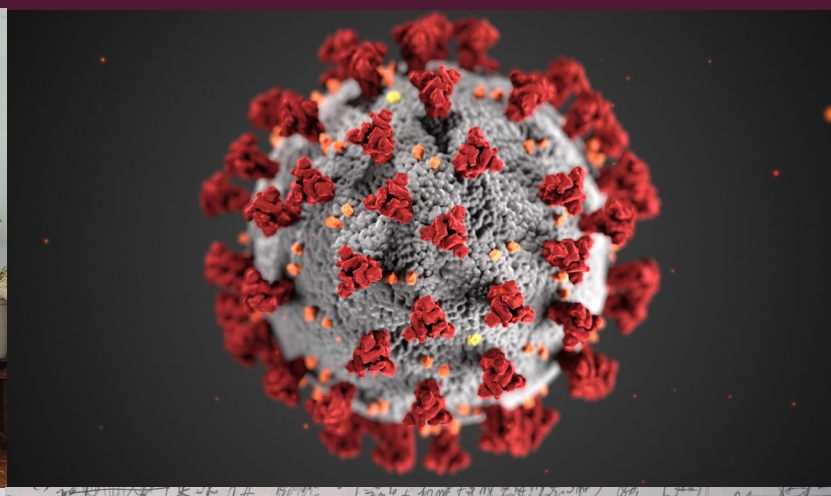
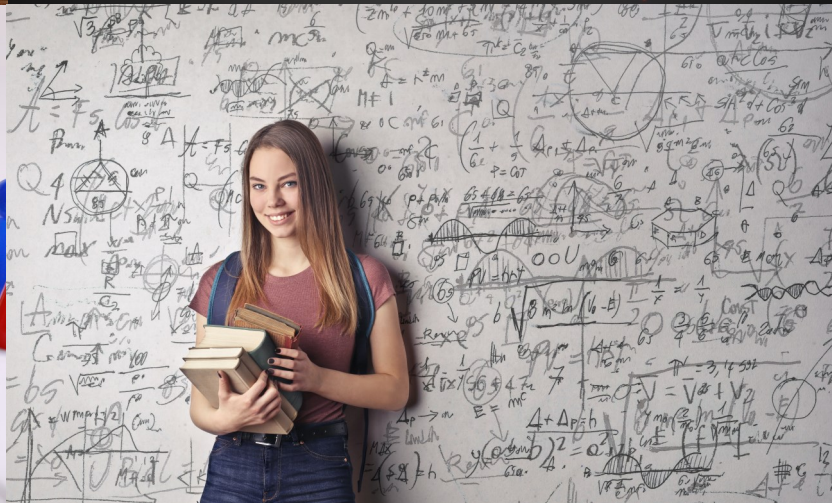
TRANSATLANTIC RESEARCH LAB ON COMPLEX SOCIETAL CHALLENGES

FIRST TRANSATLANTIC INVESTIGATOR MEETING | SEPT 02-05 2023 KREMS, AUSTRIA





Publications

- Weitzer J.; Birmann B.M.; Steffelbauer I.; Bertau M.; Zenk L.; Caniglia G.; Laubichler M.D.; Steiner G.; Schernhammer E. (2022). *Willingness to receive an annual COVID-19 booster vaccine in the German-speaking DA-CH region in Europe: A cross-sectional study*. The Lancet Regional Health - Europe, 18: 100414
- Schernhammer, E.; Weitzer, J.; Laubichler, M.D.; Birmann, B.M.; Bertau, M.; Zenk, L.; Caniglia, G.; Jäger, C.C.; Steiner, G. (2021). *Correlated of COVID-19 vaccine hesitancy in Austria: trust and the government*. Journal of Public Health, 43: https://doi.org/10.1093/pubmed/fdab122
- Weitzer J.; Laubichler M.; Birmann B.M.; Bertau M.; Zenk L.; Caniglia G.; Jäger C.C.; Steiner G.; Schernhammer E. (2021). *Comment on Alley, S.J., et al. As the Pandemic Progresses, How Does Willingness to Vaccinate against COVID-19 Evolve?* International Journal of Enviromental Research and Public Health, 18: 6
- Caniglia, G., Jaeger, C., Schernhammer, E. et al. *COVID-19 heralds a new epistemology of science for the public good*. HPLS 43, 59 (2021).https://doi.org/10.1007/s40656-021-00413-7
- Weitzer, J., Papantoniou, K., Seidel, S. et al. *Working from home, quality of life, and perceived productivity during the first 50-day COVID-19 mitigation measures in Austria: a cross-sectional study.* Int Arch Occup Environ Health (2021).https://doi.org/10.1007/s00420-021-01692-0
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- Zenk L, Steiner G, Pina E Cunha M, Laubichler MD, Bertau M, Kainz MJ, Jäger C, Schernhammer ES. *Fast Response to Superspreading: Uncertainty and Complexity in the Context of COVID-19.* Int J Environ Res Public Health. 2020 Oct 27;17(21):7884.doi: 10.3390/ijerph17217884.
- Steiner, G.; Geissler, B.; Schernhammer, E.S. *Hunger and Obesity as Symptoms of Non-Sustainable Food Systems and Malnutrition*. Appl. Sci. 2019, 9, 1062. https://doi.org/10.3390/app9061062

