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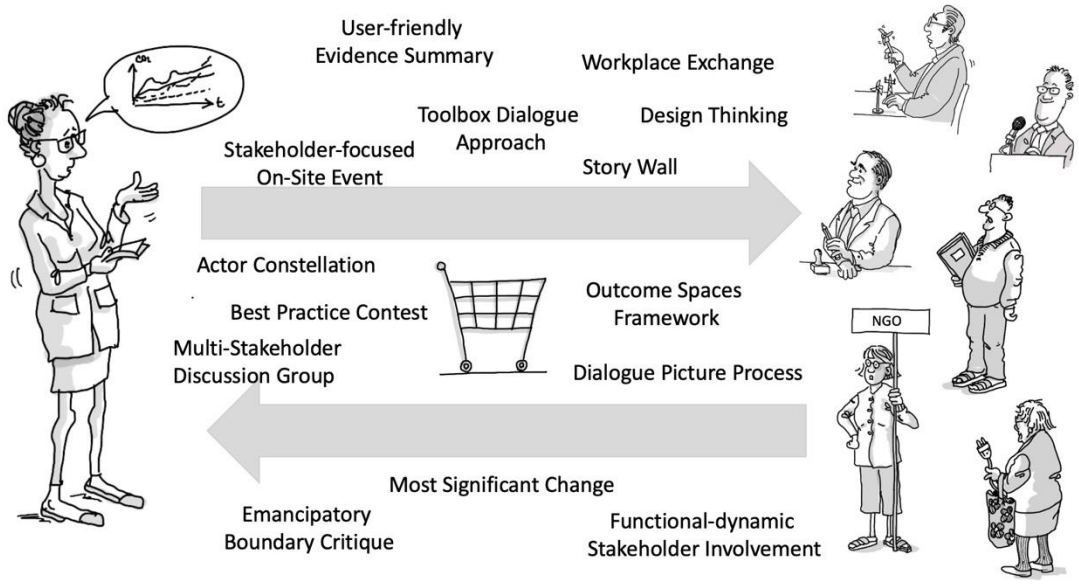
Report of February 16, 2021

Reframing Knowledge & Technology Transfer for Swiss Energy Research

30 Tools & Recommendations for the SWEET Funding Program



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CH-3003 Bern
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Agent:

novatlantis gmbh
Technoparkstrasse 1, CH-8005 Zürich
www.novatlantis.ch

Authors:

Dr. Anna Roschewitz, novatlantis gmbh, anna.roschewitz@novatlantis.ch
Dr. Astrid Björnsen Gurung, Swiss Federal Research Institute WSL, astrid.bjoernsen@wsl.ch

In collaboration with:

Dr. Peter Morf, Hightech Zentrum Aargau, peter.morf@hightechzentrum.ch

SFOE project manager: Annina Fäs, annina.faes@bfe.admin.ch

The authors of this report bear the entire responsibility for the content and for the conclusions drawn therefrom.

Swiss Federal Office of Energy SFOE
Pulverstrasse 13, CH-3063 Ittigen; postal address: Swiss Federal Office of Energy SFOE, CH-3003 Bern
Phone +41 58 462 56 11 · Fax +41 58 463 25 00 · contact@bfe.admin.ch · www.bfe.admin.ch

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GLOSSARY

Term	Description
ATTP	The *Alliance of Technology Transfer Professionals* (ATTP) is an alliance of fourteen national and international knowledge and technology transfer associations. Link
Dissemination	Dissemination means to make the results of a project public (by any appropriate means other than protecting or exploiting them, e.g. scientific publications). Dissemination is the transfer of knowledge and results to the ones that can best make use of it. Thereby it maximizes the impact of research, enabling the value of results to be potentially wider than the original focus. Link
Exploitation	Exploitation means to make use of the results produced in the scope of the project for further activities (other than those covered by the project), e.g. in other research activities; in developing, creating and marketing a product, process or service; in standardization activities). Exploitation can be commercial, societal, political, or for improving public knowledge and action. Project partners can exploit results themselves or facilitate exploitation by others (e.g. through making results available under open licenses). Link
Impact	A change in state or a change in flow resulting in whole or in part from a chain of events to which research (or other intervention) has contributed. Impacts can be economic, socio-cultural, institutional, environmental, technological or of other types (Link).
Knowledge	*Explicit knowledge* is methodical, systematic and exists in an articulated form. It is stored outside the minds of individuals in media (disembodied knowledge) and can be recorded, transmitted and stored using information and communication technology (North 1998 in Vollmar 2007). *Implicit knowledge* represents that part of knowledge which cannot be fully expressed in words. It includes both knowledge and skills, both cognitive and physical (Vollmar 2007). Implicit knowledge does not describe a state (knowledge), but the process of understanding (knowing) in the sense of cognition, thinking and perception. *Silent knowledge* can be formally articulated and made explicit through reflection and can thus be questioned, discussed and transferred in a limited way. This is (at the time in question) only present in the mind of a person (Vollmar 2017). Knowledge has also a tactic and codified component. *Tactic knowledge* is tied to a person, based on her/his specific experiences and therefore difficult to transfer (Polanyi 1967). *Codified knowledge* is not tied to a person and can be transferred or processed more easily (Cowan and Foray 1997). Tactic knowledge is more important for KTT. A broader concept offers also sustainability research differentiating between three types of knowledge: *systems knowledge*, *target knowledge* and *transformation knowledge*. Link
Knowledge Integration	Knowledge integration is the process and result of creating a holistic hole that is more than the sum of its parts.
KTT	Technology Transfer, also known as Knowledge Transfer or Knowledge Exchange, is a collaborative, creative endeavor that translates knowledge and research into impact in society and the economy (as defined by ATTP). KTT is often seen as a one-way activity bringing together technology providers and users to transfer new scientific results in the form of innovations into the economy (cf. Pleschak 2002). Link

Term	Description
	Note: In some sources KTT is also understood as “Knowledge Translation and Transfer”.
Morphological Box	The morphological box is a systematic heuristic creativity technique based on the Swiss astrophysicist Fritz Zwicky (1898–1974). The multi-dimensional matrix forms the core of the morphological analysis.
SCCER	Swiss Competence Center for Energy Research
SFOE	Swiss Federal Office of Energy
SWEET	Swiss Energy Research for the Energy Transition (Funding Program SFOE 2021-32)
Technology Transfer	Transfer of typical technology products (e.g. machines) to markets, but equally the transfer of process optimizations (e.g. mobility) or models (e.g. hydrological forecasts). Competence Centre on Technology Transfer (Link)
Toolbox	The morphological box provides an entry point for the selection of the most suitable tools in a specific context of a project or program.
Tool	In the present report the term “tool” includes instruments, platforms, forms and methods, approaches, activities, approaches, products, models of success, etc.
TRLs	Technology Readiness Levels (TRLs) describe the maturity level of a particular technology during the acquisition phase of a program. The TRL 1 is the lowest and TRLs 9 the highest. Link

1. Project Framework

1.1. Overview

The urgent need to achieve the climate targets under the Paris agreement, economic and technological developments as well as political decisions are currently leading to fundamental changes in the energy markets. In order to decarbonize the Swiss energy system, the Federal Council has developed the Energy Strategy 2050 and built national research capacities within the framework of the action plan “Coordinated Energy Research Switzerland” (2013-2020). The establishment of the Swiss Competence Centers in Energy Research (SCCERs) and other energy research programs led to profound progress in terms of technological innovation, capacity building, and inter- and transdisciplinary collaboration. Less progress was made in terms of actual system transformation, creating a need for knowledge and technology transfer (KTT, see Chapter 1 & 2), for which far less resources have been earmarked compared to research.

The new funding program “Swiss Energy research for the Energy Transition” (SWEET) of the Swiss Federal Office of Energy (SFOE) launched in 2020 responds to this observation by assigning a key role to KTT in future SWEET consortia and projects (Chapter 3).

Addressing the members of the SWEET Program Management and other interested actors in the Swiss energy innovation system, this report aims at capitalizing on available knowledge and experiences on KTT to support the SWEET program management and consortia in setting up effective mechanisms. Recommendations for actions for the SWEET Program management have been derived from the collective knowledge of the working group “KTT in large Energy Research Programs” (Table 2). A center piece of this synthesis is the customized Morphological Box (Chapter 4.1) serving as entry point for decision making to find the most suitable among 30 recommended KTT tools, which are presented alphabetically (Chapters 4.2 and 4.3) and in different spread sheets (Chapter 4.4) for quick orientation. The last Chapter 4.5 guides the reader back to the realities outside the limited framework of the KTT toolbox.

This document is an interim report meant to support the efforts of the Swiss Federal Office of Energy to improve knowledge and technology transfer for Swiss energy research. The concept and tools presented in this report will be used to elaborate, in a second step, a “KTT implementation product” to inspire and support future KTT officers. As such, it should be easy to use, effective and, if lucky, also funny to apply!

1.2. Background

In January 2015, the working group “Knowledge and Technology Transfer in Large Energy Research Programs" was launched as a voluntary learning platform for KTT officers, scientists and communication experts interested in KTT, many of which have been active in the ongoing Swiss Competence Centers for Energy Research (SCCERs), the National Research Programs 70 and 71, and other research initiatives. What these group members had in common was the sincere interest in coordinating ongoing KTT activities, but also in critically reflecting and improving KTT in their daily work. Ultimately, each of them wanted to contribute to moving the Swiss energy system closer to the targets of the Swiss Energy Strategy 2050.
The group, as a dynamic conglomerate of around 20 people, met twice a year for a one-day meeting consisting of an internal exchange and an invited external input. Both stimulated ideas

but equally advanced KTT activities as a whole (see Appendix A for meeting information). Towards the end of the SCCER funding period, the group discussed:

(i) how to capitalize on the extensive knowledge and practical experience of the KTT group for Swiss energy research after the end of the SCCERs and other programs, and
(ii) how this knowledge and experience can be systematically presented, not only to stimulate effective KTT activities in the field of energy research, but equally to identify specific opportunities and needs for adjustment in the larger systems of research-stakeholder interaction.

1.3. Procedure

Against the background of the group's strong motivation to value the KTT experience for SWEET, the SFOE commissioned the working group, consisting of Dr. Anna Roschewitz (novatlantis) and Dr. Astrid Björnsen Gurung (WSL) in collaboration with Dr. Peter Morf (Hightech Zentrum Aargau) to make the existing expertise available to future SWEET researchers in an attractive and usable form. The conceptual thoughts, experiences and the KTT toolbox presented here are tailored to the specific design of the SWEET program and take into account the different levels (program, consortia, projects). Particular importance it attached to the desired exchange between the consortia. This also enables the continuous adjustment of the KTT strategy over time. Accordingly, adjustments based on new recommendations are possible over the 10-year program term.

2. Knowledge and Technology Transfer for Energy Research

2.1. Departure Point

The development of research competencies at Swiss research institutions within the framework of the Swiss Competence Centers in Energy Research (SCCERs) will be completed by the end of 2020. In order to achieve the objectives of the Energy Strategy 2050, not only substantial progress in research will be necessary after 2020 (see "Action Plan for Coordinated Energy Research in Switzerland"), but equally progress in transferring scientific knowledge and technologies into practice.

