inn SCI

Future Skills for Openness
╱ A framework for promoting openness
in science and business

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/ **Content**

About innOsci ╱ The Stifterverband's Open Innovation Culture Forum

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innOsci is the Open Innovation Culture Forum and is organised by the Stifterverband with the support of the BMBF (Federal Ministry of Education and Research). It supports the "New Sources for New Knowledge" mission of the Federal Government's High-Tech Strategy and is part of its data strategy.

The forum is a community network of people who are active in new innovation cultures. It tests the potentials, but also the limits of an open-innovation culture. Specifically, innOsci provides people in research and innovation from academia, business and civil society with a network and works with them on the development of tools to consolidate new approaches and methods of value creation at universities and in companies, as well as recommendations for action for policymakers to promote **openness** (open science and open innovation) [1].

The innOsquad Future Skills for Openness

It is often individuals who demand change and drive innovation with high intrinsic motivation. They follow a vision, influence discourses, over-

For us, **individual and skills development** is a fundamental element in the conception of our services, because it is individuals who shape their respective departments, organisations and ultimately the system. For more info on innOsci's fields of action, visit our website www.innosci.de

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[1] innOsci Glossary: https://innosci.de/wissen/glossar

Open Innovation

is the opening of organisations to other actors in order to include external sources of innovation in their own innovation processes and to disclose unknown internal sources of innovation. "Open" here refers to the organisation and the process, not the content itself. Content and results from open innovation processes are usually not freely accessible in the corporate context.

Open Science

refers to the opening of the scientific research process to enable other actors to use and disseminate the collected data independently, to support research and to make it more transparent. Concepts such as Open Access (free access to scientific publications) and Open Data (further use of data) contribute to making research and knowledge more accessible for society.

come resistance and develop new standards. This is also the case with openness. Often, however, there is a lack of appropriate skills and abilities to broadly implement **Open Practices** (= mindset, abilities and skills as well as tools through which openness is practised).

Open Practices manifest themselves in a certain kind of methods and routines that require specific skills and abilities as well as a way of thinking and acting that is characterised by openness.

For this reason, innOsci founded the innOsquad *Future Skills for Openness*.

With a team of 11 experts from different fields, we are searching for them: the Future Skills for Openness. This article aims to describe the relevant competencies that we believe are important for implementing open practices, and to offer tips for practitioners and enablers from academia and business.

Through the participation of experts from science (university and non-university) and business (from various sectors and companies of different sizes), we make an experience-based and practice-oriented contribution to the promotion of **Open Innovation** and **Open Science**.

1 Background and Objective

╱ Why do we need more openness in science and business?

"Imagination is more important than knowledge. For knowledge is limited […]"

╱ Albert Einstein

Digital transformations accelerate innovation cycles and change innovation processes. Platform economies, networks, new connectivity and innovation ecosystems are therefore becoming increasingly important.

New fields of innovation such as connected mobility, sustainable energy supply or digital health are closely linked to global challenges and the United Nations Sustainable Development Goals (SDGs) and demand radically new solutions. As a result, we live in a world in which orientation is increasingly difficult and which is volatile, uncertain, complex and ambiguous – as expressed by the acronym VUCA (volatility, uncertainty, complexity, ambiguity). A strategic **opening of organisations** that explicitly **enables knowledge sharing, experimentation and collaborative innovation** can help to meet these challenges. *"Radical uncertainty requires radical collaboration"*,[2] as the colleagues from Sitra claim in their paper on *innovation portfolios*.[3]

What do we mean by openness in research and innovation processes?

For us, openness is the process and result of deliberately enabling, initiating and managing the flow of knowledge and (inter/transdisciplinary) collaboration across organisations and disciplines (Beck et al. 2020).

We see it as the opening-up of organisations as well as individuals to possibly unusual knowledge givers and takers.

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[2] The events of the Covid-19 crisis have shown that such collaborations are possible in commerce (see e.g. https://hbr.org/2020/06/why-now-is-the-time-for-open-innovation). In science, data has been shared and collaborated on as hardly ever before. One example is the COVID-19 Data Portal – accelerating scientific research through data (covid19dataportal.org)(7 September 2021, 13:19, both sources)..

[3] Cf. https://www.sitra.fi/en/publications/radical-uncertainty-requires-radical-collaboration/ (7 September 2021, 13:22)..

However, both organisations and individuals still need to learn to adapt to the VUCA world. Existing experiences, internalised beliefs and practices need to be radically reviewed. Causal or linear logics need to give way to dynamic and agile thinking and action, and mere reacting is to be replaced by anticipating, experimenting and prototyping. Sustainability and sensemaking are also becoming central themes in organisational development. However, old structures often stand in the way of new meaning. A change of attitude or mindset is necessary, and new or "forgotten" competencies are becoming more and more important. But what kind of **mindset**, what kind of **skills** and what kind of **tools** does Generation O, the pioneers of *openness*, the innovators and activists of today and tomorrow, need?

Openness holds great potential for transformation processes but requires a review of existing procedures and decision-making processes, especially in hierarchical structures. Creating a culture of openness may therefore lead to conflicts with current stakeholders, who may see it as a challenge to their position. It is therefore crucial to convince them of the meaningfulness of openness.

In this paper, we focus on the question of what mindset, skills and tools academics in business (open innovation) and science (open science) and in their working environments in companies, universities and research institutions need in order to promote a culture of openness. We would like to shed light on the competencies that organisations can promote so that people in the above-mentioned institutions can achieve and (co-)shape the desired change towards openness.

"We are convinced that a further opening of the science system will be essential to its own performance as well as the self-image and innovative capacity of society in the future." / Science Council
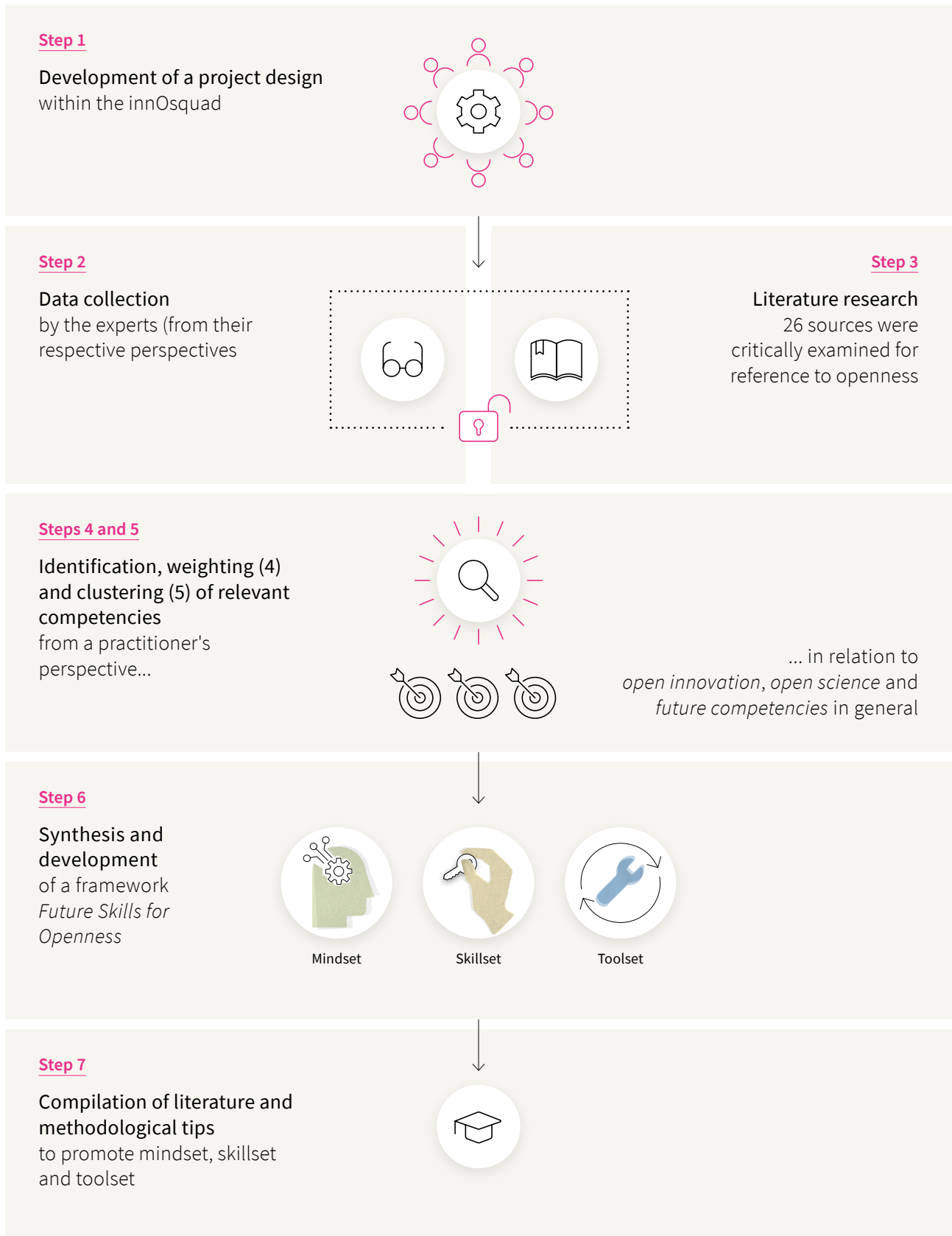
2 Project Design