The **Transatlantic Research Lab on Complex Societal Challenges** was launched on September 30, 2021. It goes back to an initiative during the early beginnings of the COVID-19 pandemic in March 2020, led by the **University for Continuing Education (Danube University) Krems**, **Faculty of Business and Globalization, Department of Knowledge and Communication Management**, and the **Medical University of Vienna, Center for Public Health, Department of Epidemiology**, in alliance with the **Complexity Science Hub Vienna**. Over the subsequent months, it developed scientific contributions to solutions for complex societal challenges based on a systems science approach.

In the spring 2020, under the impression of the COVID-19-crisis unfolding and necessitating first lockdowns across the globe, a transatlantic group of researchers began to regularly meet online to discuss pressing societal challenges that might ensue from pandemic mitigation measures. The original core of the "COVID-Group" included its founders (Steiner, Schernhammer, Zenk) and researchers from **Arizona State University, Santa Fe Institute, Harvard University**, and the **World Climate Forum**.

What started out as a loose platform for scientific exchange and collaboration, developed into a permanent weekly working format. The original group expanded, incorporating experts for mineral resources (**Technische Universität Bergakademie Freiberg**) and social evolution (**Konrad Lorenz Institute for Evolution and Cognition Research**) and was elevated to the status of a **"Transatlantic Research Lab on Complex Challenges"** on September 30, 2021,- the concluding day of the first **Global Transdisciplinarity Conference** organized by Steiner and colleagues in Krems, Austria.

The Lab aims to apply interdisciplinary and systems science-based approaches to complex challenges through common research- and publication endeavours of the participating scientists, in order to provide scientific contributions to present and future societal real-world challenges.
To this purpose, the Lab has recently made an effort to incorporate transdisciplinarity and complexity science methodologies such as the **Decision Theatre of Arizona State University**.

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UNIVERSITY OF OXFORD

Brenda Birmann
Associate Epidemiologist, Channing Division of Network Medicine, Brigham And Women's Hospital
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Director General for the African Plant Nutrition Institute (APNI)
AFRICAN PLANT NUTRITION INSTITUTE

Jakob Weizer
Assistant to the Chief Medical Officer/Director-General of Public Health
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Risk and Decision Science Focus Area Lead, US Army Engineer Research and Development Center
US Army Corps of Engineers

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Scientific Director KLI
KLI
Konrad Lorenz Institute for Evolution and Cognition Research

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THE CLUB OF ROME

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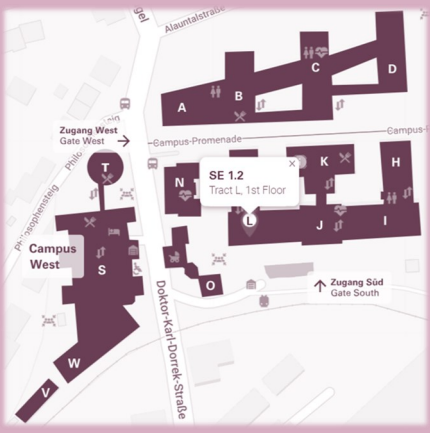

University for Continuing Education Krems
Doktor Karl Dorek Straße 30, 3500 Krems
Seminar room 1.2, Tract L, 1st Floor

Program

Saturday, September 2, 2023

18.00-open end	**Get-together**: Restaurant Wellenspiel, Krems an der Donau Restaurant Wellenspiel

