economic and political resistance. In fact, the challenge is to find approaches that help us achieve multiple objectives (economic, social and environmental) at the same time. Designing such approaches and then working toward their implementation is the "strategy" of the GSSF.
- Globalization is, to some extent, a typical feature of the traditional industrialization-based development paradigm that relies heavily on economy of scale, mass production, mono-production, monoculture, and mass consumption, while sacrificing diversity and quality of life. This is a fundamental reason why the worldwide anti-globalization wave is emerging. Thus, globalization is part of unsustainability.
- As with many transformations, globalization has the potential to provide positive as well as negative impacts and it is a matter of deliberate design and policy-making to focus on policies that enhance the benefits and reduces risks and problematic developments. For example, globalization provides many opportunities for countries to be part of the world trade system. It thus acts as a facilitator in setting global ethical standards in economics and politics, supports global communication and interchanges and allows comparative monitoring throughout the world.
- Turning toward sustainabilization, the traditional division of environmental, economic and social sustainability tends to hide, rather than highlight, the emerging trade-offs between the three dimensions. What is considered to be socially sustainable, such as the fight against poverty, requires decreasing the drive toward wealth creation that in turn, has overwhelming impacts on environment, climate change, and inequity.
- Furthermore, sustainabilization can be in alignment or in contrast to the other two major transformations. Digitalization can support sustainability through, for example, smart grids, but it can also hinder it by promoting packaging and long-distance transport of goods through e-commerce, which can be an invitation to excessive consumption, as well as a means of mis-informing citizens and mis-directing policy. The same conundrum applies in the relationship between sustainability and globalization: on the one hand, sustainability

benefits from global norms and standards, such as the WTO (World Trade Organization) or the ISO (International Standards Organization); on the other, principles of sustainability are violated across the various dimensions of globalization by, for example, the growing carbon footprint of global supply chains, ecological depletion, and increasing social inequality.

- Precisely because several, sometimes contradictory, transformation processes with disruptions and conflicts take place in parallel, the role of transformation-oriented research is particularly critical.
- The central question is not how humans can co-exist with nature. There is no objective recipe book for making the world sustainable and appropriate for the diverse contexts and cultures of the world. Rather, it is up to the different societies to define their relationship to the environment on which they depend. Societies frame and prioritize the problems they face and the solutions of value to them. Nonetheless, there is also the critical need to bring into global coherence all the individual culturally and contextually developed pathways to sustainability.
- Research is therefore needed that focuses on understanding how societies manage in their own context and how they can design appropriate and feasible strategies for making their transformations toward sustainability more robust.
- Researchers have to accelerate the pace of their research to advance the basic understanding to a fuller picture but also have to immediately begin translating incomplete knowledge into the solution space.

The second task is to better comprehend the impact and role of the Digital Revolution:

- The growth of digitalization and ICT brings both powerful positive developments and negative destabilizing features.
- On the positive side, we can see a vastly expanded access to information on health, agriculture, economics, banking and the financial sector with huge impacts on the conduct of lives in previously isolated areas. The improvements in remote sensing, mapping, data analytics, and modeling have increased the opportunities and impact of science.
- Of great concern for potential negative are the outpacing of the capacity of widespread populations to understand the “black box” systems they are using and thus their dependence on a small, wealthy, technological elite. This leads to major concerns with rapidly increasing power- and resource inequities. This also leads to an increasing sophistication and proliferation of manipulative and misleading information sources with strong ideological biases and the concomitant lack of effective control and trust.
- A long-term constant monitoring of the role of ICT in accelerating societal change and conceiving the ways in which it can be used in moving toward sustainability in a democratic and just manner is urgently needed.
- Effective strategies and creativity are required to leverage the potential of digitalization to support adaptive learning and critical thinking across the lifespan. This includes education in the assessment of validity and value of information that may negatively impact political and administrative decision-making.

The third task is to increase efforts in collecting, unpacking, and supporting narratives for collective behavior change to sustainability:

- The need to identify narratives of vision and imagination of social identity that relate to sustainability in local or regional contexts; characterize the context, function, and affective power of the narratives; support and amplify positive narratives. The core ideas are valuable

in many instances, but they must be expressed in terms that resonate in the target communities.

- The need to identify the underlying basis of narratives that oppose sustainability in order to understand the dynamics in play and determine appropriate responses that can address the negative views.
- The need for collective anticipations will help drive economies, and shared narratives will play a role in changing our values and norms, alongside the gap between science and policies.
- Collective behavior change is a major challenge for sustainability at both global and regional levels. This challenge is invoked frequently, yet with very little practical advancement.
- Changes in the education system, both through a shift toward greater emphasis on domains related to sustainability and through the effective use of ICT (and digitalization more broadly) in shaping development pathways should foster novel collective identities, collaborative and communicative skills, and problem-solving capabilities.