From the definition of the question to the development of the framework

The project design is based on an explorative approach that aimed at a combination of deductive identification of relevant competencies and inductive development of a competency framework. The starting point was the following question:

*What are the Future Skills for Openness for **academics in science and business** that are needed to be able to operate successfully in a working world characterised by open science and open innovation?*

Step 1

Development of a project design
within the innOsquad

Step 2

Data collection
by the experts (from their
respective perspectives

Step 3

Literature research
26 sources were
critically examined for
reference to openness

Steps 4 and 5

**Identification, weighting (4)
and clustering (5) of relevant
competencies**
from a practitioner's
perspective...

... in relation to
open innovation, *open science* and
future competencies in general

Step 6

**Synthesis and
development**
of a framework
*Future Skills for
Openness*

Mindset   Skillset   Toolset

Step 7

**Compilation of literature and
methodological tips**
to promote mindset, skillset
and toolset

Methodology and approach

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Derivation of the Future Skills for Openness framework

As part of the project, we developed a framework in which we define what we consider to be the most important competencies or *Future Skills for Openness*.

In this publication, *Future Skills* are defined as competencies that will become significantly more important for the professional lives of academics in science and business across all disciplines and industries in the next five years and beyond if they are to successfully initiate and implement open science and open innovation processes and collaborate across sectors.

In the context of the Higher Education Report 2020, the Stifterverband describes Future Skills as an important subset of all competencies that will be required in the future – focussed, in terms of content, on the characteristic of growing importance across all sectors.[4] In our case, this means defining the subset of competencies that are relevant to the growing importance of openness in science and business. Excluded from our definition are all competencies that are predominantly subject- or discipline/sector-specific. The timescale of five years was chosen by the Stifterverband as well as by us, as it is long enough to realistically assess the importance of already foreseeable developments (e.g. the growing importance of trans-sectoral collaboration). At the same time, this time frame is short enough to be able to make reliable statements about these competencies despite rapid (technological) development.[5]

Overall, the results of this framework are based on the critical examination of 26 sources on the topics of open innovation competencies and mindset[6] as well as (open-)science competencies,[7] 21st-century skills[8] and key competencies for the future.[9] We examined the latter for references to openness, be it in the context of open science, open innovation or more generally in the context of competencies or organisational forms for the *work of the future*. We evaluated and summarised these scientific models on the basis of our experience and practical perspective with regard to *openness*.

This article is aimed at makers and enablers of open innovation and open science processes and is intended to support them in reflecting on and specifically promoting individual and skills development within the team and the organisation. Potential examples of application are the curriculum design for new innovation study programmes, strategic human-resource management in companies, the establishment of research and innovation processes, or team-building measures along cooperation processes and personnel development.

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4 https://www.hochschulbildungsreport2020.de/2019/welche-faehigkeiten-werden-in-zukunft-benoetigt (7 September 2021, 13:19).

5 ibid.

6 Cf. e.g. Podmetina et al., 2018; Salomo et al., 2017; Engelsberger et al., 2021.

7 Cf. e.g. McCaffrey et al., 2020, p. 5.

8 Cf. e.g. Binkley et al, 2012.

9 Cf. e.g. OECD, 2019.

3 Understanding of Competencies

Underlying understanding of competencies

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A competency is more than a verifiable ability or learnable knowledge. Competencies combine knowledge and aptitude, abilities and skills. Competencies enable people to cope with complex demands and also comprise attitudes and psychosocial traits.

The literature on this subject contains a multitude of different definitions of the concept of competency[10] – there is no uniform understanding of the concept of competency. In addition, the term is used differently in Anglo-American than in German-speaking countries. The Anglo-American world favours Boyatzis' definition of competency: "Competency is an effective mix of motives, traits, skills, aspects of one's self-image or social role, of body of knowledge used by an individual"[11] In the German-speaking world, on the other hand, the understanding of competency is mainly found in Erpenbeck and Heyse, who define competency as a self-organisation disposition.[12] Both definitions were included here

in order to identify the Future Skills for Openness. We thus understand competency as an interplay of knowledge, skills/aptitude and attitude. According to Baumgartner et al., it is precisely this interplay of the three areas that is central to the development of competency.[13]

Due to the different influences and different understandings of competency, the areas of competency we have defined therefore include not only competencies but also abilities, skills and methods that promote openness. "Abilities are described as learned or dispositional prerequisites for the performance of a particular mental or physical act or

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10 Cf. Erpenbeck & Heyse, 1999; Weinert, 2001; Schippmann et al., 2000; v. Rosenstiel, 2001; Boyatzis, 1982; McClelland, 1973.

11 Boyatzis, 1982.

12 Cf. Erpenbeck & Heyse, 1999.

13 Cf. Baumgartner et al., 2018.

accomplishment."[14] *Abilities and skills in the sense of knowledge* and qualification are thus considered here, as in Erpenbeck and Heyse, to be *components of a competency.*

We use the term *skills* in reference to the concept of competency in the Anglo-American world (see above) and the *Future Skills* concept (see above). By this we primarily mean abilities and skills as a competency dimension, as described by Erpenbeck and Heyse.

Prerequisites for the acquisition of competencies

In our opinion, a growth mindset and the ability for self-regulated learning are of particular importance for the acquisition of *Future Skills for Openness* to meet the constantly new requirements.

Growth mindset (as opposed to fixed mindset) is the belief that talents, intelligence and abilities can be developed through effort, dedication and hard work. Individuals with a growth mindset look for opportunities to learn, acquire new abilities and skills, and to improve their existing abilities and skills. Failures and mistakes are experienced as learning opportunities; challenges are not con-sidered a threat of failing but as an opportunity to learn and grow.[15]

Self-regulated learning (= self-organised, self-directed, self-determined learning) is also indispensable in a rapidly changing world. Characteristics of self-regulated learning are independent goal setting, self-motivation, selection of appropriate learning strategies and tactics, overcoming problems and assessment of learning success.
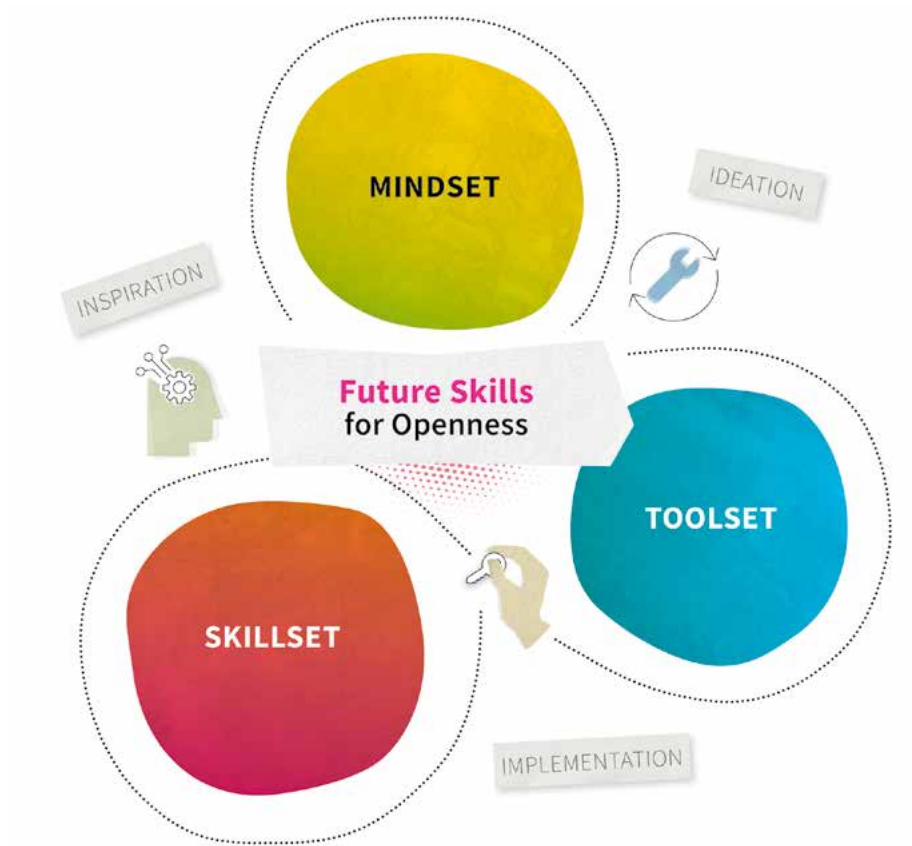
The working environment should promote a growth mindset through, for example, an appropriate culture of mistakes and feedback and self-regulated learning through appropriate offers, motivation and time resources.