Sunday, September 3, 2023

10.00	**Meeting point**: Boat landing station, Krems DDSG Blue Danube Schiffahrt GmbH, Welterbeplatz 1
10.15-10.50	**Boat cruise**: MS Dürnstein Krems to Dürnstein DDSG Blue Danube Schiffahrt MS Dürnstein
11.00-12.00	**Walking tour**: Dürnstein https://en.wikipedia.org/wiki/D%C3%BCrnstein
12.00-14.30	**Working session**: Alter Klosterkeller Dürnstein Alter Klosterkeller Dürnstein [*Steiner/Schernhammer* with *Laubichler/Lienhard/Zenk*]
12:00-12:50	Reflection of past two years in the group [Mod: *Steiner*]
12:50-13:40	Wachau nature and ONE Health [Mod: *Schernhammer*]
13:40-14:30	Setting the stage for the meeting [Mod: *Steiner/Schernhammer*]
15.00-17.00	Free Working Time
17.00-19.00	**Dinner**
19.00	**Transfer to Krems**

Monday, September 4, 2023

Theme of the Day: *A Vision for Literacy, Education, and Training for 2050 – How to deal with complexity and poly-crises in Society, Economics, and Public Administration*

09.00-09.30	**Registration** University for Continuing Education, Krems, **Seminar Room 1.2**
09.30-09.45	**Welcome:** Rector *Friedrich Faulhammer*
09.30-11.30	**Short inputs** and **Review of propositions** [Mod: *Steiner*]
09.30-10.00	(1) Mineral Resource Supply [Mod: *Bertau*]
10.00-10.30	(2) ONE Health [Mod: *Schernhammer*]
10.30-11.00	(3) Societal Crises and Sustainability [Mod: *Caniglia*]
11.00-11.30	(4) Digital Transformation: AI & Cyber Security [Mod: *Zenk*]
11.30-12.00	**Summary** [Birmann]
12.00-13.00	**Lunch break**
13.00-14.30	**Systems Scenario/Causal Loop Diagram** [Mod: *Steiner/Zenk*]
14.30-15.00	**Guest Speaker:** *Igor Linkov* "Managing multiple risks and resilience assessments" [Mod: *Steiner/Schernhammer*]
15.00-15.30	**Coffee Break**
15.30-16.00	**Guest Speaker:** *Carlos Álvarez Pereira* "No Limits to Learning 2023 and beyond" (tbc) [Mod: *Steiner/Schernhammer*]

16.00-16.30	**Guest Speakers:** *Peter Schlosser (ASU), Friedrich Faulhammer (UWK)* "The future of (complexity) education - building a transatlantic bridge" [Mod: *Steiner/Schernhammer*]
16.30-17.00	**Guest Speaker:** *Michael Obersteiner* „Systemic risk, resilience and literacy: A case of stress-tests in the banking system"
17.00-open end	**Discussion:** Implications for literacy and education towards dealing with complexity and poly-crises [Mod: *Steiner/Schernhammer*]
18.30	**Dinner** (followed by tranfer to Vienna) Restaurant Salzstadl

Tuesday, September 5, 2023

***Theme of the Day**: A Vision for 2050 – What does the data tell us?*

09.00-09.15	**Registration** and **coffee** Complexity Science Hub Vienna, Seminar Room SE 2.01
09.15-09.30	**Welcome:** *Philipp Marxgut* (CSH)
09.30-10.30	**Review of survey data from Austria** [Mod: *Steiner/Schernhammer*]
10.30-11.30	**Ideas emerging from findings, planning of ABM** [*Lienhard/Laubichler*]
11.30-12.00	**Walk to** Medical University of Vienna, Center for Public Health Kinderspitalgasse 15, Seminarraum 3, 1090 Vienna, Seminar room 3
12.00-13.30	**Science Lunch** with *Brenda Birmann*
13.30-14.00	**Walk back to Complexity Science Hub Vienna**
14.00-14.30	**"Lessons learned from Complexity Science Hub"** [*Marxgut/Steiner*]
14.30-15.00	**"Green Transition & Circular Economy"** [*Reisch*]
	"Just transition as complex system: a European labor perspective" [*Petit*]
15.00-15.30	**"A case of crisis resolution and literacy in international banking"** [*Harold*]
15.30-open end	**Discussion** [Mod: *Steiner/Schernhammer*]
18.00	**Adjourn**

ZOOM-Link for Online Participation

https://donau-uni.zoom.us/j/64218896550?pwd=Ymt4VlNyN2VZeDN3TTJlZHBXbnNEQT09

Meeting-ID: 642 1889 6550
Meeting code: 036171

Mobile
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+4312535501,,64218896550#,,,,*036171# Österreich
Local dial up: https://donau-uni.zoom.us/u/cbXK58dETs

Complexity Science Hub Vienna
Josefstaedter Strasse 39, 1080 Vienna
+43 1 59991 600
Seminar room: SE 2.01

