Technology Dynamics MOT113a

Workshop III RRI

May 29th and 30th, 2024

Dr. Claudia Werker

Following-up on most unclear discussion (mud)cards I

Questions

1. Agglomeration and deglomeration economies (please watch videos for Chapters 4.1 and 4.2)
2. Do you have to change biased algorithms if they are correct?
3. Chapter 5 about (my) opinions:
   a. Positive analysis about values is an opinion-free analysis
   b. Normative analysis about opinions rooted in analysis

Following-up on most unclear discussion (mud)cards II

should become clear today

1. RRI (and relationship to remainder of course)
2. How RRI affects technology dynamics
3. RRI implementation by future entrepreneurs

(partly) beyond the scope of the course:

- How to influence innovation systems? e.g. by mission-oriented policy
- How to prognosticate future technological developments? e.g. technological forecasting

Following-up on most unclear discussion (mud)cards III

Practical

- Table with overview of cases and visualization of concepts on whiteboard useful
- My handwriting
- Noisy groups work rooms (re-allocation)
- Exam format (today‘s trial exam is half of a former exam)

Chapter 5, Exercise 2 (45 minutes)

Please

- have a look at the cases you analysed for Chapters 2, 3 and 4 and identify the values that play a role for the stakeholders in these cases, what are sources of information do you have, e.g. representation of their values in the literature, other references, own experiences or reasoning?;
- put your results in a document, preferably using a table
- compare the cases
- put your findings on the comparison in a document.

Workshop III: RRI

TRIAL EXAM

6. RRI Systems (B/F)
7. Inclusive Research and Innovation (IRI) in STEM (TL)

Dr. Claudia Werker

Workshop III: RRI

TRIAL EXAM

6. RRI Systems (B/F)
7. Inclusive Research and Innovation (IRI) in STEM (TL)

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Trial Exam I May 29th, 2024, I

- **Please keep seated during the whole trial exam to not disturb others.** If finished turn to the assignments.
- **You have 90 minutes (for exact time see white board).**
- Required: **answers to every sub-question!** If you do not know the answer, write what you know and where you get stuck and why for every sub-question.
- **Uploading of the trial exam at 12.45h the latest.**

Trial exam I May 29th, 2024, II

Assessing another student's trial exam and uploading it

- Distribute the exams between the groups members and do not assess the exam of the one assessing your exam (e.g. by making a ring of assessment, i.e. stud 1 assessing stud 2, stud 2 assessing stud 3, …)
- Filling in your assessment: 13.45h-14.30h
- Required: **full assessment!** If you do not know how to assess it discuss it with your fellow students or someone of the teaching staff .
- Uploading your assessment: **14.40h the latest**

14.30h-15.15h Exercise of Ch. 5

Allocation of groups to classrooms

Group's work for **May 29th, 2024**

Classroom	Groups
TPM-Hall B	1-4
TPM-Hall C	7-11
TPM-Hall D	13-15
TPM-Hall E	18-21
TPM-Instruction Room D1	23,27,28
TPM-Instruction Room D2	16,22,24,25

Trial exam I May 29th, 2024

Trial exam I May 29th, 2024, III

Question 1 (45 points):

a) Please quick-read the paper on Chilean biotech by Romero, 2018, and figure out what the major concepts used, the research questions and resolutions of the paper are (20 points).

b) Please figure out the differences between the innovation system's approach and the cluster's approach (10 points).

c) Please discuss the influence of personal, social and geographical proximity on the generation of business relations in the Chilean biotech industry (15 points). Please note that the abbreviation DBF stands for dedicated biotechnology firm.

Trial exam I May 29th, 2024, IV

Exercise	Assessment Criteria	Points
1a	Major concepts with definitions: Proximity, particularly personal proximity/ agglomerations/strategic alliances/social networks Research Question (citation in quotation marks and with page number): "… is there a positive relationship between personal and business links?" (p. 3), preferably in own words (else -1 point) Resolution (citation in quotation marks and with page number): ""The results suggest a positive and highly significant relationship between personal and business relations in high-tech clusters in the context of an emerging economy, ... Personal relations can overcome certain problems when generating new collaborations between firms – such as transaction costs, monitoring costs, or information asymmetries – generating trust between two organizations. Personal relations can therefore be considered an important resource in the creation of links between firms" (p. 28), preferably in own words (else -1 point). The study also highlights a possible negative effect of relationships, as if personal and social proximities are too strong firms tend to generate cliques, which get trapped in old strategies that are detrimental for the generation of new knowledge and the growth of clusters and their firms. Full sentences with explanation	20 3 6 3 5 3
1b	"a cluster is a geographically bounded system with multiple interacting actors (Porter 1998)" (p. 842), preferably in own words (else -1 point) Both the innovation system's approach (give definition) and the cluster's approach are frameworks used to analyse and understand the actors and their relationships within a system. The main differences between the two approaches are a) that in the cluster approach we define system of geographically close innovative agents' and analyse their relationships within in this context Full sentences with explanation b) that the innovation systems approach explicitly focuses on institutions (give definition) Full sentences with explanation	3 4 3
1c	The paper suggests a positive impact of personal and business relations, as they can overcome certain problems (e.g., transaction costs) and generate trust among organizations. Full sentences with explanation However, relying too much on personal and social proximities can generate bad outcomes in the long term, as described by Boschma (2015) and Ooms et al. (2015). Full sentences with explanation The study also outlines how it is difficult to analyze the effect of personal and social proximity, because the indicator personal relations contains both types of proximities. Full sentences with explanation Through a statistical analysis support for the hypothesis that geographical proximity enhances collaboration. (Full …)	4 4 4 3

Trial exam I May 29th, 2024, V

Question 2 (45 points):

Please have a look at the innovation indicators of Switzerland as depicted on the European Innovation Scoreboard, 2022.

a) Pick five individual innovation indicators shown on this sheet, tell what they measure and discuss their advantages and disadvantages (15 points).

b) Please critically discuss the summary innovation index by particularly considering the criticism by Edquist et al. (2018) in your answer (5 points).

c) Please analyse the Swiss innovation system based on Marxt and Brunner, 2013, and the individual indicators provided by the European Innovation Scoreboard, 2022. Please elaborate also on the weaknesses and strength of the Swiss innovation system while doing so (20 points).

d) What would be your recommendations for Swiss policy? (5 points)