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14 Fröhlich, 2003, p. 174.

15 Cf. Dweck, 2017.

4 The Framework

> The Future-Skills-for-Openness Framework is a framework for describing individual competencies for successful behaviour and action in the context of openness (open science and open innovation).

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The list of competencies resulting from the literature research (see project design) was clustered into three competency areas, which are derived as follows:

Open science and open innovation require the use of certain methods and methodological knowledge as well as legal knowledge (e.g. open-mass collaboration, open-technology in- and outsourcing, or the knowledge of collaboration tools and platforms). These methods, which we call open practices, and the methodological knowledge are summarised in the **tool set** dimension.

In order to use these tools, individuals need specific skills (psychosocial and social-communication skills such as the ability to communicate, conflict-resolu-

tion skills and integration skills). These can be found in the **skill set** dimension.

Fundamental to the application of the tools and the promotion of the skills are mindsets and attitudes that make open practices possible in the first place (such as empathy, openness, or tolerance for ambiguity). We subsume these under **mindset**, which is crucial for establishing a culture of openness.

The framework is to be continued as an interactive toolbox on the innOsci website and does not claim to be exhaustive.

Mindset for openness
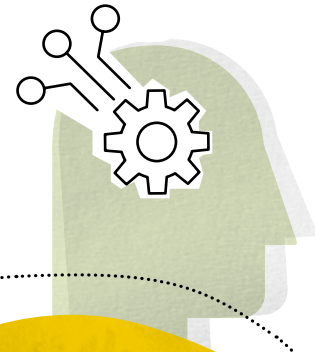
MINDSET

Openness

Empathy

Willingness to experiment

Creativity

Self-reflection

Professional and interdisciplinary recognition

Tolerance for ambiguity

In our context, the mindset for openness refers to a supportive, holistic, inner attitude towards newness, change and innovation (such as openness, empathy, willingness to experiment, or self-reflection).

The mindset for openness requires an inner readiness to positively approach newness, change and innovation.[16] A mindset – like personality – can be altered permanently and willingly. An appropriate work environment or role models are very conducive. However, to bring about change, it is crucial to have a conscious desire for change, to divide this desire into smaller achievable goals and to think of concrete instructions on how these goals can be achieved. Positive experiences with the desired changes further facilitate the process. The effect on mindset or personality becomes lasting when the instructions have become a habit and no longer need to be consciously carried out.[17]

In the following, we outline what we believe to be the most important attributes of an open mindset. [18]

See also our discussion paper Transformation Map* zon a new, open mindset or "What do muscle factories have to do with organisational development? "

Engelsberger et al. also focus on an *Open Innovation* Mindset al. (see Footnote)

* Cf. the innOsci-Website: https://innosci.de/wp-content/uploads/Transformation-Map.pdf (20.09.2021, 13:22).

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16 The OCEAN model of personality psychology or the six emotional styles by R. J. Davidson offer starting points for classification.

17 Cf. Hudson et al., 2020.

18 The latest research findings of Engelsberger et al. (2021) on the open innovation mindset are reflected in our framework explicitly as well as implicitly in the mindset (openness and creativity, risk and error tolerance – reflected in the attribute *willingness to experiment*), in the skill set (integrative complexity – reflected in the attribute *integration competence*) and in the tool set (positive attitude towards knowledge sharing – reflected in the attribute *open-mass and collaborative innovation*).

Openness

Openness describes the degree to which we are open to new ideas and experiences and how much we explicitly seek them. The OCEAN model (also called the Big Five model) is an internationally recognised model of personality research and describes five dimensions of personality within which each person can be ranked on a scale. One of these dimensions is openness to experience.

People who *score high* in this dimension are considered imaginative, resourceful, intellectually curious, open to new ideas, with a preference for variety (rather than routine), inclined to new activities, and attentive to their own and others' emotions. People with a low score in this dimension are described as, among other things, conservative, conventional and adhering to routine. Through experiences in the private, but especially also in the professional context, a person's personality changes over the entire life span.[19] If these personality dimensions can be influenced and altered by events and external circumstances, then they can also be promoted as traits or competencies.

Recommended reading

Allport, G. W. (1974): *Persönlichkeit. Struktur, Entwicklung und Erfassung der menschlichen Eigenart.* München: Kindler Verlag.

Barrick, M. R. & Mount, M. K. (1991): The Big Five Personality Dimensions and Job Performance: A Meta-Analysis. In: *Personnel Psychology* 44, 1–26.

Recommended actions/methods

• Get involved in new things in your private and professional life; start small, e.g. take different routes and means of transport to work, try out new hobbies, go to the canteen with other colleagues, regularly step out of your own comfort zone.

• Immerse yourself in foreign perspectives through professional and leadership programs such as Common Purpose or programms from www.agentur-mehrwert.de

Recommendations for everyday work in institutions/for managers

• Investment in personal development programmes for employees

• Open working environment that promotes continuous, self-regulated learning of new things, such as corporate social-volunteering programmes

• Promoting work in interdisciplinary teams

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Empathy

Empathy is the willingness and ability to recognise, understand and empathise with perceptions, emotions, thoughts and motives of other people.

By focusing on other people and understanding their needs, conditions and challenges, bridges are built across disciplinary and organisational boundaries, ultimately creating an environment for successful, open and inter- and transdisciplinary work.

Empathy can best be promoted through exchange with others.

Recommended reading

Chatenier, E. D.; Verstegen, J. A.; Biemans, H. J. et al. (2010): Identification of competencies for professionals in open innovation teams. In: *R & D Management* 40(3), 271–280.

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[19] Cf.. https://www.psychologie.hu-berlin.de/de/prof/per/forschung (13 August 2021, 13:16)..

Recommended actions/methods for promotion

- Think-pair-share method, 5-whys method; design-thinking methods such as empathy maps

- Corporate social-volunteering projects/programmes[20]

- Experiential training with a focus on the experience of the participants and their experiential world. In such settings, participants are encouraged to reflect on their experiences, analyse them and derive courses of action from them.

- Forum theatre[21]/business theatre

- Warm Data Labs[22]

Recommendations for everyday work in institutions/for managers

- Consciously assemble diverse, interdisciplinary teams; if necessary, reshuffle teams at regular intervals.

- Create spaces for (guided) exchange within the team, but also between different teams or disciplines, e.g. through group activities.

- Leadership and personal development through programmes such as Common Purpose[23]

> If you are interested, please contact us at wiebke.hoffmann@stifterverband.de

Willingness to experiment

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Willingness to experiment refers to the ability and readiness to act differently and, as a consequence, to take (un)expected risks, as well as to the joy resulting thereof.

Willingness to experiment[24] comprises all activities of willingly exposing oneself and others to new concrete situations and/or social situations with the confidence that it will benefit oneself, the group, the organisation, etc., despite potential resistance and conflicts.

Willingness to experiment requires the *willingness to take risks, error tolerance* (= understanding mistakes/errors as learning opportunities), *courage to act* (= readiness to act in the face of great uncertainties and possible disadvantages), *curiosity* (= thirst for knowledge, inquisitiveness, the desire to experience and to learn new things) and *innovative spirit* (= increased willingness and eagerness to develop innovations and to work

innovatively). Willingness to experiment can be actively promoted by an environment that is perceived as changeable and open to the future and in turn promotes open processes.