Medical University of Vienna, Center for Public Health, Kinderspitalgasse 15, **Seminar room 3**, 1090 Vienna

Flemings Selection Hotel Wien-City
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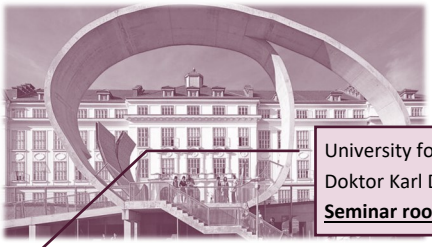

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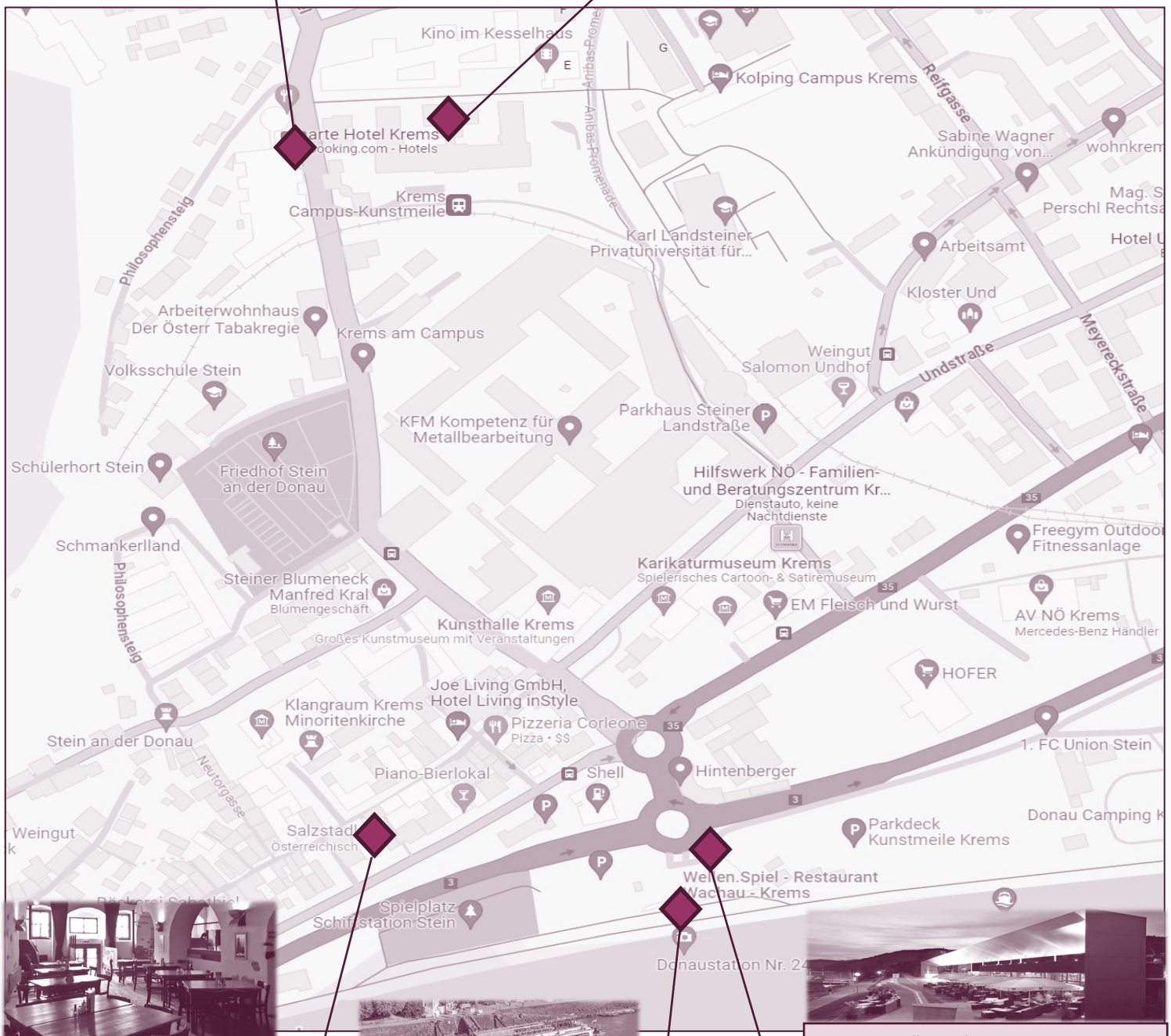