Trial exam I May 29th, 2024, VI

2a	Examples of five innovation indicators or groups of innovation indicators to discuss (full answer includes what they measure, what advantages and disadvantages they have): a) human resources indicators = input indicators: cover a broad spectrum with doctorate graduates, population with tertiary education and lifelong learning but might miss that you need engineers more than other highly educated employees for innovation and technological change b) patent application = output indicator: gives good indication of output of mostly large firms of applied research but not about basic research output in the academic sector c) innovative SMEs collaborating with others: measure relationships between stakeholders but only those involving SMEs, d) broadband penetration measures digitalisation but is only about physical infrastructure, missing out on the use of it e) R&D expenditure in the business sector = input indicator covering only the business but not the academic sector	3 for each
2b	The summary innovation index gives blurry information as it a) includes all indicators with the same weight b) mixes input and output indicators Edquist et al 2018 suggest an efficiency indicator relating input to output indicators instead	 1 1 3
2c	Following the paper by Marxt et al. and the innovation scoreboard, Switzerland comes out as a country with: • A great academic environment, composed of top-in-the-world Universities (like ETH Zurich, ETH Lausanne, etc.) • Good and well-funded, research facilities (like CERN, PSI, etc.) • Very R&D intensive businesses (Private business account for more than 70% of R&D expenses) • High spending by central government on education, a commission of Technology and Innovation (CTI), and cantons that promote economic growth in their region with specific targeted policies Strengths: very favourable for multinational companies, both from an institutional point of view (low taxation), and from a human resources point of view, with a highly skilled workforce. Weaknesses are the innovative collaboration of SMEs with others scores very low, the low governmental support to business R&D, low willingness to take the entrepreneurial risk by citizens. All: full sentences with explanation	10 5 5
2d	Actively support (the emergence) of innovative SMEs, e.g. by firm incubators at universities specialized on technology-oriented start-ups, provide funding for networking activities between SMEs, large firms, academia etc., e.g. for conferences or for seed-funds that enable them to apply for external funding. Full sentences with explanation	5
Total	**Number of Points realized**	
Calculate	Number of Points realized divided by 90 points	
Calculate	Round up or down according to the normal rules and fill in a **whole number as mark**, fill this in in feedback fruit as well	

Trial exam I May 29th, 2024, VII

- Number of points realized divided by 90 points, multiplied by 100
- Round up or down to full or half marks (two digit after the dot), e.g. 0.8-1.2 = 1; 1.3-1.7 = 1.5

- >=5.75
- >=6.75
- >=7.75
- >=8.75
- >=9.75

Chapter 5, Exercise 2 (45 minutes) REVISIT

Please

- have a look at the cases you analysed for Chapters 2, 3 and 4 and identify the values that play a role for the stakeholders in these cases, what are sources of information do you have, e.g. representation of their values in the literature, other references, own experiences or reasoning?;
- put your results in a document, preferably using a table
- compare the cases
- put your findings on the comparison in a document.

Workshop III: RRI

TRIAL EXAM

6. RRI Systems (B/F))
7. Inclusive Research and Innovation (IRI) in STEM (TL)

Dr. Claudia Werker

Chapter 6: Learning Goals

- define RRI systems
- explain why distinguishing innovative agents and other stakeholders is particularly important for RRI systems
- explain why RRI requires a system approach
- understand how to assess RRI systems using the assessment scheme provided by Werker (2020) and apply to an innovation system you analyse, by particularly picking relevant indicators
- explain possible opportunities or bottlenecks emerging from digitization, particularly big data and IoT solutions

Chapter 6. Multiple-choice question

Please go to Brightspace and follow the steps below:

- Go to **Content** in the navbar of the course
- Click on the **Multiple-choice question** module
- Click on the quiz **6. Responsible Research and Innovation (RRI) Systems**
- Enter **password**: npmlrwj
- Click on **Start quiz**

Chapter 6. Multiple-choice question

To realize RRI all stakeholders:

1. need to be part of the process
2. need not to be part of the process
3. need not to identify the effects and alternatives of innovations

6. Responsible Research and Innovation (RRI) Systems

6.1 Assessing innovation systems: state-of-the-art

6.2 Assessing RRI systems: adding responsibility to the mix

Dr. Claudia Werker

6. Responsible Research and Innovation (RRI) Systems

6.1 Assessing innovation systems: state-of-the-art

6.2 Assessing RRI systems: adding responsibility to the mix

Dr. Claudia Werker

6.1 Assessing innovation systems I

Innovation systems

- innovative agents (Bergek et al., 2008; Klein-Woolthuis et al., 2005)
- their activities (Bergek et al., 2008; Werker, 2001)
- their relationships and collaborations (Boschma, 2005; Caniels et al, 2014, Werker et al., 2016)
- Institutions (Bergek et al., 2008; Edquist, 2011; Werker et al., 2016)