The fourth task is to initiate and organize processes for co-designing transformations to sustainability with stakeholders:

- As sustainable transformations are complex and often counter-intuitive, it is essential that all citizens become involved in shaping and designing their own future. A more inclusive, bottom-up governance approach is required that engages all stakeholders in co-designing the desired changes in their complex environment. They need to have ownership over the transformations rather than becoming victims or bystanders.
- Regionalization is a major feature of GSSF. More and more evidence is emerging that regionalization will be essential to developing sustainable societies. Designing decentralized strategies (incentives) for social and political innovation in the regional context is essential.
- Cooperative milieus, such as firms, public authorities, social entrepreneurial companies and other institutions that engage in cooperative processes of socio-technical innovation, often emerge at the regional level. Reinforcing sustainability may be most effective in regions that are able to generate innovation due to strong universities, focused public authorities, etc. Can hubs be created in places that already display leadership in sustainable innovation, and take advantage of such momentum? How can synergies between educational institutions and social innovation incubators or hubs be fostered and supported?
- Scientists need to acknowledge that each region, with its idiosyncratic context, culture, and conditions, must find and follow its own unique transformation path. Hence, many different strategies attuned to different regions are needed to achieve sustainability on a global scale. Context-specific standards must be established in regions aiming for sustainable development based upon financial, environmental, and social information provided by the businesses which operate there.
- Sustainable ratings for investors will be a key determinant of sustainable regional development, as regional growth depends largely on long-term investment decisions.
- We should look at examples of regions where a (social and/or environmental) crisis or opportunity prompted a significant transformation toward sustainability. A more comprehensive and holistic understanding of the societal framing of the concurring transformations and their implications for the various regions of the world is needed.
- Current and future strategies will require the inclusion of parts of a country or region that are disconnected from the capital or “centers of power” in order to build more equitable solutions.

The fifth task is to place more effort on developing systemic approaches in designing economic and political interventions

- Systemic approaches are needed to take into account the many interdependencies between human interventions and their impacts on the natural, social and cultural environment. All these impacts are closely intertwined and need to be assessed simultaneously. This can lead to “co-benefits” when interventions serve multiple constituencies for sustainable purposes.
- One of the main goals is to make sure that sustainable actions are supported by and contribute to the economic system and vice versa. Symbolic gratifications are important, as are altruistic motives. But for a transformation to reach maturity, it is essential that economic awards are linked with actions that promote rather than hinder sustainable transformations and that stakeholders are not merely passive spectators of changes in their livelihoods.

The sixth task is the need to help reshape the purpose and structure of learning and education:

- From a bottom-up perspective, education is a fundamental tool in building the necessary capacity to implement change and to value social and cultural experiences. Can we develop innovation that is based on a wider range of values, including social innovation, driven by the search for immaterial values?
- Education plays a fundamental role in promoting and sometimes establishing the narratives that help shape evidence-informed judgments.
- Curricula must include more substantive content and methods in domains related to sustainability, fostering critical and collaborative thinking with an emphasis on complex systems thinking.
- Learning, through job training, informal learning venues and adult education, must effectively be extended beyond mandatory and higher education. This effort is important in “designing for change”, which requires continued learning, innovation, and behavior change. Life-long learning should not just provide greater information access, but a more engaging experience with core concepts, leading to a greater sense of agency, rather than alienation from change.
- Experiential learning in a variety of contexts is needed, rather than relying only on technological representations and technocratic solutions to problems.
- If science is to become effectively proactive, it needs to ensure there are changes in both the supply and demand side of science, in order to ensure that society can meet the need for future scientists equipped to face sustainability topics.
- Early education is important in establishing constructive patterns of learning, including collaborative work, appreciation of others, and encouraging curiosity and respectful questioning of ideas. This can lead to ways in which young scientists, and the public overall, can adequately grasp and consider the complex transdisciplinary space in which the sustainability dynamic evolves.
- What can be done to invite young people into the field of sustainability science and policy and to create wider and more promising opportunities for them?
- The older generation cannot take a top-down approach to defining the space for future generations or the new educational programs that are essential in this process. Rather, their mentoring should create a sustainability space within which breakthroughs can develop ways of practicing science that are currently not used.

The seventh task is to facilitate processes that initiate and promote innovations for societal well-

being

- At present, much of science is aimed at technological innovation, but that innovation is un-directed except by market principles. Technological “progress” has been a pervasive influence driven by economic incentives that has offered many improvements in living conditions, but also many unintended and severe consequences. We need innovation based on a wider range of values: social innovation that is driven by the search for immaterial values; technical and institutional innovations that improve societal well-being with reduced resource use and pollution.