> Merck's curiosity study provides an exciting contribution to the topic of curiosity in the workplace and innovation: https://www.merckgroup.com/de/company/curiosity.html

Recommended reading

Gatterer, H. (2021): *Mut zum Handeln!* Online unter: https://www.zukunftsinstitut.de/artikel/mut-zum-handeln-kommentar-von-harry-gatterer (27 August 2021, 16:13).

Guinan, E.; Boudreau, K. J. & Lakhani, K. R. (2013): Experiments in open innovation at Harvard Medical School: What happens when an elite academic institution starts to rethink how research gets done? In: *MIT Sloan Management Review* 54(3), 45.

Perel, M. (2002): One point of view: corporate courage: breaking the barrier to innovation. In: *Research-Technology Management* 45(3), 9–17.

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[20] Cf. https://www.ziviz.de/future-skills-durch-engagement (20 September 2021, 13:27).

[21] Cf. Federal Agency for Civic Education, https://www.bpb.de/gesellschaft/bildung/kulturelle-bildung/60265/forumtheater (20 September 2021, 13:29). .

[22] Cf. https://warmdatalab.net/warm-data-lab (20 September 2021, 13:31).

[23] Cf. https://commonpurpose.org/deutschland (20 September 2021, 13:33).

[24] Willingness to experiment as "innovative work behaviour" takes into account how often employees deal with topics that are not part of their daily work or deal with different or new work methods or techniques (De Jong and Den Hartog, 2010).

Recommended actions/methods for promotion

- Fuckup-Nights[25]

- FabLabs or Makerspaces[26]

- Hackathons

Recommendations for everyday work in institutions/for managers

- Flat hierarchies, personal responsibility, error tolerance

- Question fixed procedures and processes from time to time and engage in exchange with all parties involved.

- Incentive systems for experimentation and trying out new things

Creativity

Creativity is the ability to act creatively.

Creativity refers to the ability to solve problems and tasks through new conditions, structures, resources, etc. Problems and tasks are seen as opportunities to try out innovative solutions. Recognising the need for change at an early stage is essential for successful creative action.

Recommended reading

Ahonen, M.; Antikainen, M. & Mäkipää, M. (2007): Supporting collective creativity within open innovation. In: *Proceedings of the European Academy of Management (EURAM) Conference.* Paris, France, 16 – 19 June 2007 (S. 6 – 8).

Binkley, M.; Erstad, O.; Herman, J. et al.(2012): Defining Twenty-First Century Skills. In: Griffin, P. & Care, E. (Hrsg.): *Assessment and teaching of 21st century skills. Methods and approach* (S. 17– 66). Dordrecht: Springer.

Seidl, T. (2017): Kreativität als (Aus-)Bildungsziel. In: *Makerspaces. Synergie, Fachmagazin für Digitalisierung in der Lehre* 4, 18 – 19.

Recommended actions/methods for promotion

- Mind mapping, brainstorming, brainwalking, walkshops, Disney method

- Creativity training

Recommendations for everyday work in institutions/for managers

- Give staff creative freedom away from the daily business, e.g. through free network meetings or group workshops with open tasks that are to be solved creatively and collaboratively.

- Allow time for creativity in the research process or project management

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Self-reflection

Self-reflection means perceiving, analysing and questioning one's own thoughts, feelings and actions with the aim of finding out more about oneself.

Perceiving and reflecting on one's own existence can be done in a specific situation or as a long or regular processes. One may question oneself as an individual or as part of a system (e.g. a team, a company) and, in doing so, receive impulses for one's own being in a larger context, which is of particular importance for open processes.

One basis for successful self-reflection is mindfulness. Otto Scharmer describes the cultivation of mindfulness of the individual as a necessary prerequisite for collective mindfulness and systemic change. The focus is on training perception, not from a purely analytical-abstract, but also from a bodily perspective, as a prerequisite for perceiving the social field. According to Scharmer's Theory U, the opening of thinking, feeling and will are central, which can offer exciting starting points for our understanding of openness.[27]

Recommended reading

Alterio, M. & McDrury, J. (2003): *Learning through storytelling in higher education: Using reflection and experience to improve learning.* London: Routledge.

Black, P. E. & Plowright, D. (2010): A multi-dimensional model of reflective learning for professional development. In: *Reflective Practice* 11(2), 245 – 258.

Scharmer, C. O. (2019): *Achtsamkeit und die Transformation der Gesellschaft.* Online unter: https://www.youtube.com/watch?v=H-ymjafNz1U (30 August 2021, 11:23).

Schuldt, C. (Zukunftsinstitut) (o. J.): *OMline: Digital erleuchtet.* Online unter: https://www.zukunftsinstitut.de/artikel/lebensstile/omline-digital-erleuchtet (9 September 2021, 10:07).

Recommended actions/methods for promotion

- Writing reflection protocols; journaling; questioning the inner team[28]

- Mindfulness training, mindfulness exercises, for example at the beginning of (team) meetings

- Social Presencing Theatre[29]

Recommendations for everyday work in institutions/for managers

- Encourage self-reflection by supervisors (and peers), e.g. through the introduction of success teams[30]

- Regular meetings for self-reflection or supervision within one's own institution, supported by an external person

- Coaching offers

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[27] Cf. Scharmer, 2019.

[28] Cf. https://www.schulz-von-thun.de/die-modelle/das-innere-team oder https://de.wikipedia.org/wiki/Inneres_Team#Die_innere_Teamsitzung (20 September 2021, 13:51, both sources).

[29] Cf. Presencing Institute: https://www.presencing.org/aboutus/spt (20 September 2021, 13:35).

[30] Cf. https://www.uni-potsdam.de/fileadmin/projects/gleichstellung/Downloads/Familienfreundliche-Hochschule/Erfolgsteam_Handout.pdf (20 September 2021, 13:40).

Professional and interdisciplinary recognition

Professional and interdisciplinary recognition refers to the ability to recognise and value one's own professional and interdisciplinary skills as well as those of others in collaboration processes.

Professional and interdisciplinary recognition comprises social appreciation of a person's professional and methodological/processual knowledge (and not the certified qualification, licence to practise, etc.) including their ability to successfully apply and implement the knowledge in practice. Professional and interdisciplinary recognition is particularly essential in open processes, where a wide variety of people come together with their professional and methodological/processual knowledge.

Recommended reading

Tiwana, A. & McLean, E. R. (2005): Expertise integration and creativity in information systems development. In: *Journal of Management Information Systems* 22(1), 13 – 43.

Recommended actions/methods for promotion

- Learning constructive feedback

- Learning interview techniques (e.g. performance reviews)

- Reflecting on one's own resources and boosting one's self-esteem in order to be able to give recognition

- Professional and leadership programs such as Common Purpose or programms from Agentur Mehrwert

Recommendations for everyday work in institutions/for managers

- Management training (teaching communication and feedback techniques, etc.)

- Incorporate regular lectures and contributions from various disciplines into the daily work routine

- Regular supervisor feedback and peer counselling/collegial advice

- Use of reflection techniques

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Tolerance for ambiguity

Tolerance for ambiguity (= uncertainty tolerance) is the ability to tolerate ambiguous situations and contradictory courses of action.

Ambiguity-tolerant people are able to perceive ambiguities (= contradictions, cultural differences, ambiguous information that appears difficult to process or even unacceptable) without reacting aggressively or evaluating them unilaterally negatively or unreservedly positively. People with a high tolerance for ambiguity react to conflicts in a relaxed, flexible and resilient manner. They do not get flustered or worked-up. They face ambiguities openly and positively. A problem is seen as an exciting challenge to be solved. Ambiguity tolerance is an important quality especially for open processes that are characterised by contradictions, conflicts and cultural differences.

Recommended reading

Bouncken, R. B. (2015): Ambiguity and knowledge transfer in innovation alliances. In: *International Journal of Entrepreneurial Venturing* 7(4), 309 – 323.

Ambiguitätstoleranz. Lernen, mit Mehrdeutigkeit zu leben. (Tolerance for ambiguity. Learning to live with ambiguity.) A radio report by Deutschlandfunk Kultur: https://www.deutschlandfunkkultur.de/ambiguitaetstoleranz-lernen-mit-mehrdeutigkeit-

zu-leben.976.de.html?dram:article_id=466828
(13 September 2021, 14:40).

