Transforming scholarship to co-create sustainable futures

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Non-technical summary. All of humanity is facing the increasingly urgent challenge of finding pathways to the emergence of new, more sustainable patterns of living that promotes the co-evolution of natural and cultural systems. We address this challenge by proposing changes in scientific and scholarly research communities and transformations in roles, resources, actors, and institutions of scholarship (i.e., natural and social sciences, humanities, and arts), which can contribute substantially and effectively to co-designing solutions for sustainable, just, and equitable human societies.

Technical summary. The critical challenge facing humanity is the increasingly urgent need to find and implement pathways that lead humankind into a new stage of dynamic equilibrium that promotes the co-evolution of natural and cultural systems. We address this challenge for scientific and scholarly research communities and the transformations in roles, resources, actors, and institutions of scholarship (encompassing natural and social sciences, humanities, and arts), which can contribute substantially and effectively to co-designing solutions for coping with unsustainable practices and systemic risks. Our perspective builds upon a series of four workshops to identify and address global sustainability challenges at a regional scale. It is anchored in the view that nature and society are inextricably interwoven, that planetary boundaries are fundamentally societal, rather than solely environmental issues, that viable solutions to the global challenges mentioned above can be developed and most effectively implemented at a regional to local scale in conjunction with substantive changes in the education systems at all levels, and that these considerations require a complex adaptive systems approach to seeking and implementing solutions. We call for rethinking, finding creative approaches, and acting to make scholarship more capable of effectively creating just and equitable sustainable futures in diverse cultures and contexts.

Social media summary. Transforming scholarship and education to enable co-design of societal transformations to sustainable futures.

1. Introduction

The critical challenge facing humanity is the increasingly urgent need to find and implement pathways that lead humankind into a new stage of dynamic equilibrium that promotes the co-evolution of natural and cultural systems (without sacrificing one over the other), moves toward circular economy, and provides convincing concepts for social justice and the need for cultural sense-making. This all can be embraced by the term sustainability, but also other terms such as planetary health that are inspired by the same quest for a radical transformation toward a new stage of human development.

Why is this so important?

- The world faces multiple systemic risks that may breach planetary boundaries (Rockström et al., 2009; Steffen et al., 2015): The recent pandemic is only an example of the many non-linearities in global natural, social, and economic systems that pose systemic risks to human wellbeing (Schlosser et al., 2020). These risks are characterized by complex, transboundary, often global impacts, stochastic causal relationships, and multiple 'tipping events', which arise from complex interconnections and multiple feedbacks (Helbing, 2012). Systemic risks appear to be rising in magnitude and frequency because more and more humans are increasingly exposed to powerful acute and chronic stressors (Renn et al., 2020).
- Many of these systemic risks are triggered by human colonization and transformations that impair or burden the natural environment, including climate change, air pollution, desertification, and biodiversity loss, while others are byproducts of exponential economic growth and social exploitation, including widening inequalities of wealth and power and the emergence of populist movements and nationalism. In particular, the interaction between social and environmental stressors has negatively affected social and political institutions mandated to prevent, manage, and mitigate systemic risks, since they have typically been treating each risk separately and in isolation of each other. This has resulted in a piecemeal approach to global crises.

- Chronic stressors, such as demographic growth, non-toxic air pollutants, unhealthy diets, or extended use of fossil water reservoirs for agriculture, appear to emerge slowly and often escape the attention level of social institutions and professional communities. However, given their interaction and steady increase, they may soon exceed tipping points (Mathias et al., 2020; Milkoreit et al., 2018; Schellnhuber, 2009) leading to major catastrophes and even system breakdowns.
- All attempts to address or manage these systemic risks in an adequate and effective manner have been insufficient. Most indicators that assess the disaster potential and the emerging catastrophic developments show that human interventions to reduce or mitigate these risks are either missing or not effective enough (TWI2050 – The World in 2050, 2018).
- The complexities and non-linearities of today's global systems are all triggers for potential societal breakdown. However, the same properties also provide *opportunities* to trigger rapid, positive, wide-ranging improvements. If societies were able to identify crucial intervention points that could trigger multiple impacts and release positive cascading effects within closely coupled systems, there is a good chance that sustainable pathways could be pursued even within complex and still poorly understood challenges.

Much excellent research to investigate systemic risks is underway with the intent to design effective intervention strategies (European Systemic Risk Board – ESRB, 2016). However, the science system as we know it today is still compartmentalized in disciplinary silos, which are often constrained by a value-free, formalized methodology based on the assumption of linear causality and which are not communicating or cooperating among and between the disciplines, and are producing inconsistent and incompatible research results, thereby sharing an inadequate understanding about the nature and the governance of global risks. Moreover, the disciplinary division into separate natural, technical, and social sciences leads to an equivalent artificial division of the complex relationships and mutual interactions into separate natural, social, and technological systems. In order to identify and assess systemic risks, as well as systemic opportunities, societies need a new scientific approach or paradigm that treats the challenges as an expression of that paradigm, one which is based on the analysis of complex socio-technical systems and transdisciplinary research methods.