Restaurant Salzstadl
Steiner Donaulände 32, 3500 Krems
Tel.: 02732 70312

DDSG Blue Danube Schiffahrt GmbH,
Welterbeplatz 1

Restaurant Wellenspiel
Welterbeplatz 1, 3500 Krems
Tel.: 02732 75055

The **Center for Public Health at the Medical University of Vienna** is located at Kinderspitalgasse 15 in 1090 Vienna.
To reach the seminar center please use the separate entrance via Zimmermanngasse 3, 1090 Vienna.
Entrance via Zimmermanngasse 3, 1090 Vienna, **Seminar center – inner courtyard, seminar room 3 (1st floor)**

Complexity Science Hub Vienna
Josefstaedter Strasse 39, 1080 Vienna
Tel.: +43 1 59991 600
Seminar room: SE 2.01

Flemings Selection Hotel Wien-City
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The Transatlantic Research Lab on Complex Societal Challenges as ‚Complexity Task Force'

Who we are? We are an interdisciplinary group of scientists from (1) Austria with UWK – Danube University, Medical University Vienna, KLI Konrad Lorenz Institute for Evolution and Cognition Research, and the CSH Complexity Hub Vienna; from the (2) USA with Harvard University, ASU Arizona State University and SFI Santa Fe Institute; and from (3) Germany with Technische Universität – Bergakademie Freiberg and other befriended institutions. For real-world challenges and vulnerabilities, we join forces with experts from practice in transdisciplinary constellations for a deepened understanding of current system states and of scenario-based transition paths to, ultimately, help increase the decision quality in real-world settings.

Multilayered Perspective: Complexity Challenges of today all need to be based on a local, regional, and meta-regional perspective which, ultimately, are all constituents of a global perspective aimed at sustainable development. Consequently, sub- and metasystem perspectives need to be seen differentiated within their specific ecosystem conditions (which includes innovation system conditions).

Addressing socially relevant complex challenges requires knowledge integration and mutual learning between individual disciplines (interdisciplinarity) but also between science and practice and, where appropriate, society as such (transdisciplinarity). Communication processes are therefore central to this endeavor, aiming to achieve a specific understanding of these complex challenges among all stakeholders. This discourse can also provide a scientifically sound basis for developing and understanding potential future scenarios. In this context, development scenarios are shaped both by influences from the system environment and by different intervention options; with innovation being essential for sustainability-oriented intervention, especially in conjunction with businesses and entrepreneurship. Methodologically, this requires a synthesis of different quantitative and qualitative approaches and the application of tools from the fields such as data analytics, systems and scenario analysis, transdisciplinarity and co-creation. In addressing these complex challenges, we not only apply scientific methods, but also successfully develop and refine them to answer multidimensional research questions of practical and societal relevance in an inter- and transdisciplinary manner. The creation of an evidence-based foundation for future decisions or to improve the quality of decisions, in political, economic and scientific contexts is at the heart of this effort.

Today's Challenge: Poly-Crises as a Complex Problem

Currently, we are not dealing with a single crisis, but with multiple crises (poly-crises) that are challenging science, practice, and society as a whole. Poly-crises, i.e. multiple crises occurring simultaneously or in quick succession, can be considered a complex problem for several reasons:

(1) **Interconnectedness**: Poly-crises often have complex and interdependent causes, and the solutions to one crisis can impact the others. For example, climate change can exacerbate natural disasters like hurricanes or wildfires, which can lead to displacement of people and strain on emergency response systems. Addressing one crisis without considering its connection to others can lead to unintended consequences or further exacerbate the situation.

(2) Non-linearity: Poly-crises can have non-linear effects, meaning that the consequences may not be proportional to the causes or may be unexpected. For example, a pandemic can have far-reaching impacts on economies, mental health, and social systems beyond its direct effects.

(3) Uncertainty: Poly-crises often involve high levels of uncertainty and unpredictability. For example, natural disasters can be difficult to predict, and their impacts can be difficult to estimate, making it challenging to plan for and respond to them effectively.

(4) Multiple stakeholders: Poly-crises can involve multiple stakeholders with different priorities and interests, which can make it difficult to coordinate an effective response. For example, a complex humanitarian crisis may involve government agencies, NGOs, and local communities with different goals and priorities.

Overall, the complexity of poly-crises highlights the importance of taking a systems thinking approach and considering the interconnectedness of different crises and stakeholders. Effective responses require collaboration, flexibility, and a willingness to adapt to changing circumstances. Poly-crises as complex real-world challenges provide evidence for the need of complexity literacy at various societal levels including the science, industry, and business.