The eighth and last task is to support initiatives and movements that are destined to reorganize institutions for sustainability

- The fragmentation of many leading institutions could potentially be addressed through systems thinking. However, this form of thinking does not align with the domain of our governing communities, which are organized in linear and hierarchical structures. Current institutions lack the ability to regulate the order of global functionality and sustainability. Problem-organized inter-ministerial task forces may be one way to address the compartmentalization barriers.
- Currently, many new institutions are emerging in all spheres of society – many to do with information processing and communication. These have a major effect on existing institutions. How might we create an optimal fusion between the old and the new? How do we nudge societies in this direction?
- In a complex and highly interconnected and sophisticated web of relationships on all levels of society, it is not obvious how to organize effective, efficient, resilient and socially just governing processes. There is a lack of understanding about suitable governance approaches and concepts. One might consider a worldwide application of the precautionary principle which aligns technical and economic innovation with measurable progress in sustainability.

4. Changing science and its relationship with society to facilitate transformations toward sustainability

The forum calls for a profound change in science, its relationship with society, and learning needed to address the complexity of transitions to sustainability. Sustainability must be considered in terms of intertwined societal and environmental challenges, rather than as primarily an environmental challenge. What might need to change in our scientific approaches to improve both our understanding of the conundrum and the scientific contribution to the sustainability transition?

4.1 A profound change in science

The key variable for a transformation toward a holistic sustainable development is the understanding that society and nature are not separate categories, but rather interconnected dynamics that influence and modify each other. It is not solely a matter of saving or protecting nature, but of striving toward a future that is designed as human-oriented and culturally adaptive approach to co-existence of humans with other beings in a jointly inhabited environment.

Research must be grounded in understanding the basic drivers of the societal long-term trend leading to the past and current sustainability conundrum.

Scientists are in the process of profoundly changing their minds, but that that is not going as fast as required by the extraordinary circumstances in which the Earth finds itself. Social scientists have been working in an ‘outside-in’ way from the environment, studying the consequences of socio-environmental interaction and the impact of climate change on society. Thus, they have searched for ways to mitigate those consequences and adapt to them, while leaving the driving dynamic socio-economic structure unquestioned.

Social scientists should focus on the core societal dynamics themselves that have driven western societies toward a set of values that consider the environment as separate from society (the nature vs. culture distinction).

The goal of the research is to explore and implement a societal paradigm shift based on thinking outside the box of climate change to include other dynamics and competing goals. It should design new values and institutions that can serve as the foundations of future societies.

Many in the scientific community are more concerned about the preservation of the current institutional structure of science than about the science and scientists of the future, which will require very different mindsets, institutions and procedures. This is clearly visible in the “corporatization” of science. In that process, a lot of time is spent on communication and messaging in order to be policy-

relevant. Has science therefore lost substance as a result? If so, what could be done about it? Has there been a loss of trust in science as an institution?

4.2 Develop a scientific approach that includes the process of co-production of knowledge with the main actors in society

Sustainability science requires inter- and transdisciplinary approaches. Moreover, Complex systems science is an essential tool for sustainability science.

Sustainability science must produce and incorporate interdisciplinary, curiosity-driven, methodological and theoretically grounded evidence.

Scholars need to understand the impact of their world view on the concept of “sustainability” itself.

Scholars must look at the role of narratives of identity and imagined futures in anchoring their world views and decisions. Narratives are not conflicting with formal models or empirical research methods, they rather supplement each other.

There must be more emphasis on the relational and more space for ambiguity and indetermination in relation to values.

Science has so far been reactive: the scientific community needs to become proactive. Most of the science that has been applied to sustainability challenges has been either reactive, trying to explain observed phenomena, or projecting visions of the future based on extrapolation from the present (through modeling or scenario building). In the current rapid and encompassing acceleration of change in all domains of society, however, a more proactive view, which includes potential futures that cannot linearly be derived from the present dynamics, needs to be developed. We need to move from designing for stability to designing for long-term, desirable change.

4.3 Improving intellectual fusion between Science, Policy and Practice

Policy has to be evidence-informed. Until now, much scientific evidence produced has been the result of curiosity-driven research characterized by methodological and theory-based approaches. To be effective in the policy domain, that kind of research will have to be complemented by vision-driven, co-evolutionary evidence that achieves set goals through strategically construed evidence. The effort to obtain such evidence should be integration-oriented and based on plural knowledge resources to be best suited to guide action.

“Innovation for sustainability” hubs must be created, that bring together all the change agents involved, build regional hubs and provide an integrated systemic assessment for policy choices and evaluations. This requires:

- Explicit problem orientations,
- Clearly designated task forces,

Developing an integrated systems approach in policy-making presupposes:

- Create institutions that overcome (interest-driven) silo approaches
- A wide participation must remain the basis for these developments

The organization of political systems in traditional special expert groups must be overcome:

- We must combine or integrate mono-disciplinary knowledge and linear thinking with inter- and transdisciplinary, complex system thinking.