Focus on **dynamics** when assessing innovation systems

6.1 Assessing innovation systems II

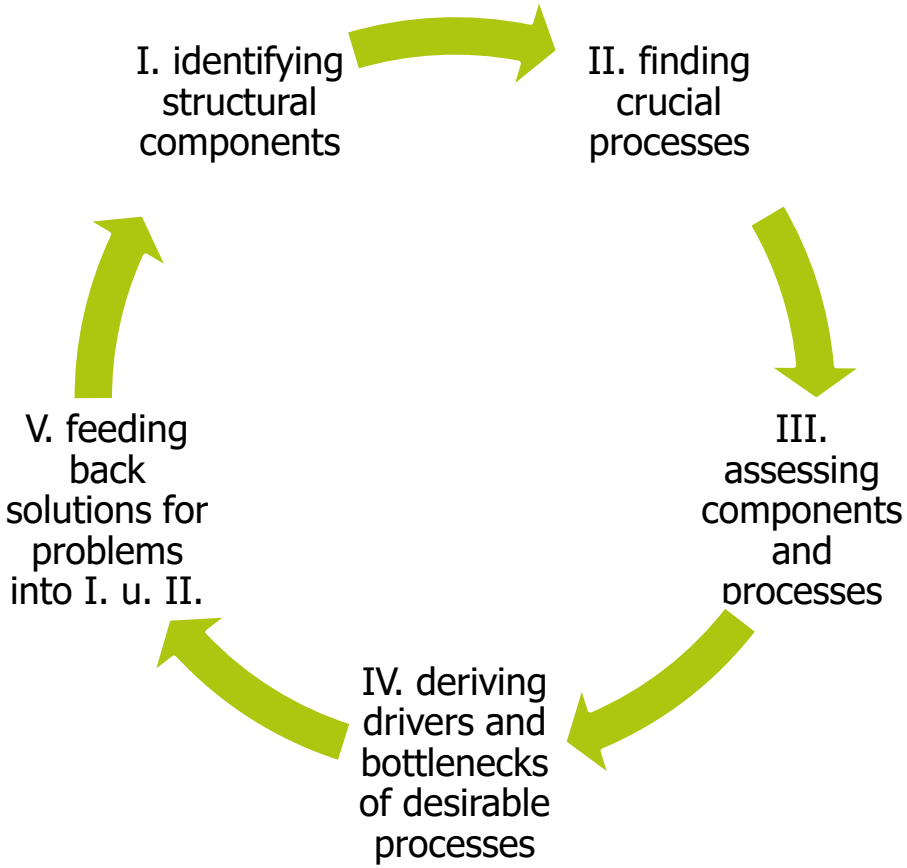


Figure 1: A scheme of assessing innovation systems inspired by Bergek et al. (2008); Edquist (2011); Klein Woolthuis et al. (2005).

6. Responsible Research and Innovation (RRI) Systems

6.1 Assessing innovation systems: state-of-the-art

6.2 Assessing RRI systems: adding responsibility to the mix

Dr. Claudia Werker

6.1 Assessing innovation systems III

Using indicators for assessment:

- Quantitative indicators such as
  - patent (citation)s, licenses, publication (citation)s,
  - venture capital
  - SMEs collaborating with others
  - SMEs product and process innovation
  - SMEs marketing/organisational innovations and SMEs innovating in-house
  - Product innovation and business innovation as newly defined by OECD/Eurostat (2018)

6.1 Assessing innovation systems IV

- Combined use of quantitative and qualitative indicators such as
  - Mission statements of agent and stakeholders
  - Institutional rules for different agent and stakeholders
  - Market phases (size, customers, user preferences, strategies, offerings)

6.2 Assessing RRI systems I

Adding responsibility to the mix:

- identify those stakeholders affected by research and innovation without having any influence on process or outcome
- develop shared values
- assessment of processes and outcomes of research and innovation based on shared values
- additional potential value-related drivers and bottlenecks
- shared values might help to choose between various policy and management measures

6.2 Assessing RRI systems II

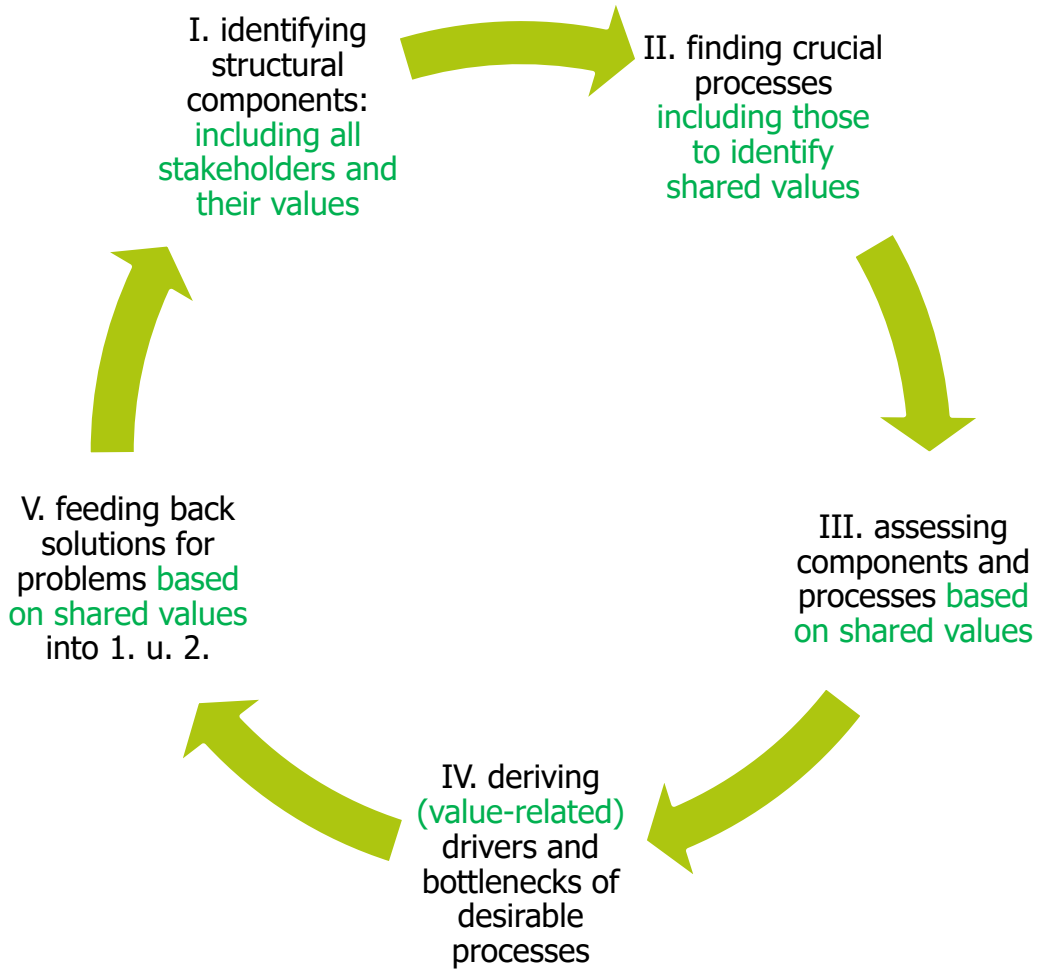


Figure 2: A scheme of assessing RRI systems

6.2 Assessing RRI systems III

Additional indicators measuring responsibility

- Expert information on all stakeholders in RRI systems
- possibly RRI key performance indicators developed by firms (van de Poel et al., 2017)
- Mid-stream modulation by third party (embedded humanist) (Flipse et al., 2013)
  - to enable communication and collaboration
  - to receive information on the values of organizations
- Possibly using information on whether ethical guideslines have been applied on a more aggregated level (Mejlgaard et al., 2018)

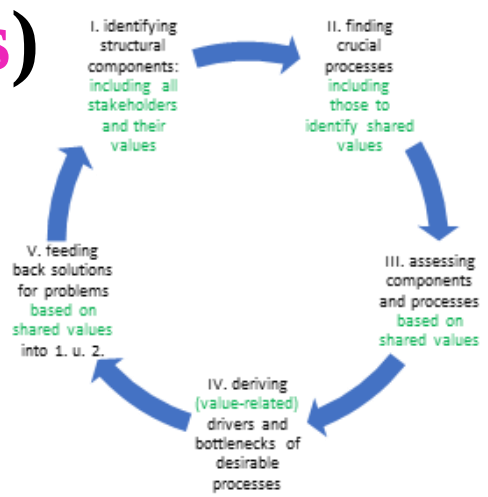
6. Responsible Research and Innovation Systems

Please explain the muddiest point you identified!