In order to align these research competencies and research capacities built up under the former Action Plan, the Swiss Federal Office for Energy launched the new research funding program SWEET (SWiss Energy research for the Energy Transition) in mid 2020. While the SCCERs have already been encouraged to integrate KTT in their research projects, the SWEET program more clearly demands rendering research efforts socially relevant and application-oriented. For instance, in addition to the proven selection criteria such as relevance to the achievement of the Energy Strategy 2050 goals, the SWEET program highlights KTT as follows:

Box 1: KTT as mentioned in the first SWEET Call 1-2020

"**Activities on communication, dissemination and exploitation of results** (knowledge and technology transfer, KTT) **require an appropriate allocation of resources**. [...] Expenses associated with such activities depend on where the focus of the consortium lies in the innovation system." (p. 22)

"Both **coordination and KTT activities** must be described in two separate work packages. The SFOE expects an allocation of **5-10% of the core budget** for each of these two activities." (p. 22)

The submission of a "**draft plan for dissemination and exploitation of the consortium's results**" is one out of eight **criteria for admissibility** (p. 27).

For the **proposal evaluation**, «Socially important impacts, such as consumer behaviour, evidence-based policy relevance and social acceptance", "industrial relevance" and the "strength of the proposed exploitation and dissemination plans" are listed among the criteria under the heading "Impact". (p. 28)

The "**utilization of trans- and interdisciplinary ways of working within the consortium**" is mentioned as a criterium under the heading "Quality and efficiency of the implementation", thus indirectly related to KTT. (p. 28)

This report offers a concept and a selection of 30 tools for the successful planning and design of KTT between scientists and different sectors represented in the SWEET program and beyond.

2.2. Knowledge and Technology Transfer

Considering the different types of knowledge like explicit, implicit, and silent knowledge (Vollmar 2007; also see glossary), the most common understanding of *Knowledge and Technology Transfer* (KTT) is a collaborative, creative endeavor that translates knowledge and research into impact in society and the economy (see ATTP). Sometimes *Knowledge Transfer* is understood as the overarching term that includes Technology Transfer. The alternative terminology *Knowledge Exchange* expresses the notion, that it is not only about conveying information from A to B, but primarily a dialogue between A and B. *Technology Transfer*, in contrast, is often understood as an independent task geared towards the transfer of tangible technologies, which of course goes along with the transfer of knowledge. But the development of technologies is not limited to scientific and technical work. Social techniques such as procedures for dealing with legal conflicts are structurally based on technological knowledge as well, which shows not only the diversity of knowledge transfer but also the breadth of technology transfer (Wissenschaftsrat, 2016, p. 10). Occasionally, KTT is understood as *Knowledge Translation and Transfer* (OMAFRA, 2014).

There is a persistent conception that KTT is, in the first instance, a one-way activity bringing together technology providers and users to transfer new scientific results in the form of innovations into the economy (cf. Pleschak 2002). As results emerge only at the end of scientific endeavors, KTT would typically be done after the project has been terminated. In the Swiss context, this would imply that knowledge and technology is generated in a first step within the SCCERs, i.e. at the institutes of the ETH Domain, Universities and Universities of Applied Sciences, and in a second step, transferred to potential recipients and end-users at the end, e.g. in final conferences, synthesis reports or white papers. These activities rarely bring the desired impact, which, again, is rarely evaluated after completion.

The present report aims to broaden the understanding of KTT as an activity

(i) targeting at *different directions of information flow* (information, consultation, dialogue and collaboration),

(ii) taking place *during all project phases*, from the initial design until the post-evaluation, and

(iii) applying *a broad range of tools* to achieve effective exchange

2.3. Knowledge Brokers

KTT is a task often assigned to the portfolio of the program manager or coordinator. Three of the SCCERs hired own KTT officers (BIOSWEET, CREST, FEEB&D), while the others tackled the task within the overall program coordination (e.g. Mobility, SoE). Right after the launch of KTT Working Group, members discussed their roles, missions and competences as “KTT officers”, which included the question of performance and adequate indicators to measure such. Indeed, diversity among the working group members was high. Most worked part-time for KTT having other obligations in management or for their own ongoing research. Common to all was the relatively small monetary and time budget to fulfill their roles of knowledge brokers in their organizations. Hence, the group repeatedly discussed (i) how to increase the performance of KTT activities with limited resources, (ii) how to measure KTT performance in terms of process and results, and ultimately (iii) how the performance of knowledge brokers could be adequately assessed and acknowledged, as this profession seems to be a widely invisible and ignored. The

paper by Maag et al. (2018) proposing indicators for measuring the contributions of individual knowledge brokers provided an ideal departure point for further reflections:

While ideally knowledge brokers are intermediaries that aim to develop networks with, among, and between producers and users of knowledge, there are narrow limits in practice when it comes to scientific programs. The following obstacles were at the center of the discussions of the KTT working group:

- *Unclear requirement specifications*: What is the role of the knowledge broker and what are the expectations? Should program managers do both, coordination and KTT? Very often, KTT tasks are simply added to the work assignments of program managers. In few cases, KTT officers are specifically employed solely for KTT tasks (Figure 1).
- *Big responsibility, small recognition*: To be successful, KTT officers need distinct traits such as excellent networking skills and verbal fluency. At the same time, they need to be recognized in academia, need to understand cutting-edge research from various disciplines, and be at eye level with various stakeholder groups. As there is neither an official job title for knowledge brokers nor a professional training, knowledge brokers occupy a niche with little recognition.
- *Lacking KTT strategy*: In many research programs it is unclear who defines the KTT tasks and foci (e.g. network building vs. adding value to society). In the same vein, there is seldom a discussion on or a concept of what activities need to be pursued at what stage of the project with which stakeholders and in what format. Such discussions are urgently needed.
- *Undefined target audiences*: Part of the KTT strategy should be the decision whether knowledge exchange should be fostered primarily between researchers of the program or competence center, or between them and partners from industry, SMEs, the public sector, policy makers, or with citizens.
- *Insufficient resources*: The lack of time, funding and personnel support for KTT activities is omnipresent in Swiss energy research programs. In contrast to the increasing expectation for implementation activities and making impact, the resources allocated in terms of budget and human resources are very limited. As a consequence, knowledge brokers usually work alone.
- *One-way transfer*: The majority of KTT activities pursued in the scope of Swiss energy research is devoted to one-way information, i.e. on transferring scientific findings to potential recipients. Alternative tools targeting on co-production of knowledge, dialogue or consultation are far less common in KTT portfolios (Figure 2). Tools for knowledge integration are applied in the first instance for intra-program coordination and synthesis processes, but less with external stakeholders (Figure 3).
- *No short-cut for trust-building*: Although inter- and transdisciplinary research has gained increasing attention and recognition in research, experience showed that in inter- and transdisciplinary teams several years are required for trust building and finding a common language (cf. Björnsen et al. 2009). So much time is rarely available in ambitious research projects, which presents a clear dilemma for knowledge brokers.

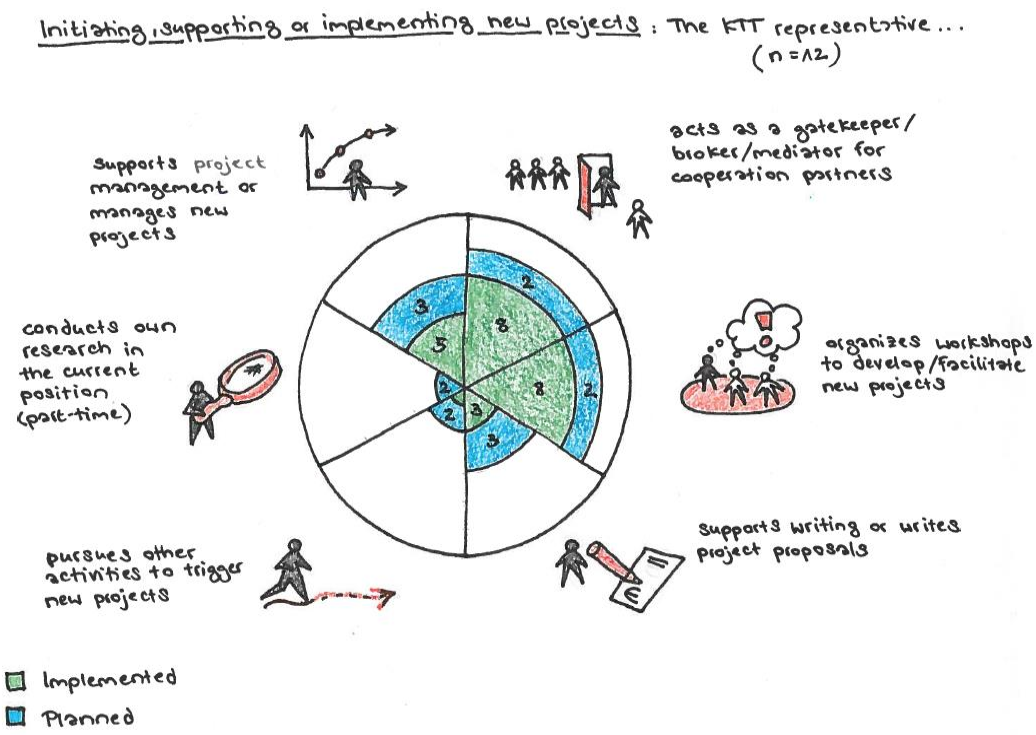


Figure 1: Knowledge brokers in Swiss energy research often act as facilitators, event managers, gatekeepers, managers and coordinators. Less resources are spent on developing new projects (Survey KTT Group 2015).

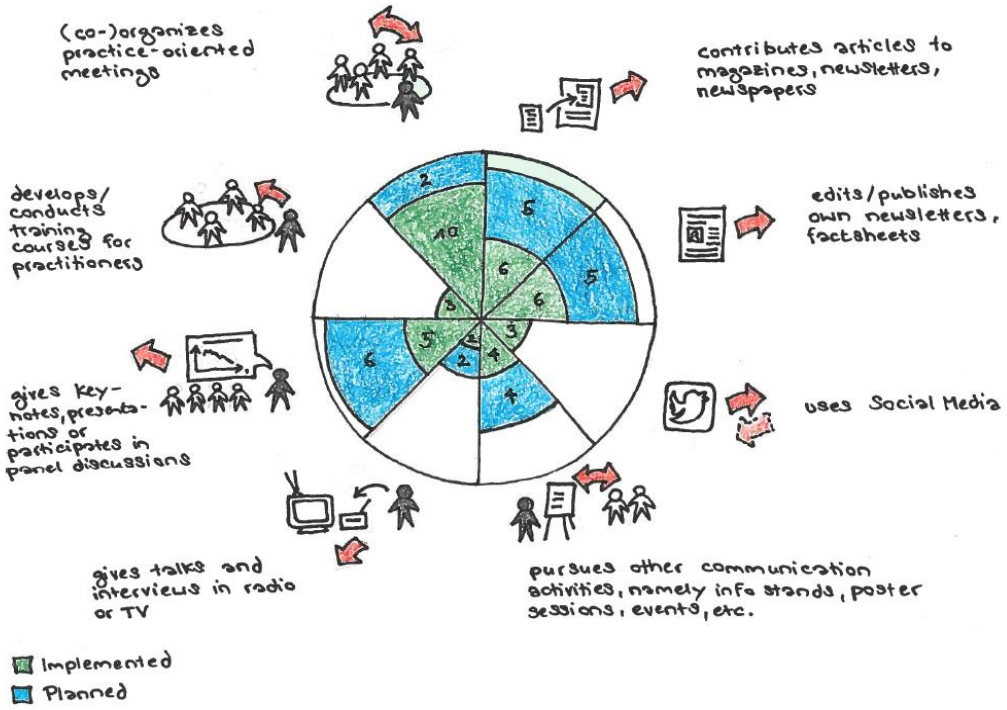


Figure 2: Communication activities within the frame of Swiss energy research is primarily one-way written information to a non-specific and rather broad audience. (Survey KTT Group 2015)