We must translate academic coherence, where relevant, into the political spectrum:

- Research should be based on long-term strategic thinking about society, not current short-term economic and technocratic engineering, so that feedbacks and corrections can be studied and implemented. It needs to identify leverage points and windows of opportunity, where action might have substantive effect; Research must thus be able to fit our long-term view to other time-frames, looking at short-term solutions in the context of long-term sustainability.
- To substantiate the linkages between scientists and change makers, one must often focus on local scales to help devise solutions. Thus, focusing on solutions raises for the policy-makers the different trade-offs locally involved. Scientists must downscale their science to be more effective in generating change.
- Co-creation and co-implementation: the scientific community is beginning to implement co-creation and co-implementation between the scientific and the policy and practice communities. However, this process must go much further, and the intellectual fusion to be achieved between communities needs to be much more profound.
- Professionalization: Society, science and policy all have an urgent need for professionalization in the interface between the scientific, policy and practice communities. This needs to be promoted institutionally by creating a community of “interface professionals” who have beyond their scientific credentials a range of capabilities in communication, translation (between the two – or more – professional and/or disciplinary languages concerned), policy design (Wiek et al. 2011), as well as co-designing for and with the society.

4.4 Define new tasks for sustainability scientists and experts

Research must focus on the integration of plural knowledge resources (time, space, and cultural contexts) in order to develop sustainable, attractive lifestyles for different regions of the world. It should avoid silo-thinking and strive to be original.

Scientists, including natural scientists, must focus on regionally adapted and simultaneously, collectively effective solutions, and turn away from universal knowledge and strategies. Decentralized strategies (incentives) for social and political innovation in the regional context are needed.

Scholars must focus on the anticipation of effects and trends in the context of complex cause-effect relationships (trial and error as learning strategies can be problematic).

Experts' vision and its implementation should overcome rhetoric in favor of action-oriented, tangible results that address the nexus of local, regional and global scales. It must include government and corporate sectors, as well as the general public.

To achieve that, researchers should pay attention to the shape of public discourse and ways to reach the unengaged by developing a wide range of means of communication.

5. Next steps, dissemination and impact

5.1 Next steps

A Synthesis Report with the main GSSF results has been prepared and is distributed among the partners for revision. The core messages of it will be disseminated in journals and wide range of public media outlets (online and offline).

The conveners and the project manager will organize other meetings with stakeholders including corporate, civil society, NGOs, and policy decision makers between March 2019 and beginning of 2020.

Regional strategies will be designed between 2020 (at the second forum) and the end of the project in mid-2021. The conveners and the GSSF project manager will also promote formation of GSSF decentralized regional hubs that will disseminate the results (through the partners' institutions).

The next forum will take place in October 2020. It will build upon the first forum and the first Synthesis Report, as well as an interim meeting in early 2020; its goal is to monitor further developments in terms of sustainable development and to update the Synthesis Report. The long-term aim is to build a permanent or renewable forum as an institution.

5.2 Dissemination

The primary audiences of the forum are decision- and policy-making individuals and institutions from the political, administrative, economic and civil society sectors. Nevertheless, the conveners and project manager want to also share the results of the expert group's thinking among a circle of the media, educators at all levels and the attentive public, and reach out to the non-engaged and a younger public. To this effect the IASS will disseminate the white paper widely among the targeted audiences, but also recruit ambassadors from among the experts to spread the word in all regions of the world and from different sectors, and engage journalists and opinion leaders.

A short film on GSSF has been produced and is now accessible on YouTube and different channels: <https://www.youtube.com/watch?v=qazkowNKxzg>

Video clips of interviews with eight of members of the expert panel are also available on YouTube at: <https://www.youtube.com/playlist?list=PLUpoMPJM7Ft2Gj4g7hfVFL9DhRHKuVYIL>

Prior to the forum, the four conveners published an article entitled "Coping with societal transformations – a regional approach to sustainability" in *The European*, a German newspaper: <https://www.theeuropean.de/ilan-chabay-und-ortwin-renn/15434-wie-wird-gesellschaftliche-veraenderung-steuerbar>, explaining the forum approach.

After the forum, *Deutschlandfunk* (German public broadcasting radio station) reported on GSSF:

https://www.deutschlandfunk.de/nachhaltige-entwicklung-verbindlichkeit-im-klimaschutz.1148.de.html?dram:article_id=443670 (German version)

The organizers have been disseminating the results of GSSF via three main channels:

- YouTube, where GSSF movie is accessible:
<https://www.youtube.com/watch?v=qazkowNKxzg&feature=youtu.be>
- GSSF Webnews on IASS Website: <https://www.iass-potsdam.de/en/news/global-sustainability-strategy-forum-meeting>
- GSSF website (hosted by IASS website): <https://www.iass-potsdam.de/en/research/global-sustainability-strategy-forum>.