Complex Real-World Challenges: These include, among others, the following vulnerability spaces which are interrelated dimensions of dynamic coupled human-environment-technology system:

(1) Energy transition

(2) Food security

(3) Mobility

(4) Resource/raw materials management

(5) Digital transformation and AI

(6) Climate change and biodiversity

(7) Viral/zoonotic threats

The Ultimate Aim: One Health and Comprehensive Wellbeing

The One Health concept is an appropriate answer to today's poly-crises and complexity challenges because it recognizes the interconnectedness of human, animal, and environmental health. One Health is a holistic approach that recognizes that the health of humans, animals, and the environment are all interconnected and that the well-being of one depends on the others.

The One Health approach recognizes that many of today's crises and challenges, such as emerging infectious diseases, climate change, and food security, are complex and interconnected problems that cannot be addressed in isolation. For example, the emergence and spread of zoonotic diseases, such as COVID-19, highlight the importance of understanding the links between human, animal, and environmental health. Similarly, climate change is leading to the emergence of new diseases, the spread of existing diseases, and changes in the distribution of infectious disease vectors.

By taking a One Health approach, we can better understand the complex interactions between human, animal, and environmental health and develop more effective strategies for preventing and managing these challenges. This requires collaboration and coor-

dination across disciplines, sectors, and stakeholders, including for example public health, veterinary medicine, agriculture, environmental science, and policy.

The One Health concept can also help to address other complex and interrelated challenges, such as biodiversity loss, pollution, and antibiotic resistance. By recognizing the interconnectedness of these issues and taking a holistic approach, we can develop more sustainable and effective solutions.

Overall, the One Health concept may represent an appropriate answer to today's polycrises and complexity challenges because it recognizes the interconnectedness of human, animal, and environmental health and provides a framework for addressing these challenges in a holistic and collaborative manner.

Data and Methodology: Systems and complexity science are entering a new era. Scientific knowledge alone is not sufficient anymore to cope with real-world challenges. Instead, sophisticated approaches need to be based on the integration of all available forms of knowledge (i.e. beyond science) and sufficient data sets. The central pillars of our approach are (A) Sophisticated data sets based on an integrity of science philosophy; (B) Stakeholder based systems perspective; (C) Transdisciplinarity as an enabler of system understanding and future/scenario thinking; (D) Collaborative Creative Problem solving (CCPS).

Transdisciplinarity and Decision Theatre – Improving Decision-Making Processes in Complex and Uncertain Situations: In a nutshell, transdisciplinarity as facilitation-based mutual learning process including a targeted interdisciplinary process and a facilitated stakeholder discourse for producing socially robust orientations (SoROs) might look like the following (exemplified by sustainable phosphorus (P) management).

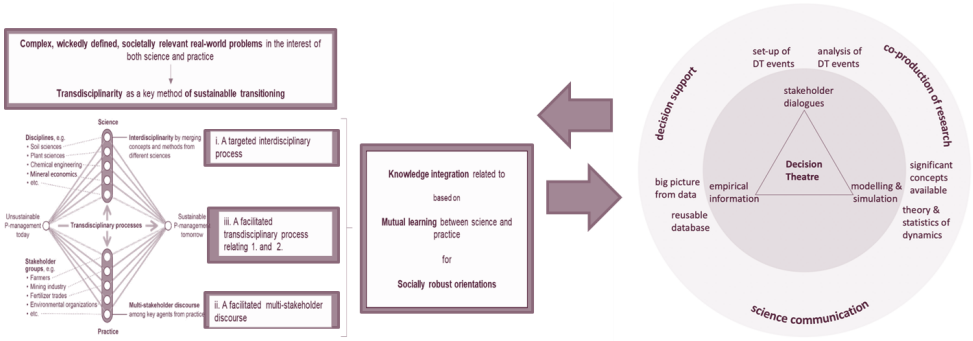


Figure 1. Transdisciplinary Process Design and Decision Theatre for (Socially) Robust Orientation

The decision theatre provides the platform for decision simulations which build on a transdisciplinary process design (on the left) and allow for decision scenarios with an underlying agent-based modeling understanding in real-time settings. As a core philosophy, one-dimensional expert knowledge, such as from one discipline or from science or practice alone, is not sufficient in dealing with highly complex real-world challenges. Instead, this calls for a well-designed mutual learning process embedded within appropriate institutional settings and supported by a sophisticated process design.