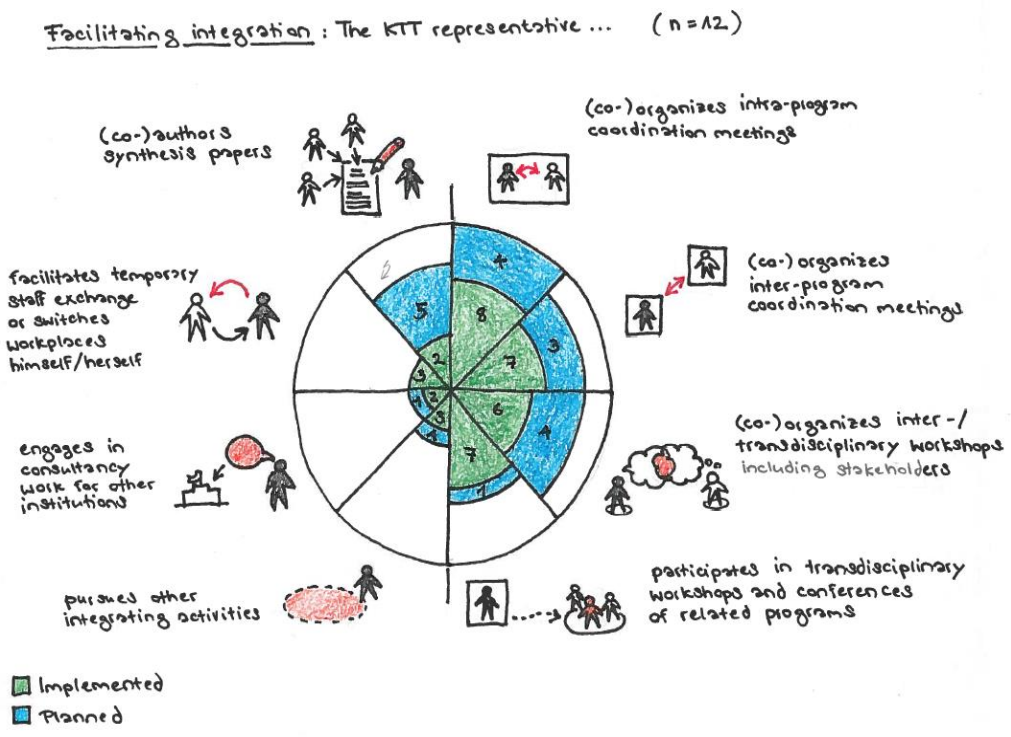


Figure 3: Swiss energy research used tools for knowledge integration primarily for intra- and inter-program coordination, workshops and synthesis processes. Knowledge integration activities with practitioners are rare. (Survey KTT Group 2015)

The repeated reflections of challenges for KTT officers and knowledge brokers led to several conclusions (see Table 1).

Table 1: Challenges and possible solutions for knowledge broker and KTT officers

Challenge	Possible solution
KTT activities are often low budget, developed under severe time constraints, spread thinly and widely ("scattergun approach")	• **Target at two-way communication**/dialogue to enhance effectiveness • **Know your clients** (who they are and what they need) and tally channels and products accordingly
KTT activities focus on the closest peers, mostly members of the science community	• **Shift effort** from intra-/inter-program coordination towards knowledge integration between science and practice • **Leave the researcher's comfort zone** using more effective tools for interactions (vs. publications)
Impact of KTT is rarely evaluated or assessed	• Couple KTT activities with **indicators** to differentiate between effective and ineffective measures, this also between low-cost and expensive KTT activities
Projects and programs are finite. Much expertise and data are lost.	• Build alternative **long-term**, if possible **self-sustaining structures** such as networks and joint data bases accessible beyond the research period

2.4. The Special Case Energy Research

KTT in the realm of energy research can draw from ample experiences in other fields and disciplines. Yet, in the current context of the Swiss energy transition, KTT in the field of energy research has some special features. Most of them are related to a particular market environment that does not follow the typical rules of economics.

Box 2: Why is KTT in Energy Research different?

- **Market failure, distorted energy prizes** due to monopolies and an only partially liberalized market together with very **strong regulations** are prominent features of the Swiss energy market. Uncertainties regarding future regulations together with political tensions present additional hurdles for the introduction of new technologies and business models.
- **Internalization of external effects**: Energy production and consumption often comes along with unwanted effects on the environment and society. These external costs are rarely considered or quantified. Therefore, KTT in energy research should foster viable business models taking into account externalities while striving for economic profitability.
- High **heterogeneity of target groups**: The implementation of the Energy Strategy 2050 will impact a wide range of sectors throughout Switzerland. KTT must not only cover an immense diversity of topics and disciplines, but equally offer highly flexible approaches and customizable tools for stakeholder interaction. **Prosumers**, i.e. persons in the role of both energy providers and consumers, represent a **new target group** with special needs.

3. Knowledge and Technology Transfer for SWEET

Concepts for KTT highly depend on the respective community. KTT from a science perspective (Chapter 3.1) works differently than KTT from an industry perspective (Chapter 3.2). This distinction has been made in the KTT analysis by Arvanitis and Woerter (2005) and the recent monitoring and evaluation report for research and innovation in Switzerland (SBFI 2020). One of SWEET's major challenges is to align these realities (Chapter 3.3) making an effective impact on the Swiss energy transition.

3.1. Concepts for Knowledge and Technology Transfer: Science perspective

Why are knowledge and technology transfer not getting more attention by researchers? What are the barriers to effective KTT in research projects and how can they be overcome? And what are the consequences of such an insufficient or even lack of exploitation? Important key questions and barriers from a science perspective are (adapted from Ala-Mutka (n.d.)):

How are KTT key terms interpreted? Often, we see a lack of distinction between communication, dissemination, exploitation (see Figure 6) as well as between impact, and implementation.

Where do researchers focus? Most researchers perceive dissemination and exploitation as necessary "tick boxes" of the project, but not belonging to the "real work" of the project. Efforts are made for implementing and validating technical objectives rather than for aligning work with user needs. In general, limited considerations of what can be valuable key results of the project outside of academia lead individual researcher to work on 3 scientific publications as their only or main focus. This is also triggered by the academic reward system giving primarily credit for scientific publications.

How is the research project embedded? A lack of reflection and joint discussions within the consortium and with other consortia lead to a lack of thinking outside the box. This further reinforces the rather low level of skills or interest to effectively consider the value and possible benefits of the key results outside the “typical” community.

Why do networks and language matter? Younger researchers in particular are faced with two hurdles: (i) a lack of networks outside their own research discipline (e.g. gap between technical and social science networks) and (ii) outside the research community (e.g. gap between research and the private sector, politics). In addition, many researchers only communicate in English (even if it is not their mother tongue) and do not speak any Swiss national language. It is difficult, however, to interact with numerous target groups e.g. in politics or in SMEs, in English.

The consequences of these barriers are tremendous. On a program level, knowledge and/or results stay with the research consortia without further use. It makes it necessary that new research consortia again re-invent the wheel without access to new seeds for innovation, which in turn results in a low value for public investment in research.

Box 3: SWEET implications of the science perspective

Give KTT a price tag! KTT should not only be a statement of commitment, but must be reflected in the budget table showing who is involved for what task at what stage producing what kind of outcome at what cost.

Know your clients! Spend time at the onset of the project to identify relevant target groups for each project phase, to understand what they need and to choose appropriate tools for interaction.

Seek help! If embracing the KTT challenge goes at the expense of your own scientific merits, consider commissioning specific KTT tasks to external experts. This saves you time while it assures quality.

3.2. Concepts for Knowledge and Technology Transfer: Industry perspective

When it comes to effective KTT, the perspective and experience of academia is not always congruent with the conception of industry. Arvanitis et al. (2005) analyzed various aspects of KTT based on an extensive survey including 2582 firms in Switzerland. In 2018, the State Secretariat for Education, Research and Innovation SERI conducted a survey including more than 6000 enterprises (SBFI 2020). Both studies reveal interesting facts and trends to be considered in KTT endeavors initiated by academic partner. A few of them are highlighted here:

Which industry partners do KTT? About 25% of all firms are undertaking active KTT (Arvanitis et al. 2005; SFBI 2020). They are often larger and older firms and those active in the high-tech sector or knowledge-based service sector. Often, those firms have a higher intensity of investments and greater export shares. Many of them are located in the Zurich region, in the Espace midland or East Switzerland. In the recent years, large firms and industries of the building sector intensified their KTT efforts (SBFI 2020).

What is the underlying motivation to do KTT? Access to human capital (62.8%), access to research results (34.0%) and financial motives (26.3%) are most important drivers for KTT (SBFI 2020). However, the financial motives for KTT are declining. To access human capital, the transfer e.g. through the recruitment of graduates seems effective, but also informal contacts and personal networks are viewed as more important than formal mechanisms (e.g. Transfer Offices).

What are major obstacles for effective KTT? The lack of firms' absorptive capacity but equally costs, risks and uncertainty can hamper KTT or closer collaboration. The recent SBFI monitoring report (2020) first mentions the lack of interest and lacking resources, both human and technical, as major obstacles (38.6%). In the same vein, the lack of qualified KTT personnel and lacking entrepreneurship on the side of the institutions of higher education (27.1%). Costs, risks and uncertainty are also listed as hampering factors for collaborations. The former report of Arvanitis et al. (2005) mentions both the lack of time to enter a sincere dialogue and the missing understanding for the realities at both sides. Related to this deficit, joint consortiums have been listed as non-effective measures for KTT. Repeatedly, difficulties to find the right contact person are noted as a relevant obstacle.

What are the preferences for KTT from an industry perspective? Industry generally favors a division of labor between universities and firms. They see a clear advantage of basic research that stimulates advanced innovations more than applied research focusing on commercialization. In the same vein, great value is attributed to scientific publications to access first-class research results (this is in stark contrast to scientists' perceptions, who view their publications as rather detached from reality). Apart from such tactic knowledge, firms would like to access to internal know-how and abilities such as problem-solving skills. In other words: They seek access to human capital, which is in turn closely linked to networks and personal contacts.

Box 4: SWEET implications of the industry perspective

Shift brains! Numerous KTT tools target at turning silent/tactic knowledge to codified knowledge, thereby rendering it transferable. Complementary, higher effort should be made to foster personal and institutional networks, which in turn could facilitate a shift of human capital.

Only half the truth. KTT efforts of research programs represent only half of the reality and contribute only half to the success. Shifting the perspective or better tallying KTT strategies with industry could enhance effectiveness.

Better than their reputation! It is incorrect down-grading scientific publications on cutting-edge research results as simple means to earn scientific merit. Scientific publications are in fact among the most important KTT channels mentioned by industry.

Selection of the fittest. What is true in evolution, is also true in KTT. The process of identifying suitable partners is highly demanding and, unfortunately, often resembles rather a last-minute panic action under the pressure of a proposal deadline than a well-sought decision.

3.3. Matching perspectives

As highlighted in the former chapters, vast differences exist between players in the Swiss energy system. Every discipline, sector or industry has its own work cultures, language, incentive system and likely also differing expectations in terms of products and services. Bridging these "valleys of death" demands for investments in terms human and monetary resources, and time (cf. Björnsen et al. 2009).

Moreover, strategies and concepts for KTT need to be very clear about the identity of potential stakeholders, but equally about their roles: too often, they are conceived as mere *recipients* of information, although they could be included as *consultants* to retrieve important information. Working together at eye level, i.e. including their expertise as *collaborators* in the project, calls again for a very different selection of KTT tools and concepts. Hence, the target group and attributed roles can be determinant for the selection of instruments applied in KTT (see Figure 4).