5.3 Initial impacts

We strive for impacts via dialog with other audiences than the scientists themselves. The initial audiences we wish to target are policy-makers.

A first meeting between the GSSF conveners and project manager and the Inland Department of the Office of the German Federal President (Dr. Oliver Schmolke) took place in Berlin Bellevue on 09.04.2019. During a two-hour meeting, Professor Ortwin Renn presented the main outputs of GSSF Forum and opened a discussion with the participants. Professor Ilan Chabay commented on the important positive contributions of sub-national responses and the influence of narratives of vision and identity on social dynamics toward sustainability. The discussion was open to all personnel of the President's office. This exercise allowed a better understanding of the questions and expectations of the political community from the forum. This was also an occasion to provide the participants with a new thinking framework on sustainability. Four main issues were discussed:

- How to address the problem of implementation of measures that are intended to better protect the environment but are not accepted by the society or can lead to social protest? How to bridge the gap between Science (providing indicators, data and evidence), Policy (acting, regulating) and societal acceptance (the society being more and more distrustful toward elite)? How to reconcile those worlds?
- The discrepancy between the urgency to address environmental problems and the long-term sustainability goal was also discussed, and what science can do to address that
- The role of visionary evidence and convincing narratives was also discussed as indispensable to address the sustainability challenge
- Science, Policy and Practice must concentrate on the conflicts between sustainability goals/indicators and targets as well as on the societal dynamics leading to unsustainability instead of focusing solely on a target-setting and target attainment approach.

At IASS on 19.03.2019, a delegation of 20 students and their teachers from CIFE University in Nice (France) were invited to attend a workshop on Energy Transition and Sustainability Strategies. The students are attending a Master on Global Economic Governance and a specific module on sustainability.

- The results of GSSF were presented to them and specific questions were raised on the role of social sciences and humanities in sustainability science and on how to bridge knowledge and action. Many students found the approach of thinking outside the box and beyond the SDGs (in terms of societal trends that hinder sustainability) very relevant and interesting. The presentation provided them with another framing of the sustainability issue.

5.4 Deviations from proposal and original concept

The deliberations during the first stage of the forum focused on the contributions of science and expertise for informing and orienting decision makers in economic, political and social institutions. Although this topic was meant to be addressed at the outset, it became more prominent during the forum than originally anticipated. This did not compromise the major goal of identifying current trends and looking for strategies to reach a more sustainable future.

There were no other deviations from the planned procedure. All objectives of the first forum were accomplished.

6. Annexes: Synopsis of sustainability reports and Table of neglected sustainability challenges

The annexed Synopsis serves as reference point for unraveling the complexities of sustainable pathways and the societal framing of these transformations that the Global Sustainability Strategy Forum seeks to address. In order to provide a streamlined structure, reports were reviewed for content addressing the following six points:

- Key Messages from the reports
- Drivers of Sustainability / Unsustainability
- Key Sustainability Challenges
- Policy Recommendations
- Global / Regional Implications
- Indicator Characteristics

Relevant text is extracted from the reports and included in the annex, alongside the name, year, a brief summary, and links to the complete reports. The participating experts were invited to explore different reports in order to complement the discussions on trends, challenges, and science-policy interface during the forum.

A mapping of the reports is available on demand: solene.droy@iass-potsdam.de

The second annex is a table of sustainability challenges identified by the experts as not being considered adequately by most actors.

6.1 Synopsis of global sustainability reports

6.1.1 Key messages

Improved economic well-being must be fundamentally decoupled from the increased use of natural resources. Improved quality of life should not be automatically related to living more prosperous lives; rather the emphasis should be on multidimensional well-being, including its dematerialized dimensions. GDP growth is weakly correlated to the vast majority of social and environmental sustainability indicators. Instead, approaches such as inclusive wealth or qualitative growth are more appropriate but need to be translated into meaningful quantitative measures for comparability.

The consensus that GDP no longer represents the most effective or useful measure of progress, due to the weak emphasis on sustainability, requires new frameworks. Competitiveness remains a requisite for technological advancement, innovation, social inclusion, income generation, well-being and

overall progress, though it is often perceived in purely economic terms with its definitional ties to productivity. Thus, gaps remain on how to best embed the competitiveness concept in regional development and ensure that regional and domestic assets are given priority in macro- and micro level policy planning. Furthermore, it is essential to find a sustainable balance between the three modes of governance: hierarchy, competition and cooperation. There is no universal solution for an optimal balance since regional and cultural specifics need to be taken into account, but the dominance of one over the others have rarely led to sustainable practices.