Recommended actions/methods for promotion

- Pursue activities that depend on tolerance for ambiguity but have no immediate practical use, such as music, art, literature, poetry[31]

Recommendations for everyday work in institutions/for managers

- Create better framework conditions through fair and clear structuring of employment contracts, e.g. justification and appropriate duration of fixed-term/time-limitation contracts, avoidance of short-term contracts, transparent requirements for probation periods.

- Introduce regular performance reviews and clear target agreements

> The basic need for security should be met through transparency, e.g. in contractual matters, so that people are free to engage with uncertainties in their daily work.

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/ Skill set for openness

SKILLSET

Communication skills
Integration capability
Conflict resolution/
conflict management
Network competence
Problem-solving skills
Intercultural competence
Systems thinking

The skill set for openness comprises a collection of social-communicative and psychosocial abilities and skills that are conducive to openness. These skills are important for and facilitate interaction and cooperation with other people. The skills can be specifically promoted (e.g. through coaching, training), but they only develop into a competency through constant application and diverse challenges in everyday life as well as the corresponding mindset.
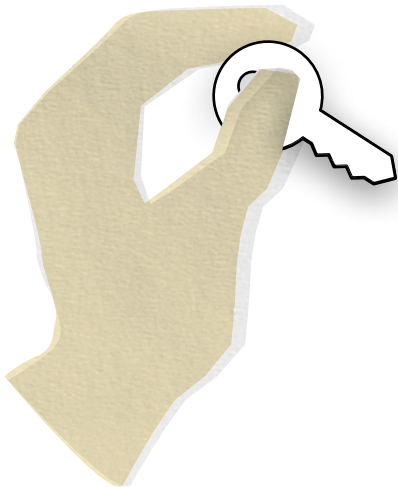
Communication skills

Communication skills encompass the ability to communicate constructively, effectively and consciously with others.

People with high communication skills approach their interlocutors openly and sympathetically and show appreciation towards them by listening and meeting objections matter-of-factly. Communication skills include eloquence, sociability and the ability to contact and persuade others, and are particularly important for the success of open systems.

Recommended reading

Schuurman, D.; Baccarne, B.; Marez, L. D. et al. (2016): Living Labs as open innovation systems for knowledge exchange: solutions for sustainable innovation development. In: *International Journal of Business Innovation and Research* 10(2 – 3), 322 – 340.

Recommended actions/methods for promotion

• Storytelling, creative writing

• Participation in Working-Out-Loud Circles

• Rhetoric classes

• PechaKucha Presentations[32]

• 4-sides(-of-a-message) model (see F. Schulz von Thun)

Recommendations for everyday work in institutions/for managers

• Create space for and encourage new exchange formats within and outside the organisation, e.g. PechaKucha sessions by one research group or project team for the others to impart knowledge about one's own work and that of other teams in an entertaining way while sharpening communication skills and promoting personal exchange

• Toastmaster programme[33]

Integration capability

Integration capability allows one to successfully work with other people.

Integration capability describes the personal ability to constructively unite different ideas, interests, (specialised) knowledge and experiences of people to achieve an (innovation-related) goal, to consolidate and direct them towards joint action, to create something new to benefit work, the company or the institution. Integration is not seen as a goal to be achieved, but as the process itself.

According to the Rotman School of Management, integrative thinking is the ability to constructively confront the tensions of opposing models and, instead of choosing one model at the expense of another, to creatively generate a resolution of the tension in the form of a new model.[34]

Especially in open processes (e.g. multi-stakeholder collaborations), integration capability is a crucial component not only for successful collaboration but also for generating new ideas.

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[32] Cf. https://www.pechakuchanight.de (20 September 2021, 13:42).

[33] Cf. https://www.toastmasters.org (20 September 2021, 13:44).

[34] Cf. https://www.rotman.utoronto.ca/ProfessionalDevelopment/Executive-Programs/FeaturedArticles/ApplyIntegrativeThinking (13 September 2021, 15:50).

Recommended reading

Lakemond, N.; Bengtsson, L.; Laursen, K. et al. (2016): Match and manage: the use of knowledge matching and project management to integrate knowledge in collaborative inbound open innovation. In: *Industrial and Corporate Change* 25(2), 333 – 352.

Martin, R. L. (2007): *The Opposable Mind: How Successful Leaders Win Through Integrative Thinking.* Boston: Harvard Business School Press.

Recommended actions/methods for promotion

- Model-based problem-solving approaches as part of the curriculum at universities

- Materials and challenge kits on *integrative thinking* (I-Think)[35]

- Training already listed under skill set and mindset (e.g. empathy training, resilience training, systems thinking)

Recommendations for everyday work in institutions/for managers

- Allow space and time for integration work and include it in the calculation

- Iterative processes facilitate rapid application and verification of integrated solutions

Conflict resolution/conflict management

Conflict resolution and conflict management refer to the ability to successfully deal with conflict situations.

They include the recognition of conflicting interests, the tolerance to accept the opinions of others even if they contradict one's own ideas, and the willingness to deal with conflict. Conflict resolution is not meant to be the result of harmonious, quick agreements, but should be achieved through a fair reconciliation of conflicting interests. An important component of the ability to resolve conflicts is the ability to present one's own points of view in a clear and well-founded manner and to convey to third parties the feeling of having arrived at a solution through one's own insights. Conflict resolution and conflict management are crucial in open systems in order to successfully direct the interests of different people towards a consensus.

Recommended reading

Glaserl, F. (Hrsg.) (2004): *Organisationsentwicklung in der Praxis. Bd. 2. Konfliktmanagement. Ein Handbuch für Führung, Beratung und Mediation* (8. und ergänzte Aufl.). Stuttgart: Verlag Freies Geistesleben.

Schwarz, G. (2013): *Konfliktmanagement. Konflikte erkennen, analysieren, lösen* (9. Aufl.). Wiesbaden: Springer Gabler Verlag.

Recommended actions/methods for promotion

- Mediation and/or supervision training for team members, systemic interventions (e.g. positioning)

- Analysis of conflict types (e.g. according to Thomas and Kilmann)[36] and conflict phases (e.g. according to F. Glaserl)[37]

- Questioning the inner team,[38] Harvard method, role reversal; game-based conflict-resolution trainings[39]

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[35] Cf. http://www.rotmanithink.ca/what-is-integrative-thinking und http://www.rotmanithink.ca/hello-ithink 13.09.2021, 15:52, both sources).

[36] Good summary here: https://projekte-leicht-gemacht.de/blog/pm-methoden-erklaert/thomas-kilmann-konflikttyp (20.09.2021, 13:45).

[37] Cf. Glaserl, 2004.

[38] Cf. https://de.wikipedia.org/wiki/Inneres_Team#Die innere Teamsitzung (20.09.2021, 13:47).

[39] Such as this LinkedIn offer: https://www.linkedin.com/events/minecraftseriousgame-konfliktl-6801797480565489664 (20.09.2021, 13:47).

Recommendations for everyday work in institutions/for managers

- Establish a positive feedback culture while setting examples

- Methodological tips (see above)

- Reflection: How are conflicts evaluated – as an obstacle or as an opportunity? How have conflicts been dealt with so far? How do we want to work together in the future?

- Offer mediation and supervision

Network competence

Network competence covers all skills that are crucial for successful relationship management and networking.

Relationship management and networking encompass the establishment, maintenance and targeted use of contacts and contact networks in order to achieve one's own goals. The communicative network presents itself as a form of cooperation that is as freely organised as possible and primarily driven by synergy between specialists. The skills required for this include relationship management, open-mindedness, making small talk, conflict resolution/conflict management, flexibility and tolerance. A person's development hinges on their network. Especially in open processes, it is important to avail oneself of this resource to actively involve diverse knowledge providers and stakeholders and to achieve a specific goal.

Recommended reading

Döhling-Wölm, J. (2020). *Karriere, Macht und Netzwerke: Spielregeln für die Karriereentwicklung.* Opladen: Verlag Barbara Budrich.

Gay, B. (2014): Open innovation, networking, and business model dynamics: the two sides. In: *Journal of Innovation and Entrepreneurship* 3(1), 1–20.

Recommended actions/methods for promotion

- Participation in Working-Out-Loud (WOL) circles

- Good preparation including practice and reflection in networking situations (practising elevator pitches to oneself)

- Participation in conferences and job and career fairs (approach at least five people and practise introducing yourself; see elevator pitch)

Recommendations for everyday work in institutions/for managers

- Encourage staff to participate in networking events

- Involve staff in networking and cooperation situations outside the institution

- Organise networking events, e.g. festivities of any kind or social occasions

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Problem-solving skills

Problem-solving skills represent the ability to successfully produce solutions to problems.