If we consider the KTT tools as the bricks, personal contacts and the ability to interact are the mortar for building a solid KTT strategy. Hence, KTT activities must primarily build on and are dependent of the effective establishment and expansion of the following areas:

a. New informal contacts and personal networks

A personal network, i.e. sound knowledge of "who is who?" and "who knows what?", is often a prerequisite for effective KTT. Personal contacts are the most important mechanisms for knowledge transfer (Kaufmann and Tödtling 2001) and can be helpful in the search for the right person, as reflected in the early survey of Arvanitis et al. (2005): More than 50% of the KTT-active firms find "informal, personal contacts" and KTT through graduates and educational activities with universities as the most important forms of KTT, independent of sector or size class. In the same vein, the recent SBFI monitoring report (SBFI 2020) highlights the importance of informal, personal contacts and personalized knowledge as a central factor for KTT, thereby assigning high importance to networks and platforms for knowledge exchange. Despite this fact, Swiss firms often face difficulties to identify the right contact person for a particular task or problem. Hence networks need to be built and managed internally (e.g. within a consortium) and externally (with people beyond the program, e.g. Energy-Connect or Innovation Booster). An optimal network connects sub-networks and people across different organizations, industries and sectors which are geographically wide spread. Apart from enhancing the effectiveness of KTT activities, networks can become a means of power if they allow to synthesize scientific insights, which are then expressed in one voice and gaining higher visibility (Ferrazzi and Raz 2014; Pfeffer 2010).

b. Access to human capital or its transfer

Inviting people or consulting them for expertise, be it for an input presentation, expert advice or for problem-solving, is an effective means to access human capital. Firms hiring well-educated graduates with problem-solving abilities pursue a highly efficient form of KTT.

c. Translation of tactic (intrinsic) knowledge to codified, thus transferable knowledge

Firms value scientific publications as highly effective communication channels, although many scientists pursue scientific publication for their own scientific merit. In contrast to this perception, firms still seek access to first-class research and support the idea of basic research ("pure science") - in contrast to more applied research - as an effective stimulant for advanced innovations. This means that making research findings available in peer-reviewed publications remains a relevant pillar of KTT.

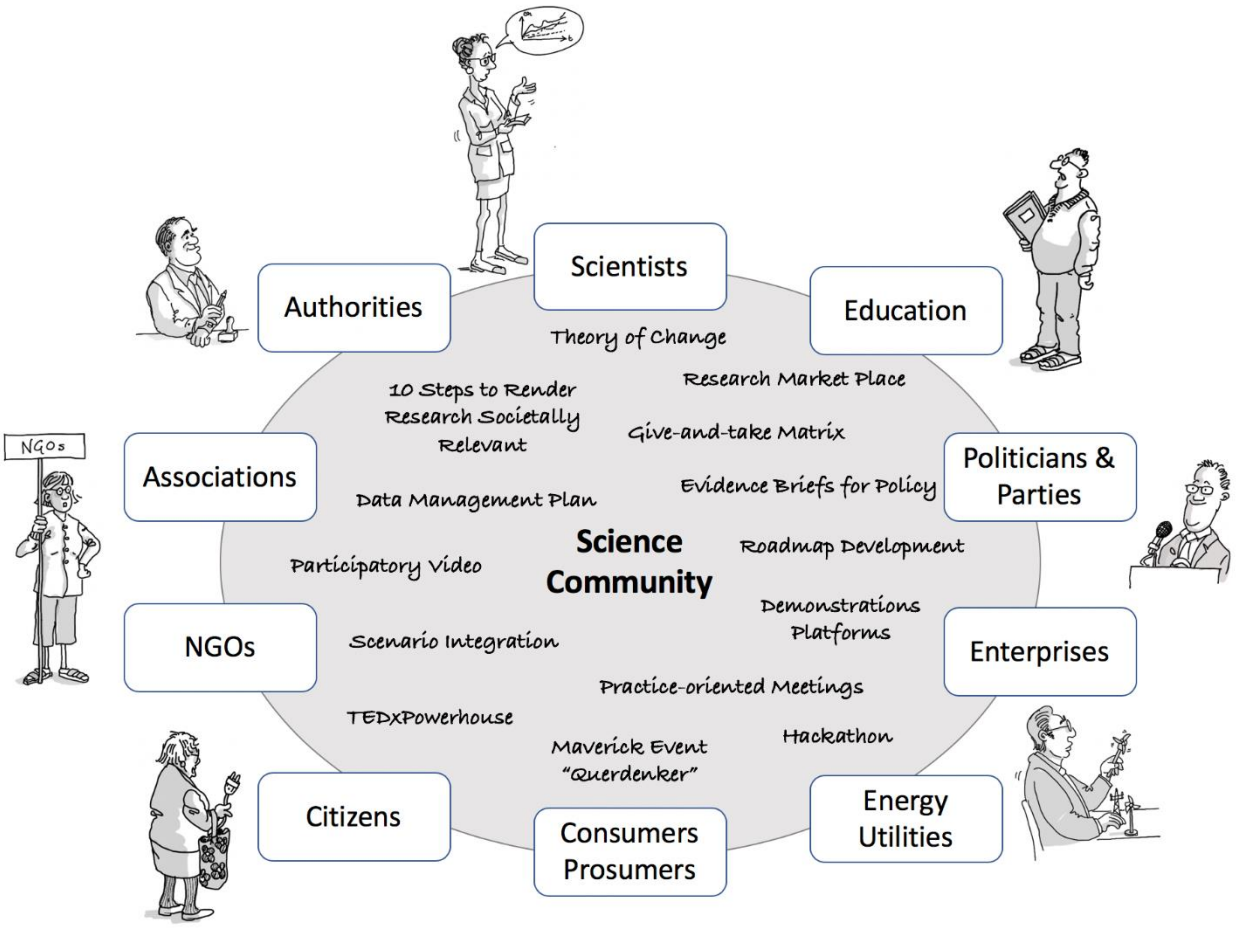


Figure 4: Stakeholders are not a homogenous group. For an appropriate selection of suitable KTT tools, stakeholders must be carefully differentiated, as some tools and respective products are target group-specific. (Illustration by A. Björnsen)

Not all tools are target group specific. A large number of tools can be used flexibly for different stakeholders or simply adjusted (Figure 5).

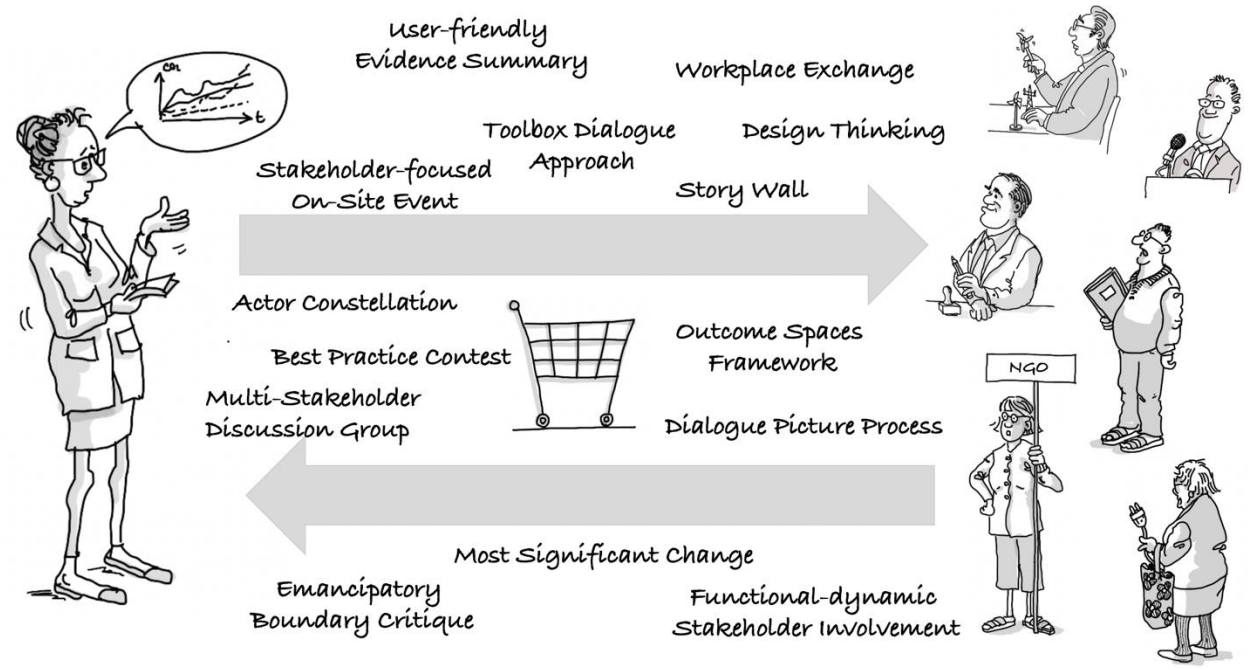


Figure 5: Despite the variety of stakeholders, a large number of KTT tools can be applied more flexibly or adjusted to the particular needs of science and practice. (Illustration by A. Björnsen)

As in Horizon 2020, project proposal evaluation in the SWEET program is also based on three criteria: *Excellence*, *impact*, and quality and efficiency of their *implementation*. In the SWEET "Call Guideline Call 1-2020" (p. 27) and "Proposal Template" (p. 5) the criterion *impact* is further differentiated according to

a) Expected impact

b) Measures to maximize impact

c) Dissemination and exploitation of results

d) Communication activities

For the dissemination and exploitation of the consortium's results, a draft plan is required (Plan for Dissemination and Exploitation PDE). But what exactly is expected in a PDE? Figure 6 briefly highlights the three central tasks, the respective stakeholders, as well as the central questions of how, when and why.

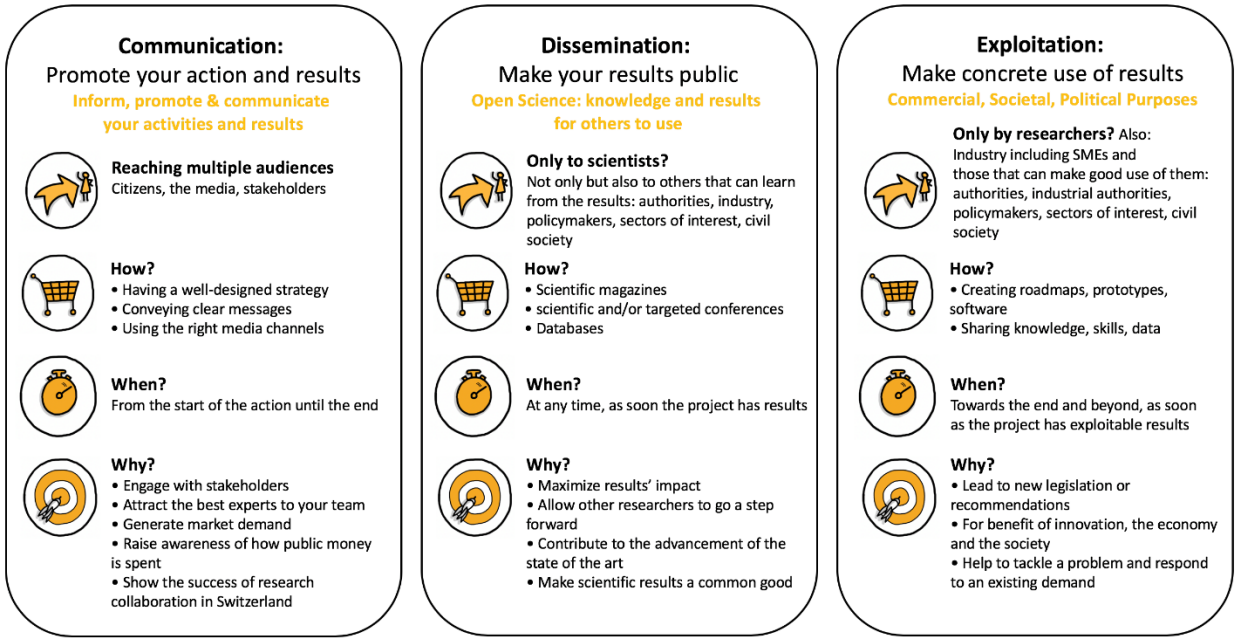


Figure 6: Communication, dissemination and exploitation: What is the difference and why do they matter? (Illustration by A. Björnsen, adapted from European Commission 2015)

A draft KTT plan for the communication, dissemination, and exploitation of the results must define clear objectives adapted to the relevant target users and set up a concrete strategy. In general, a KTT concept aims to answer a minimum of questions (see Box 5) adapted from European IPR Helpdesk 2015).