Chapter 6, Exercise 2 (35 minutes)

Please carry out this exercise as part of the take-away groups‘ work!

Chapter 6, Exercise 3 (50 minutes) carry out May 30th 8.45h in assigned halls



As a group, please take any of the cases you analysed so far. Make sure that you can answer the following questions based on the material you have.

Please use the scheme from Werker, 2020, Figure 11.2: Write up your findings in a document, indicate your sources and upload it on Brightspace by the end of the session the latest.

I. identify the structural components including all innovative agents and/or stakeholders and their values (use results from Ex. 1 of Chapter 6)

II. find crucial processes including those to identify shared values

III. assess components and processes based on shared values (if you can detect them, else provide some insights how they could look like)

IV. derive (value-related) drivers and bottlenecks of desirable processes

V. propose solutions for problems based on shared values into I. and II.

Allocation of groups to classrooms

Group's work for **May 30th, 2024**

Classroom	Groups
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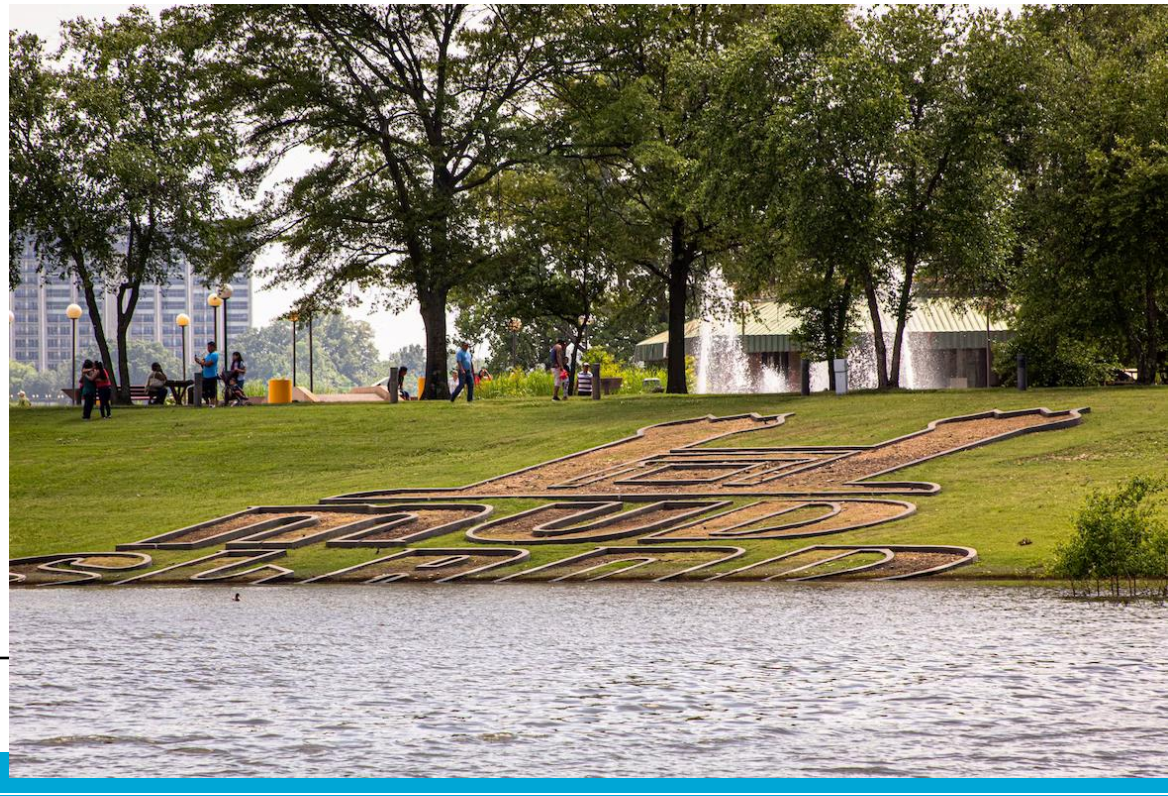
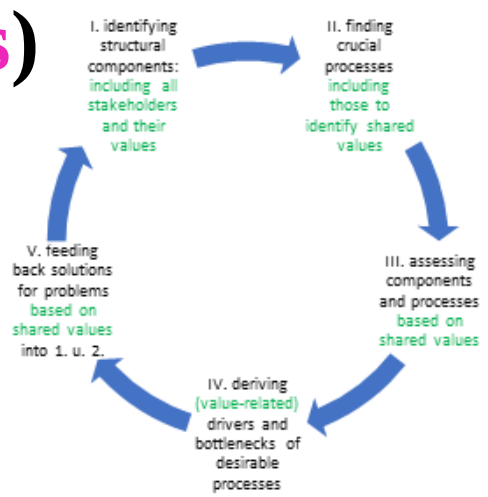
TPM-Hall C	7,10,11
TPM-Hall D	13-15
TPM-Hall E	19-21
TPM-Instruction Room D1	23,27,28
TPM-Instruction Room D2	16,22,24,25
TPM-Hall A	8,9,18

Please share your thoughts about the following questions with us:

1. What are the three things you learned today?
2. What are the two things you are still curious about?
3. What is the one thing you did not understand?