Problem-solving skills can be understood both as an individual performance prerequisite and as a social activity to initiate and stimulate the problem-solving process. Problem-solving skills are aimed at initiating group processes that lead to a clear cognitive and cooperative performance advantage over individual performance.

Resilience is an important aspect of problem-solving skills. Resilience is a problem-handling and problem-solving competency – moving away from dysfunctional stress and toxic stress effects towards functional, activating stress for learning and growth – and essential in a rapidly changing world of work.[40]

See also the SV policy paper: Corporate culture as a resilience factor? (2021)

Resilience describes the development and use of, as well as the access to the potential that enables people to overcome defeats, stressors and misfortunes flexibly, better and faster.[41] Resilience refers to the ability of both an individual and an organisation to withstand psychological and physical stress.[42]

Open processes always carry the risk (or potential) of the unexpected, of unforeseen stress factors (e.g. due to rather heterogeneous interdisciplinary teams) and of setbacks. A high level of resilience is therefore a success factor for individuals as well as for organisations.

Recommended reading

Pinto, H. & Guerreiro, A. (2019): Resilience, innovation, and knowledge transfer: Conceptual considerations and future research directions. In: Almeida, H. & Sequeira, B. (Hrsg.): *The Role of Knowledge Transfer in Open Innovation* (S. 281–299). IGI Global.

Terwiesch, C. & Xu, Y. (2008): Innovation contests, open innovation, and multiagent problem solving. In: *Management Science* 54(9), 1529–1543.

Wellensiek, S. K. (2017): *Handbuch Resilienztraining. Widerstandskraft und Flexibilität für Unternehmen und Mitarbeiter.* Weinheim: Beltz Verlag.

Recommended actions/methods for promotion

- Creativity trainings for problem solving
- Team trainings: solving problems as a team (e.g. team trainings or escape rooms)
- Resilience training

Recommendations for everyday work in institutions/for managers

- Establish team days and team training with a focus on problem-solving skills
- Establish exchange formats in the organisation to learn from good practice in peer formats
- In work practice, resilience is linked to work processes, work organisation, stress assessment and working time regulations. It is precisely these areas that managers, human resources or the works council can shape.

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40 Cf. Kompetenzatlas → Problemlösungsfähigkeit (fh-wien.ac.at).

41 https://www.resilienz-akademie.com/resilienz (14.10.2021, 13:30).

42 Cf. INQA, 2021.

Intercultural competence

Our definition of intercultural competence is based on an expanded, processual concept of culture[43], which describes culture as an open and dynamic process. This means that on a national or regional level, cultural differences and different organisational and work cultures are not defined as immutable but as "in progress" (dynamic reciprocity).[44]

Intercultural competence represents the ability to act effectively and appropriately in intercultural situations. It is promoted by certain attitudes, emotional aspects, (inter)cultural knowledge and specific skills and abilities.[45]

Interculturally competent persons grasp and understand the specific concepts of perception, thinking, feeling and acting of people from unfamiliar cultural contexts they work with. Key factors in acquiring intercultural competence are empathy, tolerance, openness, communication skills, flexibility, ability to assume different perspectives, willingness to learn, respect and self-reflection as well as knowledge of the concepts of the target culture.

Success across cultures in open systems requires all participants to have a high degree of intercultural competence.

Recommended reading

Bolten, J. (2012): *Interkulturelle Kompetenz.* Erfurt: Landeszentrale f. polit. Bild. Thüringen.

Deardorff, D. K. (2006): Identification and assessment of intercultural competence as a student outcome of internationalization at institutions of higher education in the United States. In: *Journal of Studies in International Education* 10(3), 241–266.

Recommended actions/methods for promotion

- Intercultural trainings; due to the key factors of intercultural competence described above, intercultural trainings are basically a promising method to promote an open mindset and skill set.

Recommendations for everyday work in institutions/for managers

- Job shadowing; programmes such as Common Purpose and Corporate Social Volunteering; exchange with departments, partner universities or research institutions at other locations

- Organise projects across disciplines, locations, partner organisations and, if necessary, provide intercultural supervision through briefing and debriefing

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43 Cf. Hannerz, 1992 and http://iwk-jena.uni-jena.de/wp-content/uploads/2019/03/Bolten_2013_Fuzzy_Cultures.pdf (20.09.2021, 13:47).

44 See, for example, the Sandberg model by Jürgen Bolten.

45 Cf. Boecker & Jäger, 2006.

Systems thinking

Systems thinking means thinking holistically about how the individual components of a system are connected and how systems function over time and in the context of larger systems.

Systems thinking is a learning and problem-solving approach that involves describing the behaviour of a system and then exploring ways to improve it. Open systems thinking promotes creativity and is used in learning organisations. Similarities exist to the approach of systemic therapy in the tradition of Arist von Schlippe and Jochen Schweitzer, which is applicable in psychotherapy as well as in coaching, social work, management and organisational development. This approach proceeds on the assumption that people are embedded in a social system (e.g. family, school, team, etc.) and considers a "problem" as something that arises only in relation to others, as a "collective performance", so to speak, and as something that, while undesirable, is always changeable. When a problem arises (if not sooner), systemic thinking and the opening of a system or a process make it possible to initiate changes.

Recommended reading

Schlippe, A. V. & Schweitzer, J. (2016): *Lehrbuch der systemischen Therapie und Beratung. Studienausgabe.* Teil 1. Kap. 9: Probleme als Gemeinschaftsleistung (S. 157–172). Göttingen: Vandenhoeck & Ruprecht.

Tani, M.; Papaluca, O. & Sasso, P. (2018): The system thinking perspective in the open-innovation research: A systematic review. In: *Journal of Open Innovation: Technology, Market, and Complexity* 4(3), 38.

Recommended actions/methods for promotion

- OECD OPSI[46] provides a toolkit overview

- Ashoka's Courses and Workbooks[47]

- The Systems Innovation Community offers a good collection of materials[48] such as the Systems Mapping.[49]

Recommendations for everyday work in institutions/for managers

- Allocate financial and time resources to systems mapping at the beginning of a project

- Initiate Warm Data Labs
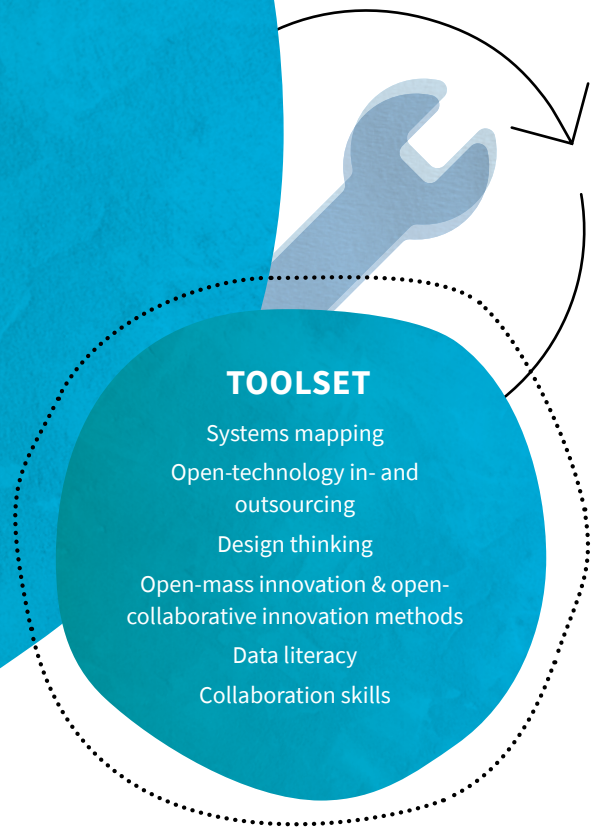
- Initiate multi-stakeholder processes

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46 Cf. https://oecd-opsi.org/search-toolkits/?_sft_discipline-or-practice=systems-change (20.09.2021, 13:49).

47 Cf. https://www.ashoka.org/de-de/program/systems-change-crash-course (20.09.2021, 13:51).

48 Cf. https://www.systemsinnovation.network (20.09.2021, 13:53).

49 Cf. https://www.systemsinnovation.io/canvases (20.09.2021, 13:55).

Tool set for openness

TOOLSET

Systems mapping

Open-technology in- and outsourcing

Design thinking

Open-mass innovation & open-collaborative innovation methods

Data literacy

Collaboration skills

The tool set for openness comprises the knowledge of specific methods (= tools, instruments) that are required to specifically open up innovation processes. We refer to these methods as **open practices**. They are part of the research and innovation process and manifest themselves in concepts such as open data, open access or co-creation.