In this article, we will address this challenge in regard to scientific and scholarly research communities and in particular, transformations in the role, resources, actors, and institutions of scholarship (encompassing natural and social sciences, humanities, and arts), which can contribute substantially and effectively to co-designing solutions for coping with unsustainable practices and systemic risks. Our perspective builds upon a series of four workshops held over the course of two years[i] to identify and address global sustainability challenges at a regional scale. It is anchored in the view that nature and society are inextricably interwoven, that planetary boundaries are fundamentally societal, rather than solely environmental issues, that viable solutions to the global challenges mentioned above can be developed and

most effectively implemented at a regional to local scale, and that these considerations require a complex adaptive system (CAS) approach to seeking and implementing solutions.

CAS studies approach socio-environmental-economic systems by incorporating multiple knowledge sources, substituting a process perspective for a static one, emphasizing the importance of dynamics and trajectories in explaining observed phenomena, and moving beyond 'Occam's razor' (the simplest explanation is the best) to looking closely at the full complexity of the dynamics concerned (Bak-Coleman et al., 2021; Preiser et al., 2018). They focus attention on non-linear interactions and spatially and temporally disperse feedback loops subject to contingent human decisions and actions. It considers systems as open and subject to the impossibility to fully predict the outcomes of their dynamics. By studying emergence (*ex ante*) rather than origins (*ex post*), they move with, rather than against, the arrow of time, developing multi-scalar long-term perspectives to learn from the past about the present that are suitable to consider the future, and to integrate the study of stability and change, process and event (Haas et al., 2020).

2. Requirements

Without any doubt, modern societies need scholarship that illuminates systemic risks and opportunities and from those insights catalyzes changes in practice and policy that lead to sustainable futures for all. This requires a substantially greater capacity to imagine, anticipate, avoid, mitigate, and adaptively cope with systemic risks. We argue for a transformative perspective that addresses the complexity of the dynamics involved and leads to a restructuring of scholarship and educational trajectories to embrace new visions of socioeconomic developments that promote the co-evolution of natural and cultural systems within the biophysical limitations of available resources. This requires a transdisciplinary concept of sustainability scholarship that includes scientific as well as experiential, cultural, and tacit knowledge and focuses on complex relationships between and among different beings and their environment at multiple temporal and spatial scales. This is essential if we are to develop the necessary knowledge for transitions toward more sustainable states.

Though not all scholars in all fields and disciplines necessarily should or will engage in this type of transformative scholarship, it is truly essential that those scholars, their institutions, and their funders who choose to address the challenges of moving to sustainable futures embrace a more inclusive, integrated, and CAS approach. As noted in the IASS Discussion Paper from the GSSF workshops (Bai et al., 2019) 'Precisely because several, sometimes contradictory, transformation processes with disruptions and conflicts take place in parallel, the role of transformation-oriented research is particularly critical'.

3. Implications

What are the concrete requirements for scholarly research and scientific institutions that should be mandated or chosen voluntarily to pursue a transformative research route?

First, the scope of scholarship that suits this purpose should be expanded to encompass more diverse knowledge sources, methods, and concepts. The epistemological basis set for establishing scope, purpose, and process of research should include both interdisciplinary knowledge about the complex structure of the problem and non-formal knowledge derived from the practical experiences that people have gained over the years (by personal,

institutional, cultural or indigenous experience). These two forms of knowledge allow meaningful co-design and co-creation of research using a plurality of knowledge sources and epistemic concepts from a wide spectrum of knowledge holders. The implicit and often unrecognized biases that privilege certain forms or sources of knowledge limit the ability to design innovative solutions that are feasible and acceptable in different cultures and contexts. Engaging from the outset of research and investigation in the concerns of communities in open, inclusive dialogues, which acknowledge and facilitate mutual learning across differences in power, resources, and knowledge, is essential.

Secondly, building the necessary and sufficient capacities to make significant further progress toward sustainability requires substantive intellectual fusion among disciplines and deeper reflection on scientific epistemologies, values, approaches, methods, and techniques, as well as scientific institutions, careers, and funding mechanisms (Stojanovic et al., 2016; Tett, 2016). Scholarship for sustainability needs to move toward a comprehensive, holistic perspective of societal and environmental trends, patterns, and emergent behavior. It involves focusing on an integrative consideration of socio-ecological-economic processes, identifying the interactions among temporally and spatially dispersed multi-scalar feedback loops and dynamics differentiated according to how different groups of people are affected. This will lead to the identification of many pathways to different futures (Purvis et al., 2019).