Box 5: Questions to be answered in a KTT plan

1. What kind of needs does the project respond to?
2. What kind of problem the proposed solution will solve and why this solution will be better than existing ones, and in which areas?
3. What new knowledge (results) the project will generate?
4. Who will use these results?
5. What benefits will be delivered and how much benefit?
6. How will end users be informed about the generated results?

As it is often the case, asking good questions is easier than answering them. The in-depth discussion of concrete KTT concepts would go beyond the scope of this report. However, to show which fields of action must be worked on in order to create a convincing KTT concept for a project or program, a quick guide is provided in the Appendix B.

3.4. KTT failures

Like other people, KTT officers most often rely on accepted practices, copy what others have done, and therefore experience what others have experienced. It is curious that only few of them take time, or have the time, to explore new tools or to get smarter in applying them, i.e. to review experiences with hindsight, evaluating what has worked well, and what has worked not so well, and why; and what could be learned from it, and how the problem could be fixed the next time. Most go on applying the same tools and repeating the same mistakes (see Box 6). In energy research, people are far more used to bragging about successes, such as running large scale, expensive events measured by the sheer number of participants but with no clearly defined success criteria. Often, little remains after an event.

Box 6: My biggest KTT failure...

... time planning too tight and not ready
... I expected more commitment from the participants
... incoherent consortium that disintegrated with time
... implementation of urban mobility management: a grandiose failure!
... discussion rounds without discussion
... marketing of a patent
... the format of "Innovation Groups"

Source: Spontaneous answers of participants of the 14th KTT Meeting "Go public with failure", 3 Nov 2020.

In a "non-KTT life", most people learn from failing repeatedly, in increasingly ambitious experiments, until they succeed. If they start admitting mistakes more openly, going public with them, other parties would benefit from gained insights, and a valuable knowledge transfer can take place. With this background, members of the working group "KTT in large Energy Research Programs" discussed their biggest KTT failures in a workshop in early November 2020. They thereby dismantled the illusion that KTT officers succeed in all they do. A few interconnected insights are presented in Figure 7.

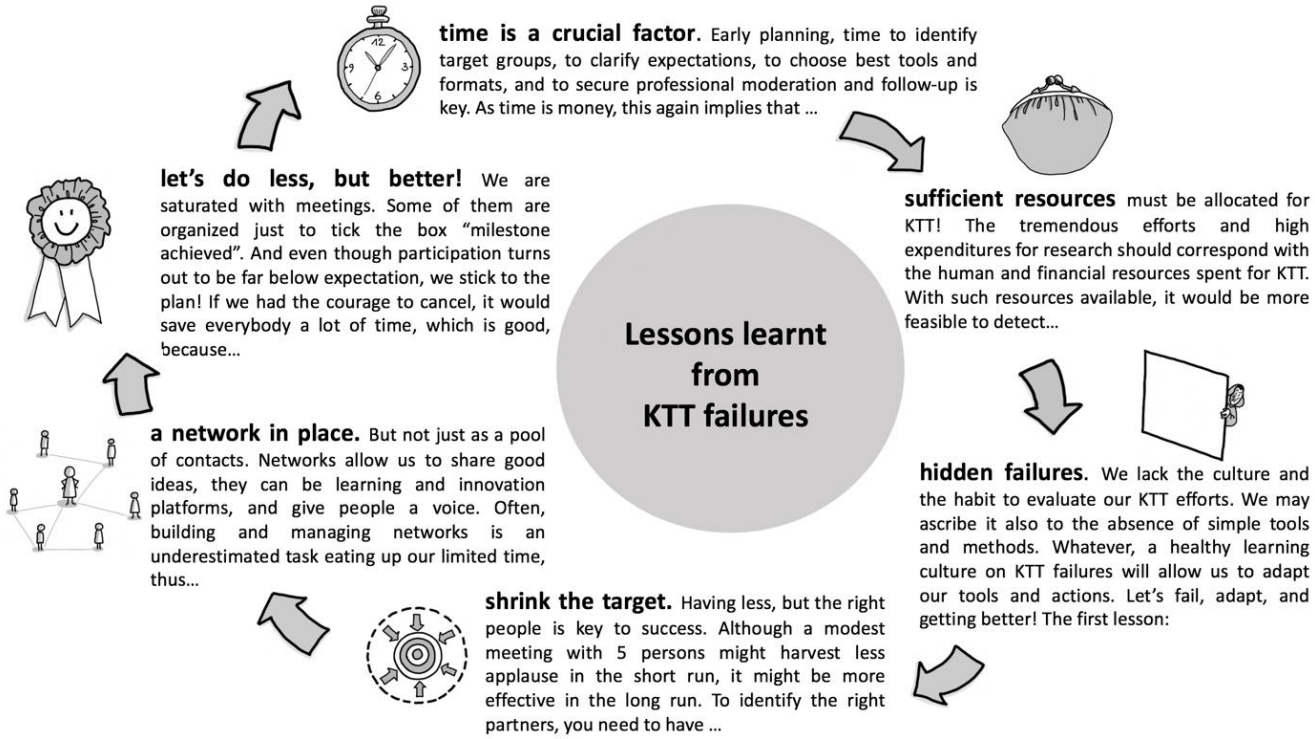


Figure 7: Lessons learnt from KTT failures: Based on online breakout sessions at the 14th workshop of the KTT Group (Illustration by A. Björnsen)

4. Morphological Box and Tools for Knowledge and Technology Transfer

The morphological box describes a systematic technique developed by the Swiss Fritz Zwicky (1898–1974). He proposed a multi-dimensional matrix to present possible options in a comprehensive and neutral manner. Such overview could then facilitate a rational choice for the most desirable option (e.g. the choice of a business model).

We have used the morphological box to develop a typology for KTT and identified a total of 12 main categories of KTT (e.g. direction of information flow or size of target group) and 4-11 corresponding variables of each category, e.g. for “direction of information flow”: (1) Information, (2) Consultation, or (3) Dialogue, Collaboration. The morphological box (see Figure 8 and Figure 17) is the result of an intensive discussion within the working group (authors of this report) and the refinement and verification exercise in the course of an KTT expert workshop in September 2020. To reduce complexity, both the number of categories and of the respective variables have been limited. This is important, as the KTT box is meant as an entry point for project or program managers and KTT officers to clarify the frame conditions of their KTT needs and resource availability. Such clear delineation of the frame conditions allows the sound selection of suitable tools and put KTT planning on a rational and comprehensible basis.

Typology of KTT Tools

	Categories	Variables						
Frame conditions	**Stage of project/program implementation**	Concept development	Project planning	Implementation	Mid-term evaluation	Final project phase	Dissemination, outreach	Post-project evaluation
	Level of readiness knowledge / technology	Basic research	Applied research	Pilot project	Demonstration project	Lighthouse project	Scaling up	(Market) Implementation
	Degree of disciplinarity	Single	Multi	Inter	Trans			
Target group characteristics	**Direction** of information flow	Information	Consultation	Dialogue, Collaboration				
	Type of external target group	Scientists	Politicians & parties	Authorities	Enterprises	Energy utilities	Consumers & prosumers	Citizens	NGOs	Associations	Education	Not yet defined
	Size of target group	Few persons <10	Small group about 20	Medium-size group about 50	Large group about 100	Large group >500	International group <50	International group >50
	Attention span of target group	30 seconds	Minutes	Hours	One day	Several days	Months	Years
Resources	**Average annual budget** allocated for KTT (CHF)	None	~ 500.-	~ 5'000.-	~ 50'000.-	~ 100'000.-	~ 0.5 Mio	Not yet defined
	Institutional settings Framework for KTT activities	Few persons <5	Small team about 20	Department, unit about 50	Institution 500-1000	Consortium e.g. SCCER	Several consortia	International consortia
	Human resources available for KTT	None	0.1-0.2 FTE	0.3-0.8 FTE	0.9-1.0 FTE	>1-5 FTE	>5 FTE	
	Qualifications & skills required for KTT	No qualification	Basics	Advanced	Expert			
	Knowledge exchange	Defining problem	Generating new knowledge	Assessing new knowledge	Disseminating new knowledge	Using new knowledge		

Figure 8: Typology of KTT tools in the style of the morphological toolbox. The matrix (Zwicky 1966) creates awareness of needs and frame conditions of projects or programs, which in turn is decisive for the right choice for a specific KTT tool

4.1. Use the morphological box for your KTT project

The ultimate aim of the morphological box is making a mental walk through your own KTT story. This will then allow the identification of the most suitable tools from an overwhelming, permanently evolving and expanding pool of instruments. Most KTT tool serve specific purposes, while only few can be applied in almost every context. It is wise to think carefully before making your choice.

(1) Clarify frame conditions, target group characteristics and resources available

Classify your project for each category. Choose one or several variables describing the type of your KTT activities best. Mark the variable with a visible dot. In most cases, you mark only a single variable per category. However, sometimes it can make sense to choose multiple variables (e.g. target Stakeholder group). Once you have finished, draw a connecting line between the dots (see e.g. Figure 9 and Figure 18).

(2) Use the morphological box repeatedly!

In large programs consisting of several projects and R&D activities, it is recommended to conduct this exercise for each sub-project separately and repeatedly during different stages of the project life cycle. Needs, potential partners as well as resources can change in the course of the project. Hence it is important to check regularly if the KTT activities are still in line with former assessments or if new realities have emerged where KTT tools need to respond to.

(3) Choose the most suitable tools

Bearing in mind the needs and resources identified in Step 2 helps to identify possible KTT tools from the selection presented in Chapter 4.2. Thirty effective tools are presented in an alphabetical order. For better orientation, 6 (out of 12) categories of the morphological box are visualized with symbols. This allows for an efficient screening of the available tools and a quick identification of your favorite tools (e.g. “suitable for stimulating dialogue” or for “small budgets”).