The distinction between growth and development can often be misinterpreted in the sustainability context. Achieving development without growth, or a qualitative improvement without a quantitative increase in resource use, presents a new and promising societal paradigm that does not adhere to current status quo of growth policies. Today, the concept of “growth” may not always translate to leading better lives, but can in fact be detrimental to society². At the same time, there is still a lack of convincing concepts for ensuring a higher quality of life for all, particularly the poor, without expanding the use of natural resources.

Green growth and degrowth, despite their differences, focus on the contradictions of environmental and economic policies. Both these domains must be responsibly pursued for societal improvements. A major gap exists in determining which new “qualitative growth” pathways will be most effective for different regions and sub-regions given their unique and heterogeneous stages of societal development.

Countries must improve global and national policy coherence by strengthening their understanding of linkages, while also addressing conflicts between goals. Impacts of decisions on domestic and foreign policy have to be assessed based on their global sustainability implications.

A silo approach to achieving all SDGs is insufficient as they set up competing games (for dominance) and even counterproductive conflicts. Complex, interconnected risks that underpin our economies, societies, and environments run the danger of “runaway collapse”, if our competencies in understanding and mitigating interconnected risks does not improve.

Continuing advances in technology, medicine, energy, and so on may run the risk of further increasing growing disparities across and within societies – particularly affecting horizontal social cohesion³, in which the greatest vulnerability remains for people being “left behind”. In this regard, what is referred to as the Fourth Industrial Revolution pathway entails these societal risks, but also brings opportunities to take advantage of regional strengths and development requirements. Transformational changes must include ways to protect and provide opportunities to those who might encounter losses as a result of globalization and technical modernization, in particular, digitalization.

The paradox of technology will continue to present a major contradiction for the sustainabilization of societies. The exponential growth of technological capabilities holds on the one hand a myriad of risks related to environmentally malign technologies and the potential to widen disparities between developed and developing societies, as hindsight has shown with globalization. On the other hand, improved technologies and medical treatment have decreased risks to life and health, in particular over the last century, and has significantly contributed to a major increase in life expectancy in almost all countries of the world. At the same time, digitalization, geoengineering, and other technological disruptions will be paramount in decarbonizing societies and extending new sustainable development pathways for various economies.

² 50 years Club of Rome: Come on! Capitalism, Short-termism, Population and the Destruction of the Planet

³ World Social Science Report 2016 | Challenging Inequalities: Pathways to a Just World, 2016

People feel threatened by accelerating change, driven by globalization, digitalization, and the sustainable development transformation. We need to seek out or create societal visions on local, national, and regional scales as positive narratives oriented toward the future and to understand how these visions interact with social identities with regard to the latter's effects on motivation for or opposing change⁴.

6.1.2 Indicator characteristics

Most global reports related to the 2030 Agenda use publicly available data from official data providers (World Bank, WHO, ILO, UN) with national level data from National Statistic Systems, which is often adjusted for comparison. Data is then aggregated into regional clusters based on geographic or economic similarities. A scorecard or dashboard is usually presented, ranking countries and/or regions in terms of SDG implementation. Hundreds of indicator frameworks have been developed so far.

Although diverse sources differ in their assessment of environmental, economic, and socio-political risks, there is a general consistency in the identification of priority areas. Climate change, the loss of biodiversity and the nexus between food, water and energy are top priorities on the environmental side. Financial market volatility, resurgence in protectionist tendencies, and implementing innovative growth strategies are priorities on the economic side. Poor governance, including corruption and populism, growing inequities and cyber-security are priorities on the socio-political side. The priorities represent global assessments of experts around the world, but do not necessarily differentiate between regions.

The common approach of ranking sustainable development progress through national comparisons rarely emphasizes the role that indicator modifications have on rankings, as iterative reports cannot consistently reflect national progress, the relative capabilities of different actors and heterogeneity of countries' development experiences. What is needed is a constant monitoring on how each nation or region performs on the crucial indicators that are (self-)selected for such a comparison. Knowing how one compares with other nations is less useful than knowing where progress has been made over time and where desired changes have not led to the expected impacts.

An important commonality of the indicators is that they provide aggregate statistical snapshots at particular times. However, they are unable to address the social, political, and environmental (ecological) bifurcations of societal processes underlying the indicators, which sometimes occur dramatically in short periods. Particular when viewing complex relationships, indicator results often suggest simple causal relationships which may lead to misperceptions of a situation and to policy actions that are inadequate.

Hence, there is a need for more disaggregated metrics and data, which must be reliable, timely, and accessible in order to move toward more effective regional and national policies in SDG implementation, as well as a more granular representation of sustainability indicators⁵. The challenges addressed by the SDGs will be shaped by sub-regional contexts and policies. Therefore, regional and global policies should be attuned to sub-regional policies. This goes beyond the popular slogan "Think globally, act locally". Rather we should think and act locally while considering the impacts for all the people and nations now and those that will come after us.