Chapter 6, Exercise 3 (50 minutes)
REVISIT May 30th
9.50h lecturing hall



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Workshop III: RRI

TRIAL EXAM

6. RRI Systems (B/F)

7. Inclusive Research and Innovation (IRI) in STEM (TL)

Dr. Claudia Werker

7. Inclusive Research and Innovation in STEM

7.1 Exclusion of Stakeholders because of STEM‘s diversity-oblivion

7.2 Beyond Gendered Research and Innovation: Inclusive Research and Innovation (IRI) in STEM

7.3 STEM cases with IRI elements

7.4 Towards Innovation Systems Supporting IRI in STEM

7. Inclusive Research and Innovation in STEM

7.1 Exclusion of Stakeholders because of STEM‘s diversity-oblivion

7.2 Beyond Gendered Research and Innovation: Inclusive Research and Innovation (IRI) in STEM

7.3 STEM cases with IRI elements

7.4 Towards Innovation Systems Supporting IRI in STEM

7.1 Exclusion of Stakeholders bec. of STEM‘s diversity-oblivion I

- Focus on ‘average‘ human being in STEM
- with consequences for all others whenever their specific characteristics relevant (e.g. Perez, 2019; Werker, 2021b)
  - Health: trials with 18-45 year old men
  - Cars: Crash test dummies as ‘average‘ man
  - Algorithms mirroring biases

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7.1 Exclusion of Stake-holders because of STEM‘s diversity-oblivion II

- Innovative agents in STEM miss an important resource of variation and selection,
- thereby hampering the overall functioning of innovation systems

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7.1 Exclusion of Stakeholders because of STEM‘s diversity-oblivion III

Three reasons

1. STEM education: responsible research and innovation in STEM education discussed (van Grunsven et al., 2023), but rarely implemented (Nielsen et al., 2018)
2. STEM tradition in collecting, analysing and reporting data: saying human beings and meaning white man (D’Ignazio & Klein, 2023)

…

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7.1 Exclusion of Stakeholders because of STEM‘s diversity-oblivion IV

…

3. notions of ‘objectivity’ hiding subjective decisions:
   STEM research and innovation has been considered ‘value-free’ (e.g. Schumpeter, 1949);
   yet decisions in STEM research and innovation are highly subjective, i.e. regarding
   - who is important for their research and innovation,
   - what is interesting and
   - what serves society …

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7.1 Exclusion of Stakeholders because of STEM's diversity-oblivion V

Danger of techno-ableism (Shew, 2020):

- Even when well-meaning STEM academics explicitly address problems of disabled human-beings,
  they often do not respect their values and needs
- Example: use of exoskeletons for everyone who cannot walk upright

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7. Inclusive Research and Innovation in STEM

7.1 Exclusion of Stakeholders because of STEM‘s diversity-oblivion

7.2 Beyond Gendered Research and Innovation: Inclusive Research and Innovation (IRI) in STEM

7.3 STEM cases with IRI elements

7.4 Towards Innovation Systems Supporting IRI in STEM

7.2 Beyond Gendered Research and Innovation: **IRI in STEM** I

Terms (e.g. Rice et al. 2019)

- Diversity referring to variety of human beings regarding sex, gender, age, sexual orientation, physical ability etc.
- Intersectionality: combinations of diverse characteristics, e.g. gender and age
- Inclusion: how are values, needs, experiences of diverse human beings considered
- Sex referring to biological characteristics
- Gender referring to behavioural, cultural and psychological characteristics

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7.2 Beyond Gendered Research and Innovation: **IRI in STEM** II

- Gendered research and innovation: using the potential of gender and sex diversity including their intersectionality for driving scientific discovery and innovation (European Commission, 2020; Nielsen et al., 2018)
- Overall, the uptake of gendered research and innovation remained unsatisfactory (Cheveigné et al. 2017)
- Possible explanation: the EU policy measures have only addressed issues of STEM's 'gender and sex-blindness in a few projects but systematic insights are missing

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7.2 Beyond Gendered Research and Innovation: **IRI in STEM** III

To fully account for diversity of human beings:

IRI in STEM means that innovative agents carry out their projects by exploring and exploiting the potential of diversity of human beings in all its facets to drive scientific discovery and innovation.

Whenever relevant, they integrate the diversity of human beings into all phases of research and innovation to warrant inclusive and excellent outcomes for all human beings.

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7. Inclusive Research and Innovation in STEM

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7.2 Beyond Gendered Research and Innovation: Inclusive Research and Innovation (IRI) in STEM

7.3 STEM cases with IRI elements

7.4 Towards Innovation Systems Supporting IRI in STEM

7.3 STEM cases with IRI elements

7.3.1 Medical Sciences

7.3.2 Automobile Engineering

7.3.3 Algorithms Technology and Mathematics

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7.3 STEM cases with IRI elements

7.3.1 Medical Sciences

7.3.2 Automobile Engineering

7.3.3 Algorithms Technology and Mathematics

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7.3.1 Medical Sciences I

- although gendered research and innovation part of medical sciences in recent years, not systematically implemented (Nielsen et al, 2018)
- example Covid-vaccines: life-threatening Astra-Zeneca side-effects more often in women than in men (Schulz et al., 2021) but detected very late in the vaccination processes

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7.3.1 Medical Sciences II

podcast Grossmann/Werker, 2024

- evidence-based medicine is gold-standard but ignores large parts of patients, particularly patients with co-morbidity, elderly, women
- collection of data mirroring the relevant patient population difficult
- interdisciplinary collaboration with mathematicians, physicists, ethicists/ philosophers and human factor designers helps

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7.3.1 Medical Sciences III

- personalized approach in patients' diagnoses and treatment necessary to provide good health care for all (podcast Grossmann/Werker, 2024)

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7.3.1 Medical Sciences IV

- changes necessary in
  - institutional set-up requiring more diverse trial populations
  - all research phases, i.e. research questions, data collection and analysis, as well as implementation of results (e.g. treatment)
  - interdisciplinary collaborations

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7.3 STEM cases with IRI elements

7.3.1 Medical Sciences

7.3.2 Automobile Engineering

7.3.3 Algorithms Technology and Mathematics

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7.3.2 Automobile Engineering I

- use of crash-test dummies mirroring the ‘average man’ (Perez, 2019)
- Particularly dangerous for women (usually smaller, lighter and have a severely different body composition (Barry, 2019)

Podcast Klug/Lex/Hirz/W. 2023:

- Car manufacturers do not use more varied crash-test dummies for cost reasons; no require-ments by institutions to do so far
- 50% female ‘average’ person might be used in a project
- …

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7.3.2 Automobile Engineering II

Podcast
Klug/Lex/Hirz/Werker, 2023

…

- Goal to provide comfortable, safe and secure cars for all
- Interdisciplinary collaboration with medical sciences, psychology
- Combination of working with drivers and passengers differing in sex, age, body composition etc. and simulation models (for cost reasons)