Transdisciplinarity – institutional settings: Various Transdisciplinarity Labs are devoted to different themes. In its purest form, Transdisciplinarity Labs are based on co-leadership between science and practice to allow for knowledge integration already in the phase of problem discovery, which is needed when what is obvious might only represent symptoms (e.g., SDE Td-Lab and SMR Td-Lab in the Figure 2 below).

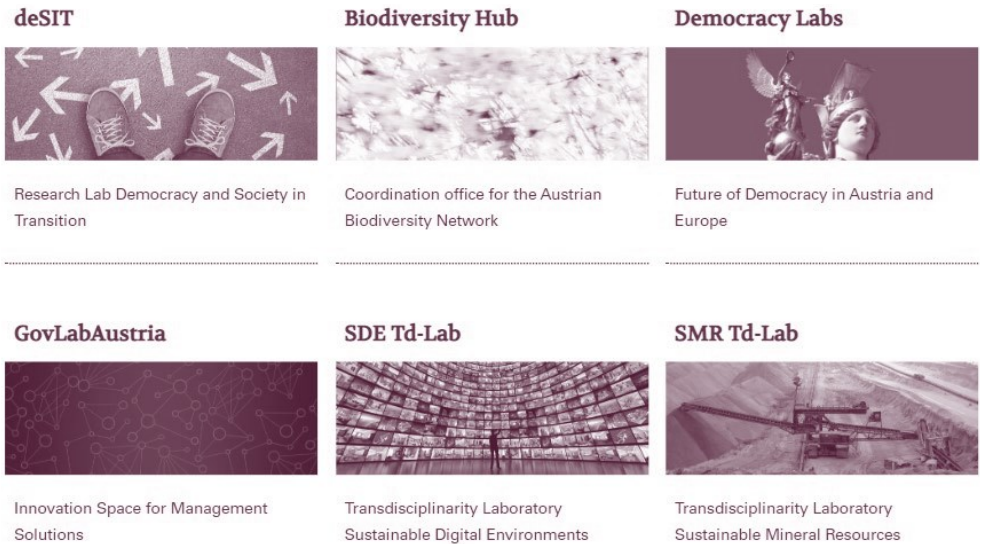


Figure 2. Transdisciplinarity Laboratories

The various labs (see Figure 2 above) are providing discourse arenas for mutual learning beyond a pure project orientation but act also as communication and collaboration hub for screening, collecting, and systematizing of the most pressing complex challenges to deal with. This may occur face-to-face, online or in hybrid manner.

Transdisciplinarity – process design for transforming vulnerability spaces into innovation niches: Complex systems such as the provision of industry with sufficient raw materials or the development of interventions which allow for simultaneous consideration of eventually diverging interests from business, special interest groups, and society in large often call for a case-faceting which allows to consider the total system as an interplay of subsystems with specific vulnerability spaces.

These vulnerabilities are usually related to coupled human-nature-technology systems which need to be understood from various stakeholder perspectives. To design interventions which tackle potential threat scenarios, a transdisciplinary design for a comprehensive knowledge integration is of key importance (see Figure 3 above).