With regard to open innovation, we present methods following the classification proposed by Podmetina et al. (2018), e.g. open-innovation technology in- and outsourcing or open-mass collaboration.

We also describe what we consider to be important *standard* tools, both for looking at the overall contexts of open science and business processes (systems mapping) and for iteratively responding to challenges (design thinking).

The methods in the tool set facilitate open-process control and allow users to view confusing and complex processes from the outside and as a whole.

With the help of these methods, information can be better classified, and the possible effects of one's own actions can be recognised more easily. In addition, the tool set contains concrete aids for process control (collaboration tools).

In the tool set, we expand our definitions to include applications such as platforms, example projects or toolboxes.

Systems mapping

Systems mapping is the ability to visually represent a system including its relationships and feedback loops, actors and trends.

Systems mapping aims to provide a simplified conceptual understanding of a complex system so that collective and collaborative action can be taken. Systems mapping shows the components and boundaries of a system in time. A system map is effectively a list of components. Systems mapping makes it possible to clarify thoughts at an early stage of analysis, to decide on structural elements, to experiment with boundaries, to decide on the level of interest (= focus), and to communicate the basic structure of the system to others. Especially in complex, open systems, systems mapping constitutes the basis for all participants to understand the open system in its entirety.

Recommended reading

Sedlacko, M.; Martinuzzi, A.; Røpke, I. et al. (2014): Participatory systems mapping for sustainable consumption: Discussion of a method promoting systemic insights. In: *Ecological Economics* 106, 33–43.

Methods, examples and applications

- Methods: see Systems Thinking

- Application/example: The development of the innOsci mission statement (see innOsci website)

Open-technology in- and outsourcing

Open-technology in- and outsourcing (= exchange of technologies with other market participants) refers to the methodological expertise needed to expand one's own innovation portfolio by acquiring technologies, services and intellectual property or to exploit one's own technologies, services and intellectual property by selling or licensing them out to others.

This expertise includes knowledge of technology transfer, patent law, contract law as well as entrepreneurial and business-oriented thinking and negotiation skills.

Recommended reading

Chesbrough, H. (2020): *Open Innovation Results. Going Beyond the Hype, and Getting Down to Business.* Oxford: Oxford University Press.

Methods, examples and applications

- Ip4inno – E-learning courses on EPO patent law (free certificates): https://e-courses.epo.org/course/view.php?id=61

- Information and e-learning offers on intellectual property and licences: IPR-Helpdesk: https://www.iprhelpdesk.eu/home

- Training in data protection as well as technology transfer, patent law and contract law in the institution

Design thinking

Design thinking is the ability to think in an iterative, solution-oriented and user-friendly way and leads to the solution of problems as well as the development of new ideas.

Design thinking is based on the assumption that problems can be solved better if people from different disciplines work together in an environment that promotes creativity, where they raise questions, take people's needs and motivations into account and then develop concepts that are tested multiple times. The potential of different perspectives, the alternation between divergent and convergent work, and quick prototypes expand the solution space. Design thinking aims to release as much creative potential as possible in all stakeholders of an innovation project in order to systematically solve complex problems or tasks.

Recommended reading

Brown, T. & Wyatt, J. (2010): Design thinking for social innovation. In: *Development Outreach* 12(1), 29 – 43.

Tschimmel, K. (2012): Design Thinking as an effective Toolkit for Innovation. In: *Proceedings of the XXIII ISPIM Conference: Action for Innovation: Innovating from Experience* (S. 1–20). Barcelona.

Methods, examples and applications

- Free method templates: https://design-thinkit.de/templates

- Example of DT Challenge from the TU Berlin and others: http://nachhaltigkeitsinnovation.de/Beispiele/b1.html

- Liberating Structures[50] as small methodological units for use in DT workshops

- Design-thinking training courses, e.g. at the hpi-academy.de

- Participation in the University Innovation Fellow Programme of the HPi and the D.school[51]

- Work on concrete solutions, e.g. at the Cross-Innovation Hub[52] of the Kreativgesellschaft Hamburg

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Open-mass innovation & open-collaborative innovation methods

In the description of the recommended reading and of the method tips or application examples in particular, we conflate open-mass innovation and open-collaborative innovation, as they cannot always be considered separately.

Open-mass innovation refers to the act of using the ideas of the many for innovation. It is the generation of ideas with the help of a multitude of knowledge providers, i.e. the generation of ideas from the *crowd.*

Open-mass innovation encompasses the methodological knowledge and skills needed to find the ideas and knowledge of very large and very diverse groups of users – in particular also of unusual knowledge providers – and to involve them in the development of innovations. This includes the ability to put users at the centre and to plan and stage idea competitions and large group events. Examples include idea competitions for product design; hackathons aimed at problem solving; crowdsourcing platforms; maker spaces and FabLabs.

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50 Cf. https://www.liberatingstructures.com (20.09.2021, 13:51).

51 Cf. https://universityinnovationfellows.org (20.09.2021, 13:53).

52 Cf. https://kreativgesellschaft.org/cross-innovation-hub (20.09.2021, 13:55).

Methodological knowledge of open-collaborative innovation is the knowledge to design collaborative innovation projects, manage trust-based innovation partnerships and apply open-collaborative innovation methods.

Open-collaborative innovation methods are methods that are used to jointly generate innovations with a limited number of actors and innovation partners from different economic, scientific and social groups (e.g. Citizen Science). This methodological knowledge includes the moderation of innovation workshops, the know-how of digital collaboration tools and knowledge of agile project-management methods.

Both areas are based on a positive attitude towards "knowledge sourcing and sharing", as Engelsberger et al. describe it in their open-innovation mindset.[53]

Recommended reading

Chesbrough, H. (2020): *Open Innovation Results. Going Beyond the Hype, and Getting Down to Business.* Oxford: Oxford University Press.

Podmetina, D.; Soderquist, K. E.; Petraite, M. et al. (2018): Developing a competency model for open innovation. From the individual to the organisational level. In: *Management Decision* 56 (6), 1306–1335.

Vohland, K.; Land-Zandstra, A.; Ceccaroni, L. et al. (Hrsg.) (2021): *The Science of Citizen Science.* Cham: Springer.

Recommended actions/methods for promotion

The following *toolkits for the application of open innovation*, developed with funding from Horizon 2020 (EU) and the Austrian Federal Government, provide a good overview:

- Human-centred design approaches as a basic principle

- https://inspire-smes.com

- https://www.fair-open-innovation.at

Other toolboxes

- https://kreativgesellschaft.org/cross-innovation-hub/unsere-methoden

- http://itec.aalto.fi/participatory-design/workshop-guidelines

Examples and applications

- Challenge-based learning as a tool for learning to use open-collaborative innovation methods: https://challenges.eciu.org/challenges

- Example of open innovation and open science: the EU project CIRCUIT: https://www.circuit-project.eu/about-circuit

- Platform for Citizen Science: https://www.buergerschaffenwissen.de

- Segment on the acquisition of this competency: Lunch break with "Bürger schaffen Wissen" (https://www.buergerschaffenwissen.de/citizen-science/veranstaltungen/online-format-mit-tagspause-mit-buerger-schaffen-wissen)

- CityScienceLab at HafenCity University Hamburg

- University of Twente (2018): Students working on social challenges from four European cities using design thinking: https://www.20creathon.eu/eciu-creathon

- University Innovation Fellows of d.school: https://dschool.stanford.edu/university-innovation/university-innovation-fellows oder: https://universityinnovationfellows.org

- Product design idea competitions, e.g. Lego Ideass: https://ideas.lego.com

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Helpful tips and practical experiences for open-science actors can also be found in our publication "Die Öffnung der Wissenschaft/ Werkheft zur Gestaltung der Transformation"

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53 Cf. Engelsberger et al., 2021.

Data literacy

Data literacy is the ability to collect, manage, evaluate and apply data in a critical way and requires numerous individual competencies from different disciplines, such as mathematics, statistics or programming. Taken together, they constitute the competency of handling data.