7.3.2 Automobile Engineering III

IRI in STEM in Automobile Engineering SIIS:

changes necessary in

- institutional set-up
  requiring diverse crash-test dummies
- changes in all research phases
- systematic interdisciplinary research and innovation

7.3 STEM cases with IRI elements

7.3.1 Medical Sciences

7.3.2 Automobile Engineering

7.3.3 Algorithms Technology and Mathematics

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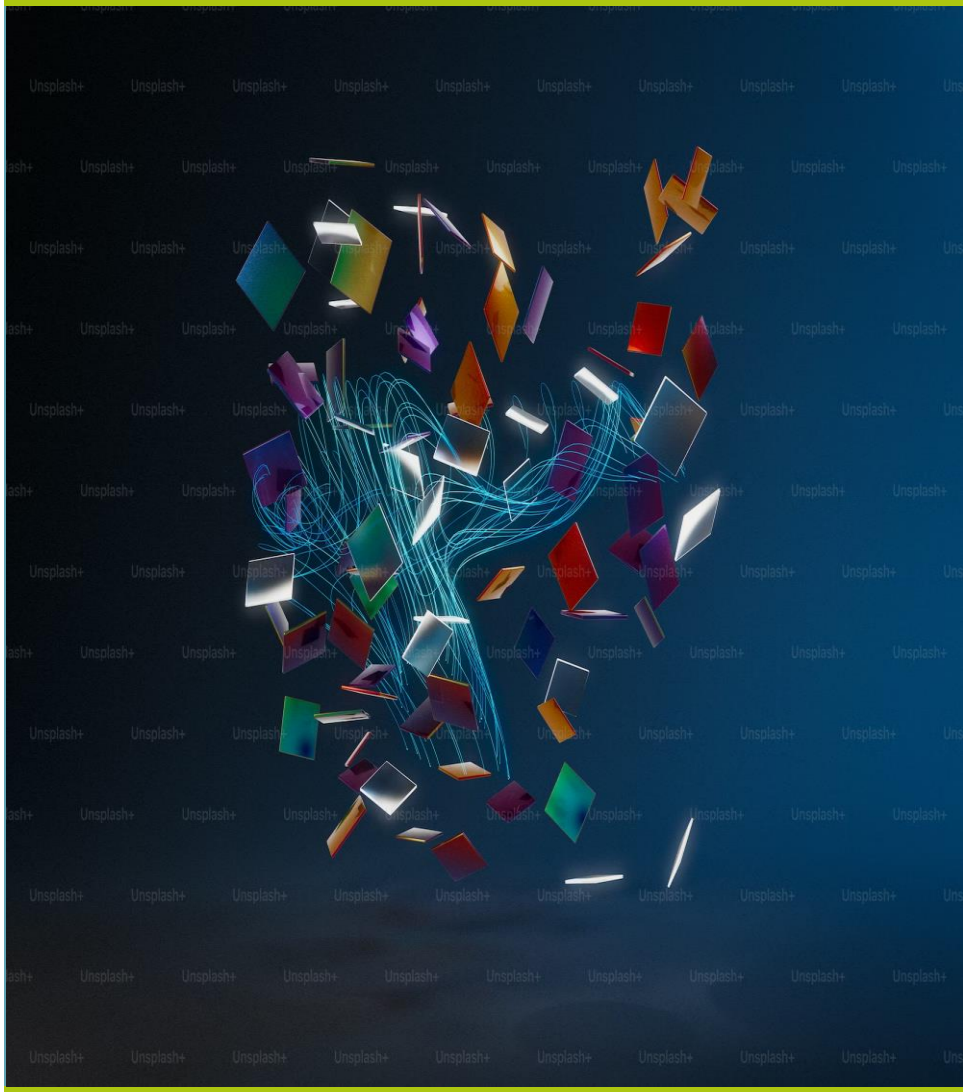
7.3.3 Algorithms Technology and Mathematics I

Many examples of discrimination via algorithms (Werker, 2021a and 2021b):

- price discrimination if algorithms detect willingness to pay;
- autonomous cars not detecting people with dark skin;
- pre-selection of university admission based on sex or kind of last name



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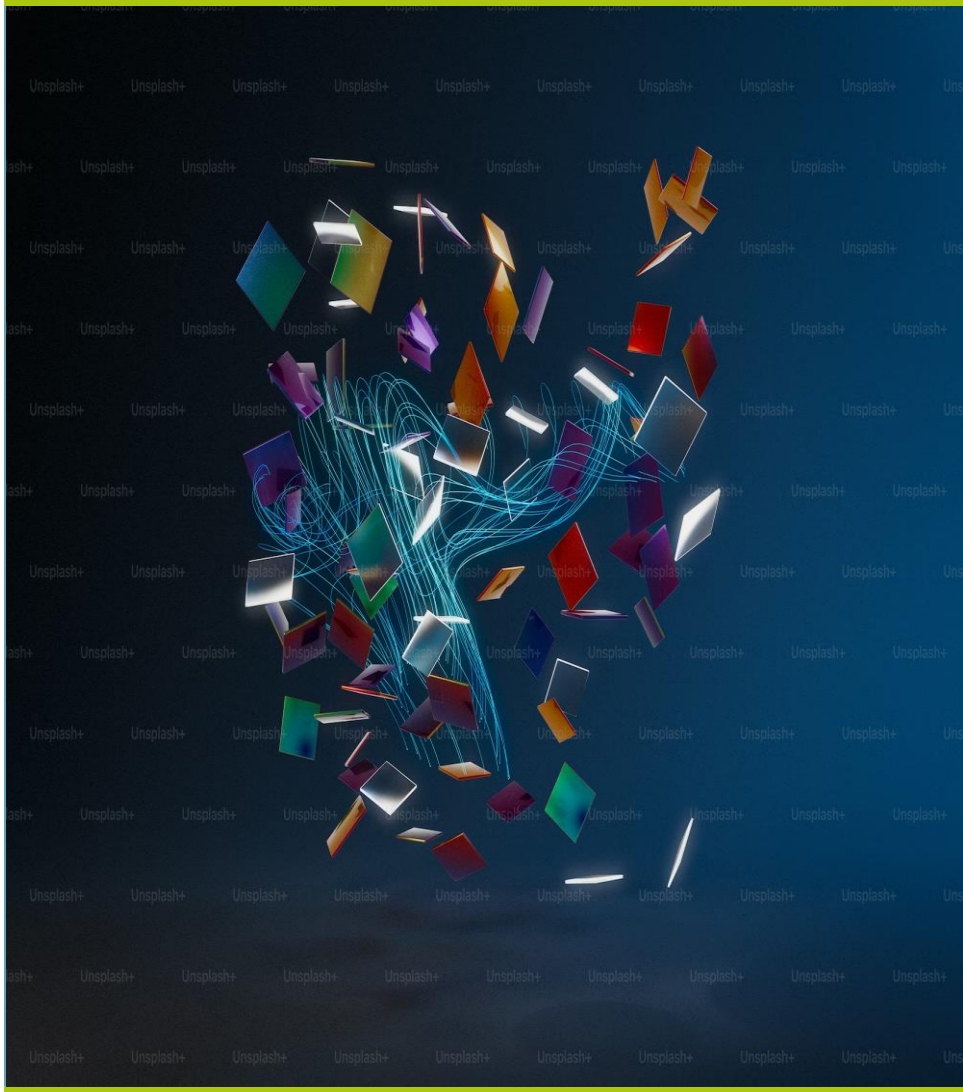
7.33 Algorithms