The discrepancy across sustainability indicator priorities for different regions and countries forms a major challenge in aggregate assessment efforts with certain indicators carrying more weight and

⁴ The World in 2050 Initiative: Transformations to achieve the SDGs, 2018

⁵ The World in 2050 Initiative: Transformations to achieve the SDGs, 2018

relevancy than in others. The ‘tier-based’ approach, where indicators are classified based on their stage of methodological development, should be replicated in regional and sub-regional assessments⁶. The tier classification of Global SDG indicators made by the Inter-agency and Expert Group on SDGs should help inform priority areas for different actors.

A central contradiction is that of urbanization and cities becoming humanity’s primary habitat. Despite being hubs of social, economic, and cultural transactions, the human ecological impacts are manifold. Accurately measuring the ecological footprint of cities, which extends far beyond the land surface they cover, remains a major gap. Likewise, ensuring that cities thrive on regional, as opposed to global resources, conflicts with the role of cities in facilitating global networks and flows.

There is a constant call for regionalization of sustainable pathways but no common ‘recipe’ on how to implement this shift. One major goal of this forum is to address the issue of developing protocols for regional sustainability assessments that reflect and incorporate regional and cultural differences without losing sight of the interconnected global challenges and risks that need to be adequately addressed in each part of the world.

6.1.3 Recommendations

The disaggregation of data underscores the global commitment to “leave no one behind”, a foundational principle of the Agenda 2030. Despite countless benefits of aggregating data into dashboards and summary reports, which lead to similar conclusions about global inequalities, the omission of disparities and unchecked inequality within societies undermines current goals and targets. National Statistical Systems must be improved so that countries can establish proper baselines and targeted policies for bottom-up policy development. In particular, meaningful monitoring schemes need to be developed that help each nation or region learn from successes and mistakes. This should begin at local levels, with strengthened infrastructure and harmonization of all actors (government, NGOs, CSOs, private sector, academia), and then scaled-up to regional levels.

The Fourth Industrial Revolution must be harnessed sustainably to take advantage of the technological, economic, and social opportunities it offers for cities, agriculture, financial systems, and so on. The polarizations in global development that occurred in the third industrial revolution must be addressed by guaranteeing that new opportunities are well-distributed and inclusive. Regions must leverage collective strengths to ensure effective development strategies and take advantage of the opportunity for select countries to ‘leapfrog’ traditional development pathways. For countries unable to do this, decoupling and avoiding the risks of being locked into unsustainable development pathways must take precedence through sustainable finance mechanisms and commitment to global and regional agreements.

Alternative bottom-line metrics that measure socio-economic progress must be prioritized by governments and policy-makers alike. These must reflect the values that citizens perceive as indicative of progress in their regions and countries and will differ from one economy to another. The Inclusive Development Index, Social Progress Index, and Gross National Happiness Index are examples of metrics that implant sustainability in their assessment. These solutions must move beyond being seen as supplementary tools to being used as the groundwork for measuring socio-economic progress.

⁶ The World in 2050 Initiative: Transformations to achieve the SDGs, 2018



Sample of reports included in the Overview Synopsis preceding the first Global Sustainability Strategy Forum

6.2 Sustainability challenges not being adequately considered by most actors

1. Three “umbrellas”, each one encompassing a group of issues:

Population – includes migration crisis, urban-rural interfaces, great urban agglomerations and sustainable cities, population aging, sustainable consumption.

Climate – includes climate refugees, the costs of adaptation, scarcity of water, loss of biodiversity and forests, extreme events, impacts on human health.

Science – includes the paradox of too much specialization and too little integration of knowledge, the lack of communication between academia and the real world (more commitment with publishing for the peers than with proposing effective solutions to public decisions), uncertainties, and skepticism.

2. Three domains relating the "umbrellas"

The intertwined nature and dynamics of human-environment interactions

The embeddedness of any sustainable societal development within biosphere capacity

The search for leverage points toward sustainability transformations

3. Specific domains that do not receive enough attention

What sort of development is compatible with environmental protection in concrete terms

Water related issues

The growing use of chemicals

4. The relationship between science and policy formulation and implementation

Identifying pathways toward global sustainability and assisting societies with the creation and advocacy of policies and public action that can successfully move them along those pathways.

That challenge is exemplified by the globally agreed 2030 Agenda and its integrated 2030 is not 17 systems represented by 17 SDGs, but one hyper-complex system with 17 facets.

Apprehending the present and future impacts of the Digital Revolution and its opportunities and challenges, including Big Data Integration.

Dealing with the knowledge divide between the Northern and Southern hemispheres.