Global Standards for Digital Literacy, Skills and Readiness have been developed by the DQ Institute. Info and materials can be found here: https://www.dqinstitute.org/global-standards

FAIR data stands for findability, accessibility, interoperability and reusability. The principles of FAIR data provide guidance for managing and handling scientific data in particular and are relevant for all stakeholders in the digital ecosystem. They are aimed directly at data producers and data publishers in order to promote the maximum use of (research) data.

The methodological knowledge of open data, open access and open source is particularly important for open processes. Open data are all data stocks that are made freely accessible for use and further dissemination in the interest of the general public without any restriction. Open access comprises a set of principles and practices through which research results in particular are disseminated online without incurring costs or access limitation. Open source is source code that is made freely available so that it can be modified and redistributed. An open-source product includes permission to use the source code, design documents or content of the product.

Recommended reading

Burgelman, J. C.; Pascu, C.; Szkuta, K. et al. (2019): Open science, open data, and open scholarship: European policies to make science fit for the twenty-first century. In: *Frontiers in Big Data* 2, 43.

Masuzzo P. & Martens L. (2017): Do you speak open science? Resources and tips to learn the language. In: *PeerJ Preprints* 5:e2689v1.

Methods, examples and applications

- Open badges as incentives for open science: Open-science badges enhance open science: Open Science Badges (cos.io)

- Toolbox of the LMU Open Science Centre: Toolbox – Open Science Center – LMU Munich (uni-muenchen.de)

- Accelerating research through data sharing: : https://www.covid19dataportal.org

- Start your research training now: https://www.fosteropenscience.eu

- Open access: official portal where results from European research are published: https://open-research-europe.ec.europa.eu

- Canadian Institute for health – Linkage Tool for Covid Rapid response: https://cihr-irsc.gc.ca/e/51934.html

- COVID-19 Social Science Research Tracker: https://github.com/natematias/covid-19-social-science-research

Collaboration skills

In our context, collaboration skills refer to the knowledge of (especially digital, but also analogue) collaboration tools that optimise cooperation within a team across borders, in particular with regard to communication and distribution and performance of tasks.

Most of these are web-based software-as-a-service (SaaS) solutions and smartphone apps. Modern examples include Trello, Asana and Wunderlist (task management), Doodle (scheduling), Confluence (Wiki), messaging programmes or integrated solutions such as Slack and Yammer. Digital collaboration tools can help avoid data silos, share information across organisational units and make processes more transparent. They thus make it possible to provide orientation in larger groups.

Recommended reading

Leonardi, P. (2021): Picking the Right Approach to Digital Collaboration. In: *MIT Sloan Management Review* 62(2), 1–7.

Recommended actions/methods for promotion

• Promoting connected thinking and collaboration through e.g. job rotation

• Practising the use of collaboration tools such as Conceptboard/Miro/Mural/Padlet etc. in virtual meetings; e.g. Slack, Trello, MS Teams for communication

• Collaboration and open-innovation platforms such as innosabi: https://innosabi.com

• Non-digital collaboration: team-building measures to promote cooperation, communication, decision-making, problem-solving within the team

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Development process – our findings
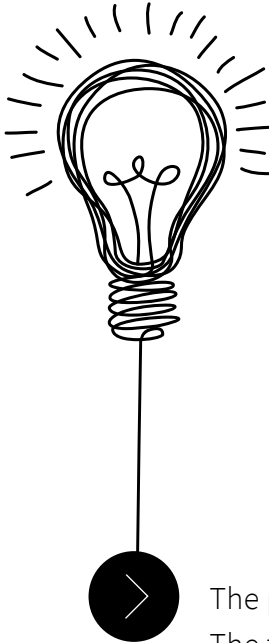
The process of developing the framework was exploratory and iterative. The findings from this process are briefly explained here.

Iterative processes as a basis for open practices

In the first attempt, we were looking to assign the extracted competencies to the research or innovation process and to map them in a processual manner. We pursued this approach intensively, as we saw the advantage of imparting knowledge about the two processes in addition to knowledge about the competencies.

The core of open science and business processes is iterative work, i.e. dividing the overall process into phases and repeating the work in these phases in iteration loops in order to gradually approach a goal that may still be unknown at the start of the project or undergo changes over its course.

"Thinking in iterations helps teams to start quickly with the development of a prototype without months of conception phases and theoretical discussions, and then to continuously develop it further based on real feedback. The findings are integrated in the next iteration phase. This work requires a high level of reflection within the team and the willingness to discard or readjust current processes."[54]

This approach described above ultimately proved to be impractical. On the one hand, the diagram would have become overly complex with the two process representations. On the other hand, a large part of the relevant competency dimensions is important for all process steps, so they could be assigned to all phases. A pinpointed allocation, as we had intended, would not have been possible in this way.

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[54] New-Work Glossary: https://newworkglossar.de/wie-laeuft-iteratives-arbeiten-ab (06.09.2021, 22:36).

An iterative process characterised by an open attitude is very important to us; in the graphic representation, however, it receded into the background.

Open mindset as a basis of open practices

These problems in classification result from the fact that most of these competencies are located in the areas of values or mindset and the interpersonal, psycho-social skills. Concrete knowledge and skills from open-science and open-innovation practices, i.e. methodological knowledge, on the other hand, form the smaller part of our framework.

A similar weighting of competencies can also be found in the Stifterverband's discussion paper Future Skills: What Competencies Are Missing in Germany. It emphasises that although (technological) expert and methodological knowledge are going to increase at the top of the pyramid of actors and the corresponding skills are going to become more important, "[...] the forms of work and the job requirements are changing for a large part of all employees. Many employees therefore need a changed set of digital and non-digital key skills."[55] Competencies such as creativity and problem-solving skills or collaborative working (as a digital key qualification!) are also listed here.

Our framework reflects the relevance of attitude or mindset for skills development, as outlined in different contexts in the discussion paper *(Wert-)Haltung als wichtiger Bestandteil der 21st Century Skills an Hochschulen [Values as an Important Component of 21st Century Skills at Universities]* by the Higher Education Forum on Digitisation[56] and in Busch et al. in Future Skills: *Ein Framework für Data Literacy [Future Skills: A Framework for Data Literacy]*[57] respectively.

Without the corresponding mindset, there can be no skills development, and without the corresponding competencies and mindset, the tools and open practices will rarely be successfully and sustainably applied in organisations.

It is therefore the task of university teaching and in-service qualification measures in all disciplines and sectors to promote these qualities, traits and skills summarised under mindset.

Mindset, skillset, toolset

In the next step, we approached the framework via different clusters. The question arose as to whether there ought to be separate competency clusters for open science and open innovation or a general open-practices cluster (comprising both open science and open innovation). Again, we encountered the problem of attribution: Methods originally attributed to open-innovation processes, such as methods from the field of open-mass collaboration (e.g. crowdsourcing), are increasingly finding their way into (open) science. FAIR data is by no means only relevant in university research institutions, but also in R&D departments in commercial enterprises. Bringing both practices together in one cluster therefore seemed logical to us.

From the attempts to represent our competencies and tools in classical models, which divide competencies e.g. into instances of self-competence, social competence and professional competence[58] or personal, social, professional and methodological competence[59], the clear and easily transferable triad of **mindset, skill set**, and **tool set** for openness in science and business gradually emerged within the innOsquad.

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55 https://www.future-skills.net/analysen/strategische-potenziale-fuer-hochschulen (16.08.2021, 15:31).

56 Cf. Baumgartner et al., 2018.

57 Cf. Busch et al., 2019.

58 Cf. Roth 1971.

59 Cf. Mudra 2004, S. 364.

5 Conclusion & Outlook

„Now, as always, the future is uncertain." / www.unesco.org, 02.09.2021, 13:40

> **Complex problems require openness to new approaches.
> Radical uncertainties need radical collaborations**

Involving new, unusual knowledge providers, quad-ruple-helix approaches/multi-stakeholder involvement or building innovation ecosystems can prepare us for uncertain futures and shape transformations. We have developed our framework for the openness required to do this.

Through expanded mindfulness and (self-)reflection, through the ability to welcome complexity and to invite diversity, new methods of collaboration and an attitude of openness, a new capacity for action emerges. That is why this contribution is above all a guide to the ability to act in open processes.

However, we do not want to downplay that it takes a lot of time to practise and apply new methods, to self-reflect, empathise and change one's perspective, to listen, to anticipate, to make mistakes, to rethink and to try out different approaches. And time is often a critical factor in science and business..

*„The times are urgent:
let us slow down."*

/ Bayo Akomolafe

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