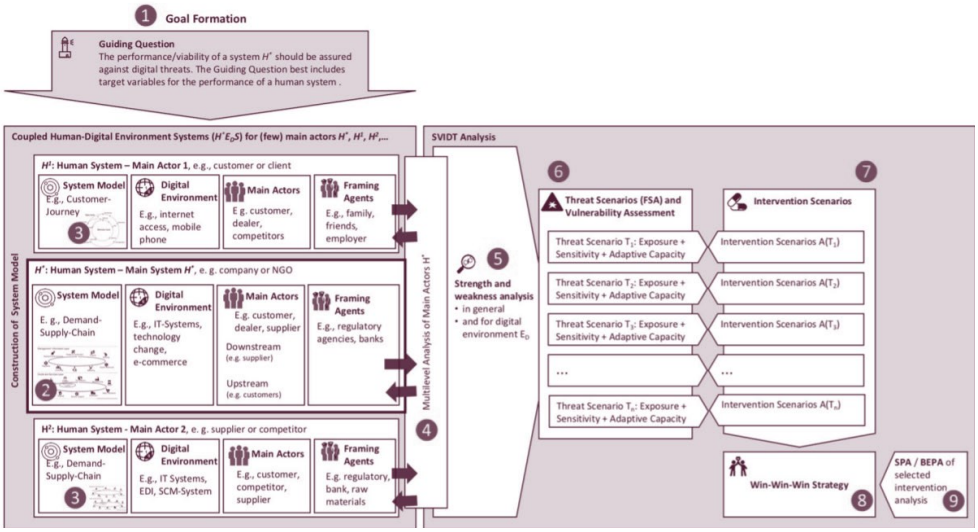
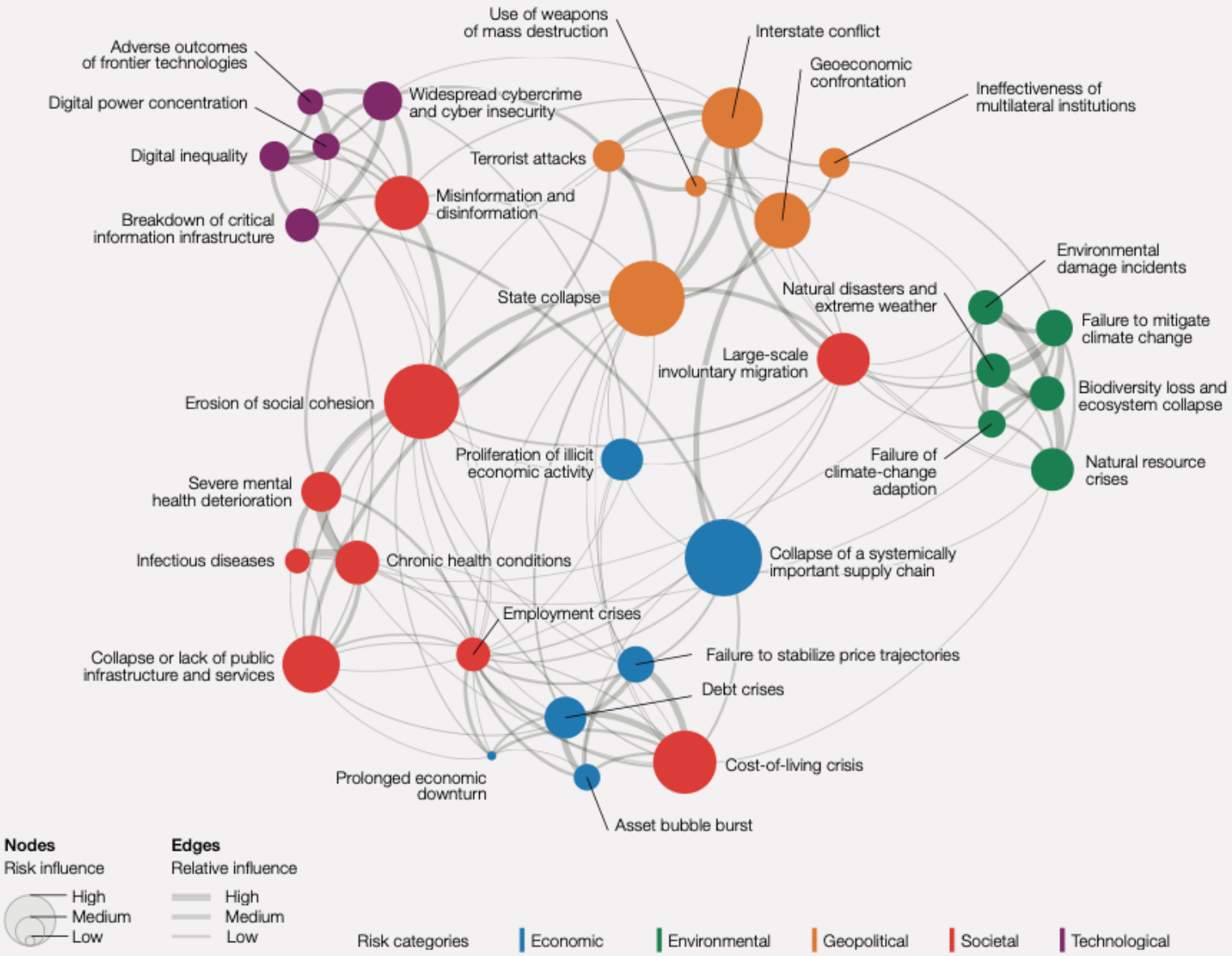


Figure 3. From Vulnerability Spaces to Innovation Niches

Scholz, Roland W. (2017). Digital Threat and Vulnerability Management: The SVIDT Method. Sustainability 9, no. 4: 554. https://doi.org/10.3390/su9040554

FIGURE C | **Global risks landscape: an interconnections map**



Source

World Economic Forum, Global Risks Perception Survey 2022-2023.

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MEDICAL UNIVERSITY OF VIENNA

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