More specifically, transformative research needs to

- Identify and characterize mechanisms that could lead to *non-linearities in global systems (early warning)*,
- analyze mechanisms that connect *stress with behavioral patterns* across physical and social systems,
- provide better instruments to *understand, model, and simulate complex, dynamic interactions* between stressors and risk-absorbing systems, and
- design *high-leverage intervention points* in cultural, institutional, and technological systems that have the potential to reduce systemic risk – and in turn lead to transformations that make societies more just, prosperous, and mindful.
- provide guidance and process recommendations for implementing the policy options that have been informed by the state-of-the-art in scientific research and deliberated for value consistency with the major stakeholders and affected groups.

Thirdly, the solution space for meeting the current challenges is not likely to be found in a singular 'right' answer to existing problems, but rather in a co-creative process built upon a plurality of future visions and existing traditions, local contexts, hidden trajectories, and cultural narratives. People will act in the direction of sustainable practices only if the actions make sense in terms of their social identities and cultural narratives to which they assign credibility and faith. Furthermore, these narratives should include incentives for mobilizing actions, thus implying individual and collective agency to change living conditions. Sustainable futures should thus emerge out of mutual learning and by linking social identities with cultural traditions, diverse knowledges, and compelling visions of inclusive societal well-being adapted to and thriving in existing and anticipated environmental conditions. Scholars can help to structure discourses in which these narratives are jointly developed and internalized. They can also assist policy makers and change agents, such as representatives of NGOs, dedicated corporations, or political movements, to identify cultural traditions, local knowledge reservoirs, and folk customs, and link them to the relevant insights from scientific analysis. Neither relying only on indigenous knowledge nor replacing it with abstract scientific facts will be effective in generating the necessary changes. The real art will be to synchronize tradition with science, tacit with systematic knowledge.

4. Crucial role of narratives

Narratives, as a fundamental communicative mechanism of humanity (Bruner, 1991; Morgan, 2001; Niles, 1999), have great normative power in reflecting culture, reinforcing present or past patterns of behavior, and orienting the society toward a target future state. From these narratives, insights can be derived into context- and culture-specific perceptions, hopes or fears, and social dynamics that are essential components in a new model of scholarship for understanding and acting on complex societal challenges.

Narrative expressions that circulate in particular co-located or online communities provide insights into opportunities and hindrances for transformations from unsustainable to more sustainable futures as perceived from the perspective of the group. Narrative content can be conceptualized 'as being embedded within a recognizable culture and context and containing either fictional or non-fictional accounts, which often serve to communicate visions looking toward the future or to reflect on individual or community experiences and identity. … People use narratives not only to reflect society or to imagine a future, but also to intervene in the world and try to actively shape reality as they know it' (Chabay et al., 2019, pp. 2–3). The narratives function to recruit new members and reinforce the culture of the group. They may also encompass a vision that the group believes is desirable and requires their active support to enact. In some instances, the narrative vision may be an expression of grievances from perceived unfair treatment or injustices, often taking the form of a conspiracy theory – a dystopian narrative unsubstantiated by evidence.

The proliferation of narratives in digital media allows for broad many-to-many societal participation in dialogues on issues seen as significant to the online communities. It also brings with it the rapid evolution and recasting and redirecting narratives in efforts to recruit and establish new groups to react to or precipitate new actions.

Scholarship should look more closely at these narratives and take a critical look at conspiracy theories, since these are influential in orienting people, including with regard to questions of sustainability. There are significant efforts underway to counter the misinformation, fake news, and conspiracy theories that have proliferated in recent years in digital media (Granik & Mesyura, 2017; Pan et al., 2018). However, a closer look at the perceptions and purposes of these dystopian and destructive narratives is crucial for our understanding and ability to address the underlying issues that impede behavior change to sustainable futures.

Narratives, stories, and observation of actions of players in narrative-based games, as well as unstructured or semi-structured interviews with diverse stakeholders and knowledge holders, provide important qualitative data that should be considered on an equal basis with quantitative data in seeking ideas and insights for sustainability. Games created in physical forms, such as board games, or as digital representations can be effective boundary objects to facilitate dialogues (Chabay, 2020; Chabay et al., 2019; Clark et al., 2016; White et al., 2010) and allow the observation of individual and group deliberations and strategies (Monechi et al., 2021). As the qualitative methods become

enriched and expanded through improvements in technology for semantic analysis and measurement, the sharp delineation and traditional primacy of quantitative methods is becoming usefully blurred and is better treated as complementary resources for understanding complex systemic issues.

5. Emphasis on mutual learning

Scholars in pursuit of sustainability should therefore move to an interactive mutual learning (transdisciplinary) approach that includes stakeholders and civil society more widely outside the domain of science and scholarship. They must not limit themselves to signaling that a trainwreck is coming, but engage in avoiding it as part of a societal process. Hence, they should actively take the opportunity to participate as one of the important knowledge carriers in concert with other societal actors in shaping processes and outcomes of policymaking.