Technology and Mathematics II

Podcast Wagner/W., 2024

- Big tech companies crucial players with vested interests
- More detailed data about diverse people necessary which is expensive
- Public funding needed to not follow the interests of big tech
- Interdisciplinary collaboration with social scientists necessary to understand emergence of biases and how to deal with them



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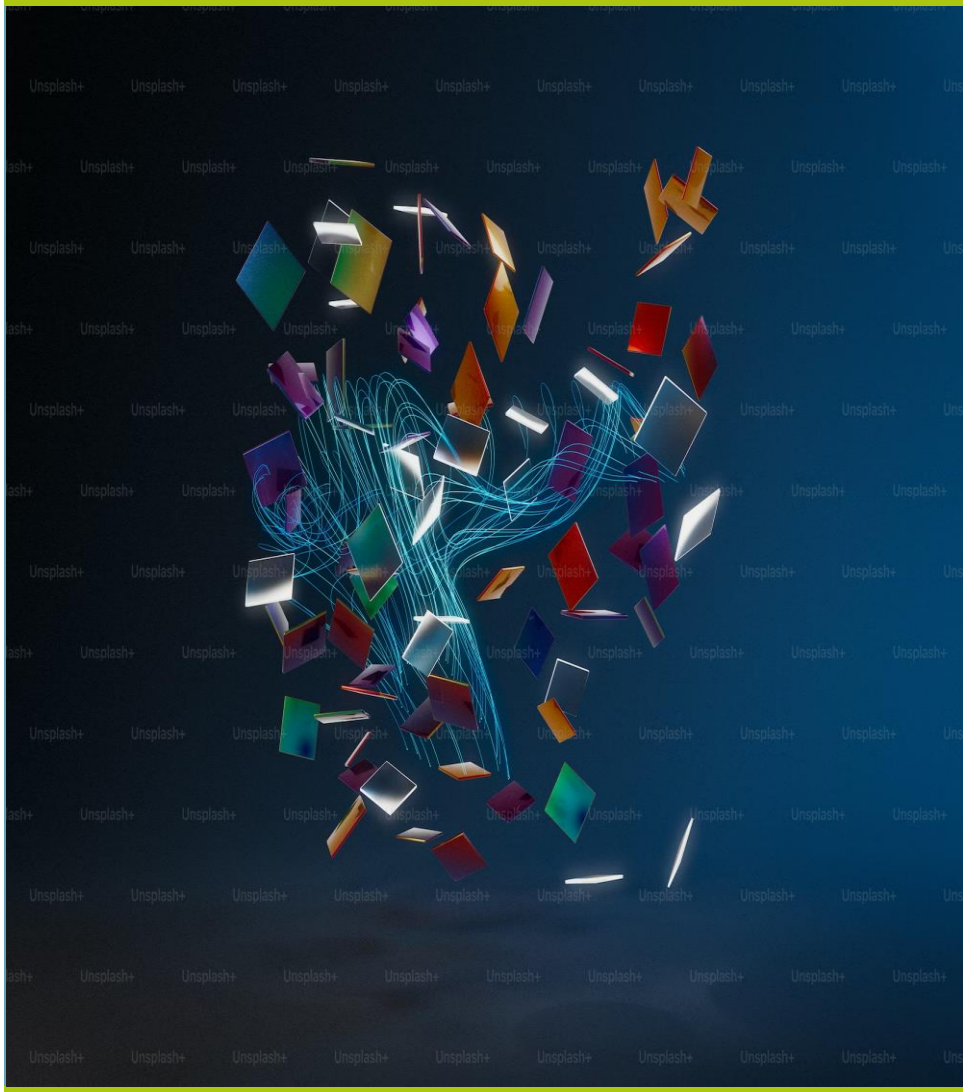
7.3.3 Algorithms Technology and Mathematics III

IRI in STEM in Algorithms innovation syst.:

changes necessary in

- public funding enabling broader and more detailed data collection
- interdisciplinary research and innovation, particularly with social scientists
- other than big techs as players



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7. Inclusive Research and Innovation in STEM

7.1 Exclusion of Stakeholders because of STEM‘s diversity-oblivion

7.2 Beyond Gendered Research and Innovation: Inclusive Research and Innovation (IRI) in STEM

7.3 STEM cases with IRI elements

7.4 Towards Innovation Systems Supporting IRI in STEM

7.4 Towards Innovation Systems supporting IRI in STEM I

7.4.1 Inclusion of Stakeholders and changing Institutions

- including stakeholders excluded yet affected lead to changes in the whole research and innovation process, i.e.
- policy is crucial in changing institutions, particularly formal ones such as rules and regulations

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7.4 Towards Innovation Systems supporting IRI in STEM II

7.4.2 Knowledge Creation and Learning in an interdisciplinary Way

- Learning and knowledge creation change when including stakeholders excluded yet affected
- Interdisciplinary collaborations enable IRI in STEM

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Chapter 7. Multiple-choice question

Please go to Brightspace and follow the steps below:

- Go to **Content** in the navbar of the course
- Click on the **Multiple-choice question** module
- Click on the quiz **7. Inclusive Research and Innovation (IRI) in STEM**
- Enter **password**: ikmueaj
- Click on **Start quiz**