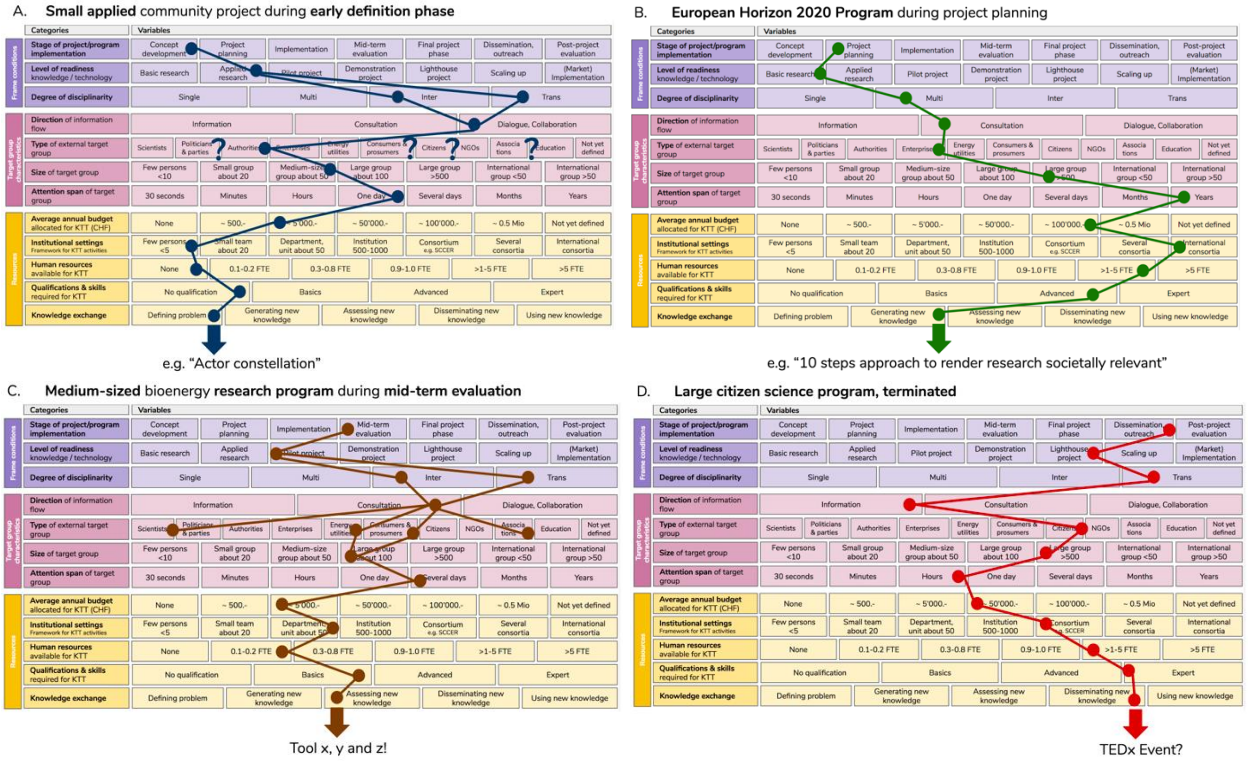


Figure 9: Example of 4 different project classifications with the help of the morphological box. A. Small, applied & early stage; B. Large, applied & planning stage; C. Medium, pilot & mid-term; and D. Large, citizen-science & terminated.

4.2. Find your favorite KTT tool

The number of KTT tools is huge. This report does not attempt to present them all. Instead, a selection of 30 KTT tools is listed below fulfilling the following criteria:

- ***covering the broad range of needs*** reflected in the morphological box, e.g. tools suitable for very small as well as large target groups;

- ***addressing the needs of the Swiss energy research community****, hence picking rather target-oriented tools that are in accordance to the needs of busy scientists (vs. process- and emotion-ally oriented);*

- ***offering new and creative pathways*** going beyond conventional tools.

As sub-set of the criteria introduced in the morphological box has been visualized to allow a quick orientation of the 30 tools based on six criteria and their symbols (see Figure 10).

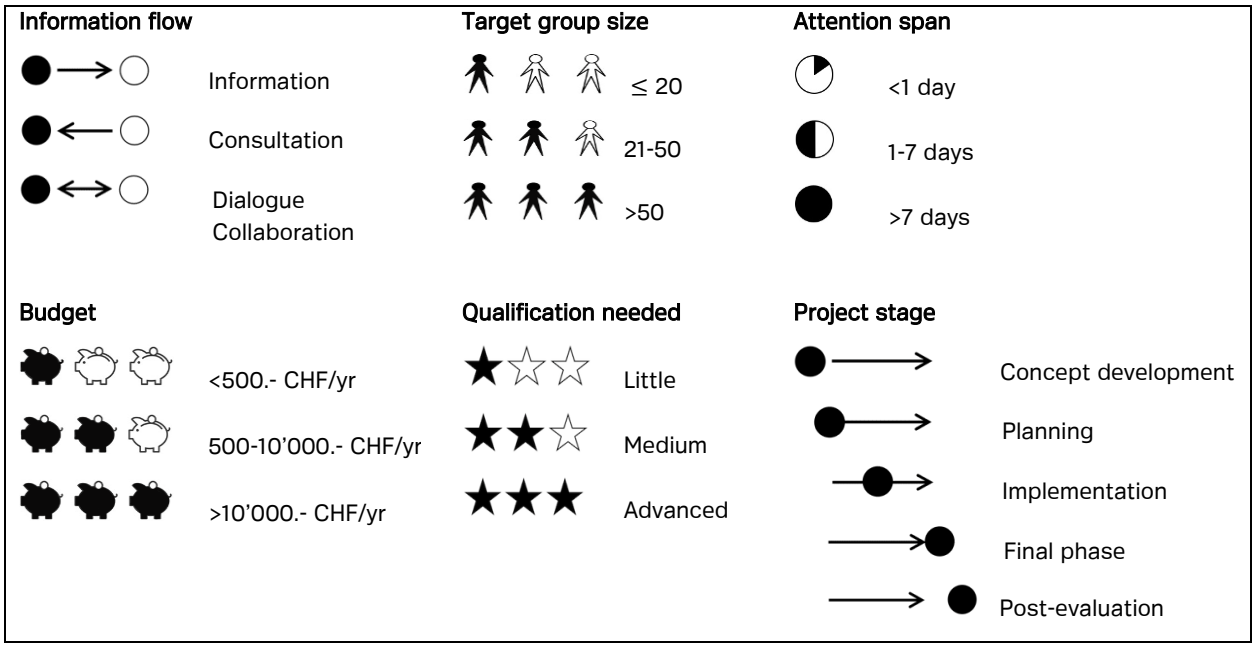


Figure 10: Sub-set of six criteria and their symbols for a quick orientation of the 30 tools.

The respective boundaries between the characteristics of the criteria are of course not rigid. The aim is a quick overview and not quantitative accuracy. Attention span means the attention span of the participants. The preparation and follow-up time for the use of methods by the moderating person(s) is not included.

Box 7: Dialogue and Collaboration?

There is a great potential in interacting with people from other research disciplines or with stakeholders. We might speak different languages in our respective disciplines, we might have different beliefs about knowledge, technology, and the world. And perhaps we represent different values.

Dialogue and collaboration help to understand, reduce or overcome these differences! This can be achieved through measures that promote dialogue and thereby enable cooperation. In this chapter, all measures that can be described as "co-production of knowledge" or "co-producing knowledge" are marked with ●↔○ symbolizing a two-way flow of information.

4.3. Have a look at the toolbox with 30 tools

The collection of 30 tools for knowledge and technology transfer is intended to support all those responsible for consortia, research projects as well as pilot and demonstration projects in the SWEET program in finding the most suitable tools to make their KTT work more effective. To facilitate a systematic overview, the tools are listed in alphabetical order. An overview can be found in the table of contents.

1. Actor constellation

A role-play for identifying the relevance of various involved actors, their disciplines or social roles in order to tackle a specific research question. This tool helps a research project leader to manage interactions with multiple stakeholders and associates from various disciplines.

Step 1: Identification of the ten most important actors and stakeholders, their disciplines and societal role, followed by an alignment of these actors according to the influence on the specific research question.
Step 2: Physical positioning of the stakeholders in relation to the research question in real space or positioning with the help of paper figures.

After an initial positioning, types of influences are specified and re-positioning is considered until participants agree on a final – rearranged – actor constellation. If done as a (physical) role play, moderate facilitation skills are required.

At a glance

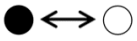
Information flow	●↔○
Target group size	🧍🧍🧍
Attention span	◔
Budget	🐷🐷🐷
Qualifications	★☆☆
Project stage	●→

Learn more: CCES Winter School with cut-out sheet; Actor Constellation at "td-net" (Link); 13 types of actor constellation games in policy implementation in Switzerland: P. Knoepfel (2019)

2. Best Practice Contest

The Best Practice Contest is an effective tool (i) to identify potential project partners from various stakeholder groups, and to (ii) support and disseminate good practices, ideas and innovations. The contest starts with the publication of the contest via different communication channels (radio, newspaper, social media). The submitted proposals are evaluated by a committee who then invite winners and their competitors for an award ceremony. The best practices are awarded with a prize or seed-money for related activities or investments.

At a glance

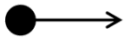
Information flow 

Target group size 

Attention span 

Budget 

Qualifications 

Project stage 

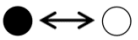
Learn more: Best Practice Contest of the Green Energy Project, WSL (Link)

3. Design Thinking

Design Thinking movement is questioning the assumption that technology alone can solve problems! It is a human-centered, integrative and iterative methodology for (re)framing problems, but also solving them by co-creating implementable solutions in a small group using visual thinking and prototyping. Specifically, it is a collaborative problem-solving strategy that embraces visualization, storytelling, and experimentation through building and testing prototypes. Typically, it involves 5 phases: Emphasize, Design, Ideate, Prototype, Test.

Design is too important to be left to designers!

At a glance

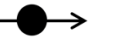
Information flow 

Target group size 

Attention span 

Budget 

Qualifications 

Project stage 

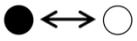
Learn more: Design Thinking at “td-net” (Link), TED Talk Tim Brown (Link) and examples (Link)

4. Demonstration platforms

Demonstration platforms aim to accelerate the innovation process from technological innovations in labs to large, industrial scales and to yield marketable solutions. Demonstration platforms are large-scale projects with several research partners working in close collaboration with industry.

Although the practical effects of the platforms and their cost-benefit ratio are not always clear, they can be significant for SWEET by i) using the existing platforms and ii) initiating, helping to shape, and developing new platforms.

At a glance

Information flow 

Target group size 

Attention span 

Budget 

Qualifications 

Project stage 

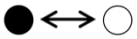
Learn more: Empa Research and Technology Transfer Platforms NEST, move and ehub; PSI Energy System Integration Platform ESI. Eawag Water Hub: ETH Zurich Renewable Management and Real-Time Control Platform ReMaP; Societal demonstration platform Smart Energy Åland, Sweden.

5. Dialogue Picture Process

The joint development of a real picture integrating different perspectives and visions is an ideal departure point not only for KTT, but for all projects in their initial phase. It requires professional facilitation (moderation, illustration) to re-shape the visualization along the project development and activate participants who contribute and discuss their perspectives. The dialogue picture is a multi-purpose tool. It provides an evolving anchor for journeys in complex terrains and effectively helps to structure content. It can integrate other KTT tools and should be considered a meta-knowledge-sharing platform for projects, consortia, and partnerships with stakeholders.

The tool "Rich Picture" serves a similar purpose (see below).

At a glance

Information flow	
Target group size	
Attention span	
Budget	
Qualifications	
Project stage	along the process

Learn more: Dialogbilder als Element der Mitarbeiterkommunikation, Weber 1999 (DE) (Link) and Video; Rich Picture method description, including videos and webinar on how to use rich picture for evaluation and how to analyse a rich picture experience report.

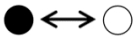
6. Emancipatory Boundary Critique

The Emancipatory Boundary Critique guides non-experts to critically challenge an expert's suggested solution to a problem and the solution's social and ecological implications. Hence, the method can be applied, for instance, if researchers have developed solutions they like to propose to practitioners.

The key to emancipatory boundary critique is a checklist of 12 boundary questions that the non-expert poses to the expert. The questions are organized along the themes "Sources of Motivation", "Sources of Power", "Sources of Knowledge", and "Sources of Legitimation". The outcome is a broader understanding of a proposed solution.

The EBC can also be planned as a dialogue meeting lasting 1-2 hours.

At a glance

Information flow	
Target group size	
Attention span	
Budget	
Qualifications	
Project stage	

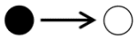
Learn more: Emancipatory boundary critique at "td-net" (Link); at "Critical Systems Heuristic" (Link)

7. Evidence Briefs for Policy (academic factsheets)

Evidence briefs for policy provide an overview of important scientific findings on politically relevant topics.

They are short reports about high priority and policy relevant issues that describe the problem, alternative policy options and policy implementation considerations.