More extensive participation of scholars in the societal and political discussions must be accompanied by great humility on their part (Jasanoff, 2003), since they do not have inherent authority in determining the direction in which society should move. Decisions may be informed by scholarship, yet they are nevertheless grounded in values and beliefs, and are thus inherently normative. Scholars are certainly entitled to be active participants in these normative decisions, but they should not have more authority in these issues than any other citizen joining the debate.

Opening up scholarship would expand the range of approaches and methods for mutual learning between scholars and the wider spectrum of societal actors. In addition to more traditional empirical studies, the growing trend of scientists to study narratives, stories, scenarios, and games can provide entrées into creative and speculative constructs related to sustainability. These are forms of safe spaces for important explorations of ideas and asking 'what if…' questions, whether by individuals or as boundary spaces or objects to facilitate group dialogues across social, political, economic, and cultural gaps.

6. From research to education

Transformations in scholarship to guide and support the transformation in society to sustainable futures will require major changes in education from early learning through elementary, secondary, tertiary, and lifelong learning. The trajectory of learning and expectations of learners at all ages urgently needs to be changed to build the essential capacity to engage meaningfully in determining the sustainable future appropriate for their community, region, and nation. Stimulating and nurturing the curiosity of learners from early childhood on, incorporating increased opportunities for dialogues on ideas, and collaboration on projects, all model the processes that allow for more constructive engagement in participatory dialogues. The urgency and importance of this capacity for understanding and participating in democratic processes to address complex issues was all too clearly demonstrated by the destructive actions and angry rhetoric of large numbers of people in reaction to COVID-19 restrictions and systemic racism. We need much greater and sustained efforts to redirect and restructure the educational system at all levels to build a foundation for constructive dialogues across societal divides and governance levels to establish the basis of a just and equitable sustainable future for all.

Transformation for sustainability also requires reconstructing mechanisms to support scholars to develop their capacity and commitment to recognize with humility the epistemic limitations and strengths of their intellectual disciplines, seek to collaborate meaningfully and substantially with a wide range of pertinent stakeholders, rights holders, and knowledge holders in order to identify mutually relevant issues, frame and conduct research, interpret data, and communicate conclusions in constructive dialogues that are open for new ideas, arguments, and narratives.

This educational renewal will require more fluid academic arrangements and funding and the establishment of new institutes, including in developing countries, which are able to foster synthesis across intellectual traditions and domains and to do so successfully in different cultural, economic, and political contexts. Mastery of the concepts and methods of research in a discipline must remain an essential part of higher education, but with it must also come experience in and understanding of research in a wider perspective and with greater value placed on communicating across disciplines and social divisions. This has major repercussions on the way that academic institutions are organized today. First, academic career metrics should include reference to inter- or transdisciplinary activities with a high impact on one's academic score (New H-Score given specific emphasis on papers written with colleagues from other disciplines and for publications with non-scientists). Second, service to community and public good activities should be rewarded in terms of salary bonus and career opportunities. Third, funding agencies should place more emphasis on inter- and transdisciplinary cooperation and provide extra funds for measuring impact and societal resonance. Fourth, the curricula of secondary schools and undergraduate and graduate studies should include more basic information about sustainability from a holistic perspective and provide more space for exploring how each discipline and sub-discipline can contribute to the overall goal. Finally, educational institutions should foster cooperation with economic or civil society actors to develop common projects, creating multiple opportunities for internships and creating a mutual learning space for all parties involved.

In order for the scholarship to flourish and attract new scholars to enter and advance in the field, publication of transformative research papers by early career and developing country scholars, particularly those that span disciplines and methods, must become more accessible in high-quality journals and in media addressing the wider public (e.g. the Guardian, New York Times, Public Broadcasting System, and the wide range of online media). For this to happen, senior scholars should be willing and encouraged to provide training and personal coaching. In addition, appropriate review criteria and reviewers with interest and experience in inter- and trans-disciplinary research, as well as means for offsetting publishing fees are needed.

Strengthening and expanding the capacity for scholarship through education is crucial, but not sufficient in itself. Scholarship needs to take a catalytic role in society. This requires that the communication of results of the scholarship in society is available, salient, and understandable for policy makers, citizens, and business, so that it provides the necessary substantive content and process-related knowledge to facilitate mutual learning processes among stakeholders for transforming to sustainable futures.

7. Conclusion

In essence, we invite and strongly urge the wider community of sustainability scientists and scholars, as well as those responsible for designing and implementing policies for the transformation to a sustainable future, to join in rethinking, finding creative

approaches, and acting in a new paradigm that is capable of more effectively tackling the profound challenges of creating just and equitable sustainable futures in diverse cultures and contexts.

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