Chapter 7. Multiple-choice question

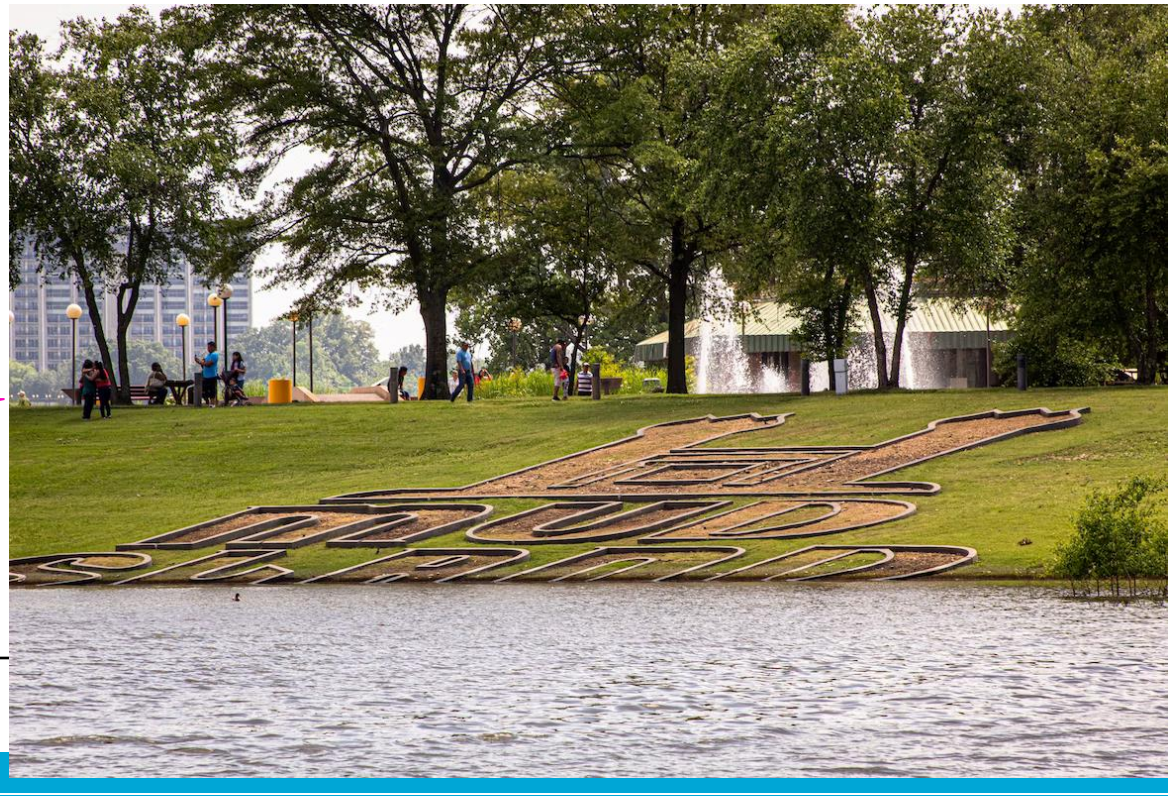
Inclusive Research and Innovation refers to:

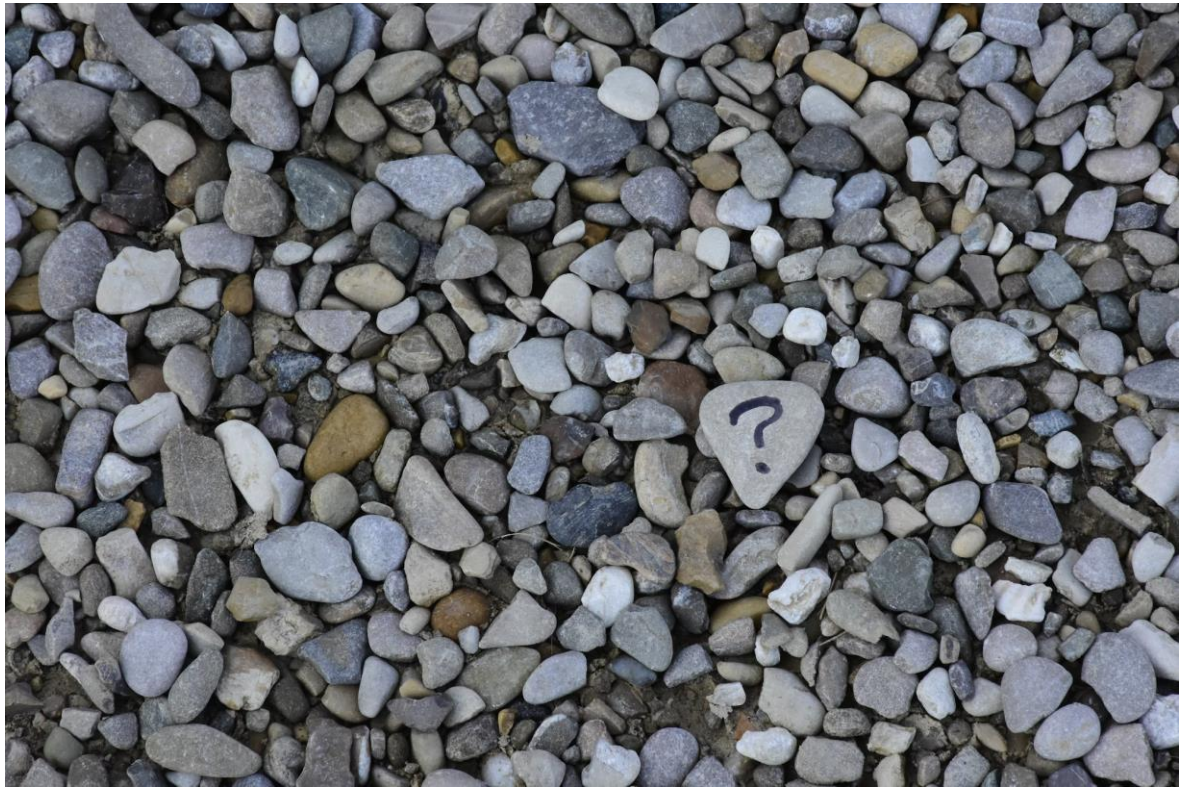
1. gender only
2. a variety of diverse characteristics and their combinations
3. age only

Please fill in the mud cards (1 minute) and return them to us!

1. What are the three things you learned today?
2. What are the two things you are still curious about?
3. What is the one thing you did not understand?

LOOKING FORWARD TO SEEING YOU AT WORKSHOP IV





We answer your questions during the workshops.