5. Linking societal and environmental diversity

Social and economic inequalities can lead to societal challenges, but they can also allow for differential exploration and exploitation of resources

Biodiversity is linked to environmental differences, and has to be preserved while at the same time used to promote and maintain a wide range of resources

Sustainable production is the result of combining these two factors into a harmonious integrated system

6. Three domains for scientific analysis that can improve sustainability strategies

Inequality:

Important similarities and differences exist between inequality in nature and society (Scheffer et al. PNAS, 2017). Globalization has led to new patterns of inequality dynamics. "Phases of upscaling of governance successfully curbed unconstrained growth of inequality first in the communities of late medieval Europe and later in the nation states of the 20th century, in a lengthy and painful process. Whether scaling up of effective governance can now be done at the global level [...] remains unclear." What is clear is that inequality presents a key challenge for sustainability strategies.

Regional Innovation Systems:

Jaeger (1993, citing Sabel 1987) emphasizes that „Research on economic restructuring has shown that cooperative milieus, in which firm and public authorities as well as other institutions engage in cooperative processes of socio-technical innovation, often emerge at a regional level. This offers a remarkable opportunity for the greenhouse marathon.” The conditions under which they emerge, however, are not known. Comparative case studies are needed.

Sustainability Ratings for Investors:

Sustainable regional development depends critically on investment decisions. Lev and Gu (2016) argue that “environmental regulations are constantly debated and challenged in the public arena.” A key challenge for regions aiming for sustainable development is to establish standards for the context-specific financial, environmental, and social information to be provided by businesses operating in the region.

7. Investment issues

New investment policies are needed for high-carbon energy resources such as coal. This includes CCS.

New investment and legal constraints are needed to control the spread of Information on various issues including health, personal behavior, money, etc. (such as by GAFAs and IoT companies).

There is too much urbanization, especially in developing countries. Investment is needed to attract people to rural areas.

8. Change beyond climate and/or economic change

The need for deep systems change (and not only climate and/or economic change) speaks to much deeper transformation

To begin to effectuate that, we need to reintroduce major value changes in our societies – moving from categorization and opposition to thinking in terms of relationships and tolerance

One way to achieve that is to foster growing informality – requiring new approaches to development.

9. Nudging societies in a different direction

Demographic growth and improvements in medicine threaten resource shortages; we must try to limit the growth effects of both

We need long-term and constant monitoring of the role of ICT in accelerating societal change, and conceiving ways in which it could be used to move toward sustainability; that does imply gaining control over the current development of the field

Part of this can be achieved by reinforcing the legal context of business and governance in many countries.

10. Thinking outside the box

Lack of new thinking and new theory. The standard economic theory was established in the traditional industrial era. It can neither explain sustainability crises, nor provide solutions. We must pro-

mote ecological logic over traditional industrial logic, to avoid unrealistically expecting to achieve sustainable development through breakthrough of so-called green technological innovation. Green development, on the other hand, represents the most comprehensive and profound paradigm shift of development since the Industrial Revolution.

Few recognize the huge social cost of the existing growth model, and its hidden loss of well-being, since our preference has actually been systemically reshaped by the commercial forces in order to create sufficient market demand through overconsumption. More material consumption does not necessarily bring higher happiness. The 'Disease of affluence' is a typical example, which increases economic growth, but harms our health, distorts agriculture, and damages the environment. Due to vested interests, it is hard to change.

The existing global governance was established in the old global division of labor, based on the traditional growth model. Politicians are often hijacked by populism and nationalism at home. As scholars, we know that there is an exit to the crisis, but whether our society can get out of the crisis is largely up to politicians.

Sustainability must be based on market solution, but there is a lack of effective business models to turn 'sustainability' into 'gold'. The prevalent business models established in traditional industrial age are unable to recognize and realize the business opportunities of sustainability. 'Green' represents a new direction of value creation, meeting new intangible needs beyond materialistic ones.

11. Transformation and persistence

Simultaneous unfolding of three major transformations: globalization, digitalization, sustainabilization.

Persistence of trajectories and path dependencies.

Developing inclusive, effective and fair governance that ensures that society remains within biosphere capacity requires developing attractive and sustainable lifestyles.

12. Tipping points

The big near-term challenges are not environmental, but rather socio-technical and political (the other two legs of the sustainability stool). We are as likely to hit socio-political tipping points as we are geophysical.

The "apparent" failure of liberal democracies to meet the aspirations of their populations and the growing lack of trust in these political institutions and disenchantment with the "establishment" and the elite capture of many key institutions.

Growing "tribalism" in search of identity and meaning - and narratives that tend to divide, rather than unite.

The future of work - and the future of the youth "bulge" in the demographic transition underway. On the one hand there is a steady exodus from primary production (farming, fisheries) due to failing economic model, and at the same time, there is the increasing dominance of machines in most manufacturing operations.

7. Literature

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Randers, J.; Rockström, J.; Stokes P.-E. and others (2018): *Achieving the 17 Sustainable Development Goals within 9 Planetary Boundaries*. *EarthArXiv*, <https://doi.org/10.31223/osf.io/xwevb>

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