At a glance

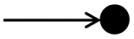
Information flow 

Target group size 

Attention span 

Budget 

Qualifications 

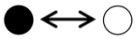
Project stage 

Learn more: Swiss Academies Factsheets (Link), Factsheets Energy (Link), Engaging and Influencing Policy (Toolkit #2 GAIA 24/4: 221 (2015)

8. Forum for Science & Practice

A Forum is a conference-like, inter- and transdisciplinary meeting of about 100-150 participants and preferably convened in non-academic environment. It is meant as a platform facilitating the dialogue between science and practice. For that reason, the agenda encompasses scientific contributions as well as practical lectures. In addition, it can accommodate a series of workshops, a market place for entrepreneurs, field excursions and social events for networking. Ideally, as in the case of the *Forum Alpinum* and *Forum Carpaticum*, the Forum is organized every two years in rotation by one of the network member countries.

At a glance

Information flow 

Target group size 

Attention span 

Budget 

Qualifications 

Project stage any

Learn more: Forum Alpinum (Link) and Forum Carpaticum (Link)

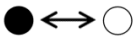
9. Functional-dynamic Stakeholder Involvement

Not all stakeholders need to be involved at the same level of intensity throughout the project; and it is wise to plan this in advance! This approach helps to specify the *functional* involvement of the stakeholder, i.e. related to the goal of the respective project step, as well as the *dynamic* involvement related to the type of participation. In other words, who needs to be involved why, when, regarding what aspects and how.

The stakeholder involvement is visualized in a diagram, listing the intensity of involvement (inform, consult, collaborate) of different stakeholders along a timeline of process steps.

Like the actor constellation, this method is more effective if it is used as a project planning tool.

At a glance

Information flow 

Target group size 

Attention span 

Budget 

Qualifications 

Project stage 

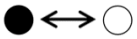
Learn more: Functional-dynamic stakeholder involvement at “td-net” (Link); Template (Link)

10. Give-and-take-matrix

Give-and-take is a structured and relatively simple process allowing research teams with diverse disciplinary backgrounds to establish links between individual research parts or subprojects. It is ideally conducted in the project design or planning phase with all project members involved.

The exercise also helps to clarify expectations and to think early about possible data, formats and products.

At a glance

Information flow	
Target group size	
Attention span	
Budget	
Qualifications	
Project stage	

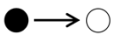
Learn more: Give-and-take-matrix at “td-net” (Link) and A3 Template (PDF)

11. Hackathon/Hackdays

Hackathon/Hackdays foster innovation in organisations or entire multidisciplinary and multifaceted communities. Hackathons can provide solutions and functional prototypes in short time on preselected or spontaneous found problems - the challenges. The target audience and the technology are very specific (Machine learning, Internet of things, AI, Augmented reality, Bots).

There are four stages to make a Hackathon work:
1. Define the area of interest
2. Define the community of hackers/participants
3. Production of challenges by challenge owners
4. Organize a two day event – the hackathon/hackdays

At a glance

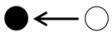
Information flow	
Target group size	
Attention span	
Budget	
Qualifications	
Project stage	any

Learn more: The complete guide to organizing a successful hackathon (Hackerearth Link)

12. Maverick Event (“Querdenker”)

Mavericks are experts that like to think out of the box and offer their collective innovation power to SMEs and industries wanting to explore new markets, develop new products & services or realign their strategies in response to new trends. They can cross-check their ideas with experienced, yet fresh and independent minds. Maverick events can be powerful KTT tools at different stages of the project implementation.
Mavericks offer their ideas free of cost during 2-4 hours workshops or evening meetings. The process is usually guided by a professional facilitator. Costs usually incur for the venue and reporting only.

At a glance

Information flow	
Target group size	
Attention span	
Budget	
Qualifications	
Project stage	any

Learn more: Querdenker-Pool (Link)

13. Most Significant Change

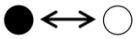
Most Significant Change, also called "Soft Systems Methodology", is a story-based, qualitative method for uncovering and collecting most significant project impacts experienced by individuals, scientists, or practitioners. It is applied to *projects aiming at triggering (social) change* and can be used throughout or at the end of a project or program cycle.

After defining 3-5 relevant domains of change, various actors from a heterogeneous group provide short stories (1-2 pages) describing the most significant change that took place from their personal perspectives. The stories are allocated to the identified domains of change and then discussed more thoroughly with respect to lessons learnt and expectations.

The tool is also helpful to complement quantitative evaluation measures and to identify unintended effects.

When you aspire to use the method to collect a consolidated view on effects of your project, a substantial budget is needed. But you can also use the simple question "what is the most significant change our project/consortium evoked in you?" as a low threshold version of the tool in project workshops or meetings.

At a glance

Information flow 

Target group size 

Attention span 

Budget 

Qualifications 

Project stage 

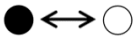
Learn more: Most significant change at "td-net" (Link), at "Better Evaluation" (Link), and at ZEWO (Link), Soft Systems Methodology at toolshero (Link) shows how the method that can be followed in 7 steps.

14. Multi-stakeholder Discussion Group

The Multi-stakeholder Discussion Group should be applied if specific societal actors are relevant for the project but not yet strongly enough involved. It brings together various stakeholders on a regular basis and runs in parallel to an on-going research project. The targeted output is a research question or research plan adapted to the perspectives of stakeholders.

To form the group, about 10 representatives from the most relevant institutions, associations and networks are selected in relation to the (societal) problem addressed in the project. A professional moderator will lead through several workshops according to a decided plan. A final meeting, e.g. a vernissage preferably connected to a stakeholder event, is organized to show the project's achievements.

At a glance

Information flow 

Target group size 

Attention span 

Budget 

Qualifications 

Project stage 

Learn more: Multi-stakeholder discussion group at "td-net" (Link) and at "Better Evaluation" (Link), example of a multi-stakeholder discussion group that produced 9 videos see Fry. P., S. Thieme (2019)

15. Outcome Spaces Framework

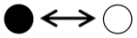
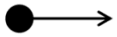
This tool is a simple framework to clarify expectations and motivations among project partners ideally at the beginning of a project. As such, it can guide the conception, design, implementation, and evaluation of transdisciplinary research. The Outcome Spaces drawn on a paper board distinguish 3 spaces:

(i) improving the *situation* or field of inquiry,
(ii) generating relevant stocks and flows of *knowledge*, and
(iii) mutual and transformational *learning* by the researcher(s) and involved participants.

Participants write their respective expectations on cards and place them on the board for further discussion. The group decides for each card if it falls inside or outside the boundaries of the project. So, together with stakeholders, the project boundaries are drawn between desirable outcomes and feasible outcomes. This exercise allows to reveal, categorize, articulate, and evaluate the impact of research.

An initial layout can be done in a workshop of 2 hours. If the tool is used as a monitoring and evaluation instrument, it takes more than 1 day.

At a glance

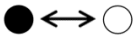
Information flow 
Target group size 
Attention span 
Budget 
Qualifications 
Project stage 

Learn more: Outcome spaces framework at “td-net” (Link) including an experience report; Outcome Spaces (Mitchel et al. 2018)

16. Participatory Video (PV)

PV is a set of techniques to involve a group or community in shaping and creating their own film. This is a great way of bringing people together to explore issues, voice concerns and to tell stories. This process can facilitate the communication between stakeholders and researchers to identify relevant research topics, to develop applied projects or to kick off processes in a group or community.

At a glance

Information flow 
Target group size 
Attention span 
Budget 
Qualifications 
Project stage 

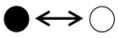
Learn more: PV Video product (YouTube) and introduction (TEDxTalk by Chris Lunch); Photovoice (Link), A Practical Guide to Photovoice (Link), Experience Report combining a multi-stakeholder discussion group & video production as KTT (Link)

17. Practice Oriented Meetings (POM)

Practice Oriented Meetings (also “practice circles”) are workshops or trainings designed for specialists from industry, administration, engineering, environmental consultancies, as well as for University representatives. The meetings focus on a specific topic to provide up-to-date knowledge and to promote targeted and constructive exchange of knowledge and experience.

Sometimes these meetings lead to the development of new products or processes.

At a glance

Information flow	
Target group size	
Attention span	
Budget	
Qualifications	
Project stage	any

Learn more: POM at empa-Akademie, Praxisorientierte eawag-Kurse (PEAK), Hightech Zentrum Aargau (Link), Supercomputing Systems AG

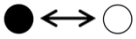
18. Research marketplace

A tool to initiate bilateral and small group exchange between (sub)projects that need to be linked. It is organized as a group workshop of min. 1 hour and includes the following steps: 1) Individual project poster preparation; 2) Discussion and visiting round to all posters (adding notes); 3) Individual review of notes on its own poster; 4) Conclusions for future work in the plenary.

This tool provides a platform for interactions within research teams and with various societal actors. In contrast to a classical poster presentation, the research marketplace focuses on collecting feedback: e.g. by providing blank space on the poster to write feedback down individually and by organizing feedback sessions in plenum. It is especially useful at the beginning of a project planning, and best during the actual problem framing.

Can be implemented in 2-3 hours; with preparation and post-processing the attention span is more than a 1 day.

At a glance

Information flow	
Target group size	
Attention span	
Budget	
Qualifications	
Project stage	

Learn more: Research marketplace at “td-net” (Link)

19. Roadmap development

The roadmap is a synonym for a strategy or a project plan. It provides a visual overview of how a thing (a product or a project) develops over time. Further, the roadmap is characterized by its preparatory character and is used to structure long-term projects into individual, easier-to-manage steps, whereby uncertainties and possible scenarios for target achievement are considered.

A *technology roadmap* is a flexible planning technique to support strategic and long-range planning, by matching short-term and long-term goals with specific technology solutions.

At a glance

Information flow 

Target group size 

Attention span 

Budget 

Qualifications 

Project stage 

Learn more: Technology Roadmapping (Phaal et al. 2004); Product Roadmap Tools (The Product Manager), Roadmapping am Fraunhofer-Institut für System- und Innovationsforschung (Gesamt-Roadmap Energiespeicher); Innovation Roadmap (InnoSuisse)

20. Scenario Integration

Using scenario planning, this tool allows for collectively drafting possible future developments of a societal challenge.

The scenario integration tool uses qualitative and quantitative elements of scenario planning to collectively draft possible developments of a societal challenge. It is typically applied in a structured one-day workshop. The tool is suited for use by heterogeneous groups of experts with diverse disciplinary backgrounds as well as various societal actors. For the scenario integration, not only the moderation, but also the participants have to be prepared and go through a 7-step process.

At a glance

Information flow 

Target group size 

Attention span 

Budget 

Qualifications 

Project stage 

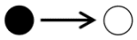
Learn more: Scenario integration at “td-net” (Link)

21. Social Media

Social Media is computer-based technology that facilitates the sharing of ideas, thoughts, and information through the building of virtual networks and communities. Although many scientists perceive it as a one-way communication channel to an undefined audience, various social media channels can effectively amplify the impact of communication products, including scientific publications, and, contrary to the general view, can stimulate dialogue. Social Media is crucial for the development and management of networks.

Note: While the target group that receives information is big, the target group that is involved in the dialogue is rather small.

At a glance

Information flow 

Target group size 

Attention span 

Budget 

Qualifications 

Project stage any

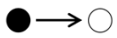
Learn more: Twitter, LinkedIn, Facebook, Instagram and many others

22. Stakeholder-focused On-site Events

Such events include e.g. open days, exhibitions, guided visits and tours, real laboratories, experiments, demos, lab visits, and panel discussions,

What these events have in common is that they take place on site, i.e. at the research location, and are intended to give a wide range of interested people a direct, integrative insight into research and include offers for all ages.

At a glance

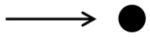
Information flow 

Target group size 

Attention span 

Budget 

Qualifications 

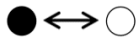
Project stage 

Learn more: Science City (Link), Children's University (e.g. Zurich), Forest laboratory Zurich (Waldlabor) with guided tours and experiments (Link)

23. Story wall

The story wall is a story-based, qualitative method for retrospectively assembling crucial events in a collective process. It allows different actors to look at how they have perceived a joint process. It uses storytelling to collect the individual perspectives and to create a joint understanding of the past. It can be applied at the end of the project or also years later.
The starting point is a simple timeline (horizontal axis) on an empty poster. The assembled group of participants agrees on and marks major process phases or crucial events of their joint story and finds a way to exchange on what has been important, for whom and why.

At a glance

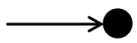
Information flow 

Target group size 

Attention span 

Budget 

Qualifications 

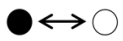
Project stage 

Learn more: **Story wall** at "td-net" (Link)

24. TEDx Powerhouse

A TEDxTalk is a showcase for speakers presenting great ideas in a well-prepared 12-min. presentation. The talks are given in the frame of a one-day, rather glamorous event with a mixed audience. All talks are professionally recorded and available online. Since a few years, TEDxTalks are organized at the SRF Studios Zurich and other places in Switzerland. The event hosts a market place and is enriched with several performances. Each year, the event has a new theme. Speakers as well as members of the audience need to apply and are selected on a highly competitive basis. A smaller alternative is the TEDxSaloon, a licensed TEDx event.

At a glance

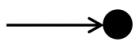
Information flow 

Target group size 

Attention span 

Budget 

Qualifications 

Project stage 

Learn more: TEDxZurich (Link) or "Augmented creativity" by Bob Summers 2016 (Link)

25. Ten steps to render research societally relevant

The "10 steps" stand for a systematic procedure for thinking through ways to better link research to societal problem solving. The approach addresses transdisciplinarity experts and researchers who want to think about how to best align their research projects with the requirements of transdisciplinarity. Ten questions guide discussions around specific research issues, identify and review the societal problems addressed, identify relevant actors and disciplines, and clarify the purpose and form of the interaction with them. The time requirement is about 1-2 days (see Figure 11).

At a glance

Information flow

Target group size

Attention span

Budget

Qualifications

Project stage

Learn more: ETHZ Sustainability Summer/Winter Schools (Link); Pohl C. et al. 2018 (Link)

26. Translating knowledge into practice

Research projects often produce valuable results, methods and tools, but at the end of the project neither time nor money remains for dissemination. Some funding schemes target at this gap and allow a systematic evaluation of research results to extract those elements and messages that are valuable for a specific community of practitioners or policy makers. This activity involves a team of scientists and practitioners over a longer period (months to years) screening a large number of projects for practice-relevant information that is then made available in a database, website or other accessible form.

At a glance

Information flow

Target group size

Attention span

Budget

Qualifications

Project stage

Learn more: Comics "Hot Dry Rock" by Geo-Energie Suisse (Link); EU CAS "mountain TRIP" (Link) and project website (Link).

27. Theory of Change

The Theory of Change (ToC) is a model of a change process including typical project activities and outputs, but also more indirect outcomes and impacts achieved through actors outside the project consortium. As such, it provides a description and explanation of how and why an activity or a set of activities is expected to lead or contribute to a process of change. It can be useful at any stage of a project or program. A ToC model is typically developed in a workshop setting and presented as a narrative, table and/or flow diagram. The participants should include the research project/program management, collaborators, and ideally any key stakeholders. A facilitator moderates the discussion.

At a glance

Information flow

Target group size

Attention span

Budget

Qualifications

Project stage: any

Learn more: ToC at "td-net" (Link); Conceptual Overview (Link); Facilitating Questions (Link), Templates and Bibliography (Link), Toolkit #5 Change (GAIA 25/3: 149 (2016), Nauheimer, H. The Change Management Toolbook (2015) (Link), at ZEWO (Link)

28. Toolbox Dialogue Approach

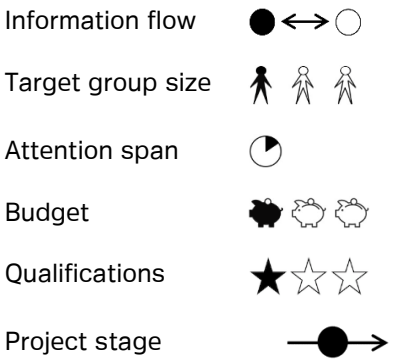
The Toolbox Dialogue Approach is a tool
(i) to reflect disciplinary differences,
(ii) to uncover implicit assumptions and shared understandings of research and practice disciplines, and
(iii) to oppose them to thought styles of other disciplines.

The toolbox dialogue approach consists of a set of questions and statements (the "toolbox") used to trigger dialogue in a workshop format. It helps researchers become aware of their own (disciplinary) thought style and the (disciplinary) thought style of their collaborators.

Note 1: It is helpful to use some prompts to induce discussion as a sequence of a workshop day, so the attention span can be <1 day.

Note 2: The application of the method is relatively simple (little qualification). Designing the discussion in such a way that it is constructive for the future cooperation of the participants, however, requires more moderation skills (basic qualification).

At a glance



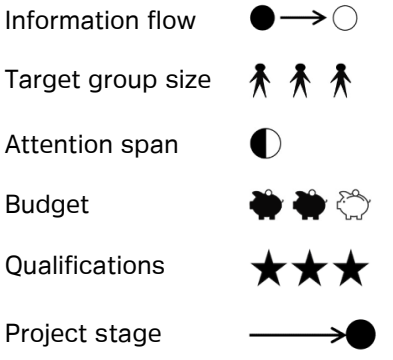
Learn more: Toolbox dialogue approach at "td-net" (Link); Toolbox dialogue initiative at Michigan State University (Link), for more dialogue methods for knowledge synthesis see "Toolkit #3: Dialogue Methods for Knowledge Synthesis" (GAIA 25/1: 7 (2016)

29. User-friendly Evidence Summaries

User-friendly evidence summaries are concise plain-language formats that describe the key messages and considerations of knowledge **for end-users**.

Key elements of evidence summaries are
- Key messages
- Intended audience
- Background
- Summary of Findings
- Levels of Evidence for each included study

At a glance



Learn more: Merkblatt für die Praxis, WSL (Link); Merkblätter Umwelt (Link), Merkblätter Gebäudeenergie EnergieSchweiz (Link), Process guide for Evidence summaries (in health sector)

30. Workplace Exchange (Job rotation)

Workplace exchange is a low resource, high impact tool for workforce exchanges between different professions. While every exchange is based on a similar process (a bilateral, structured and time-limited exchange), each workplace exchange has its own character due to the respective individual task and the overarching work environment in research, business or the public sector. Swapping workplaces can take place within projects, consortia or also in partnerships with stakeholders.

The goals of workplace exchanges are to train flexibility, to expand the internal network, to optimize interdisciplinarity and knowledge transfer.

At a glance

Information flow	●↔○
Target group size	
Attention span	◐
Budget	
Qualifications	★☆☆
Project stage	any

Learn more: Different ways of workplace exchange/job rotation including Software (Tandemploy)

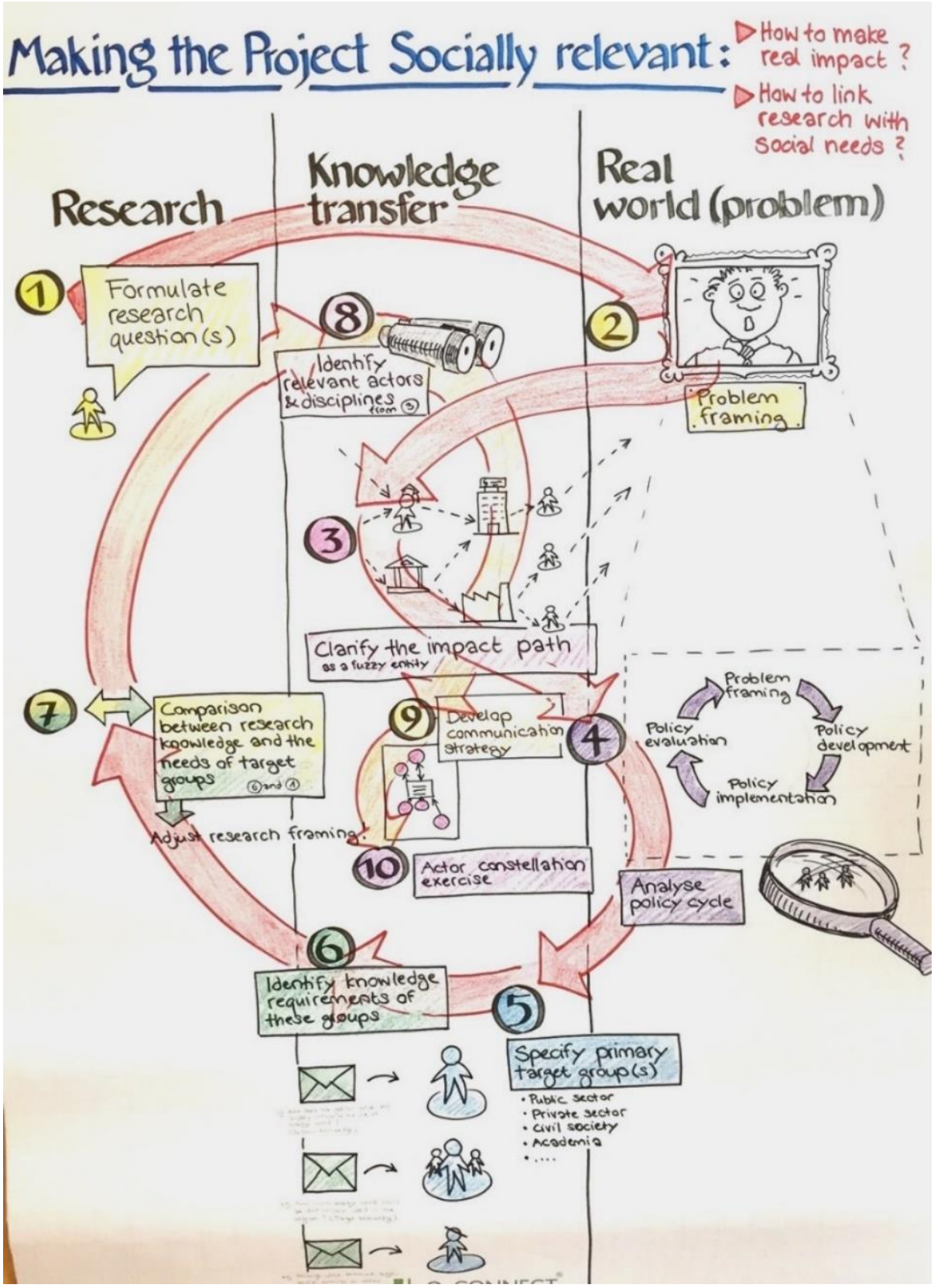


Figure 11: For Ten steps guiding the systematic reflection of research questions with the aim to make them more societally relevant (Illustration by A. Björnsen based on the publication of Pohl et al. 2018).

4.4. Get a quick orientation of the tools

In the three figures below (see Figure 12, Figure 13, and Figure 14) we propose different visualizations to classify the KTT tools along important features. The visualizations repeatedly present the same set of tools in a different fashion. The different layouts shall assist you in identifying the appropriate tool(s) as quickly and clearly as possible. Knowing that there will always be budget and time constraints, it is crucial not only to prioritize the most effective tools, but equally to partner up with the most influential or important groups. Hence, do not skip step 1 in Chapter 4.1 (Use the morphological box for your KTT project)!

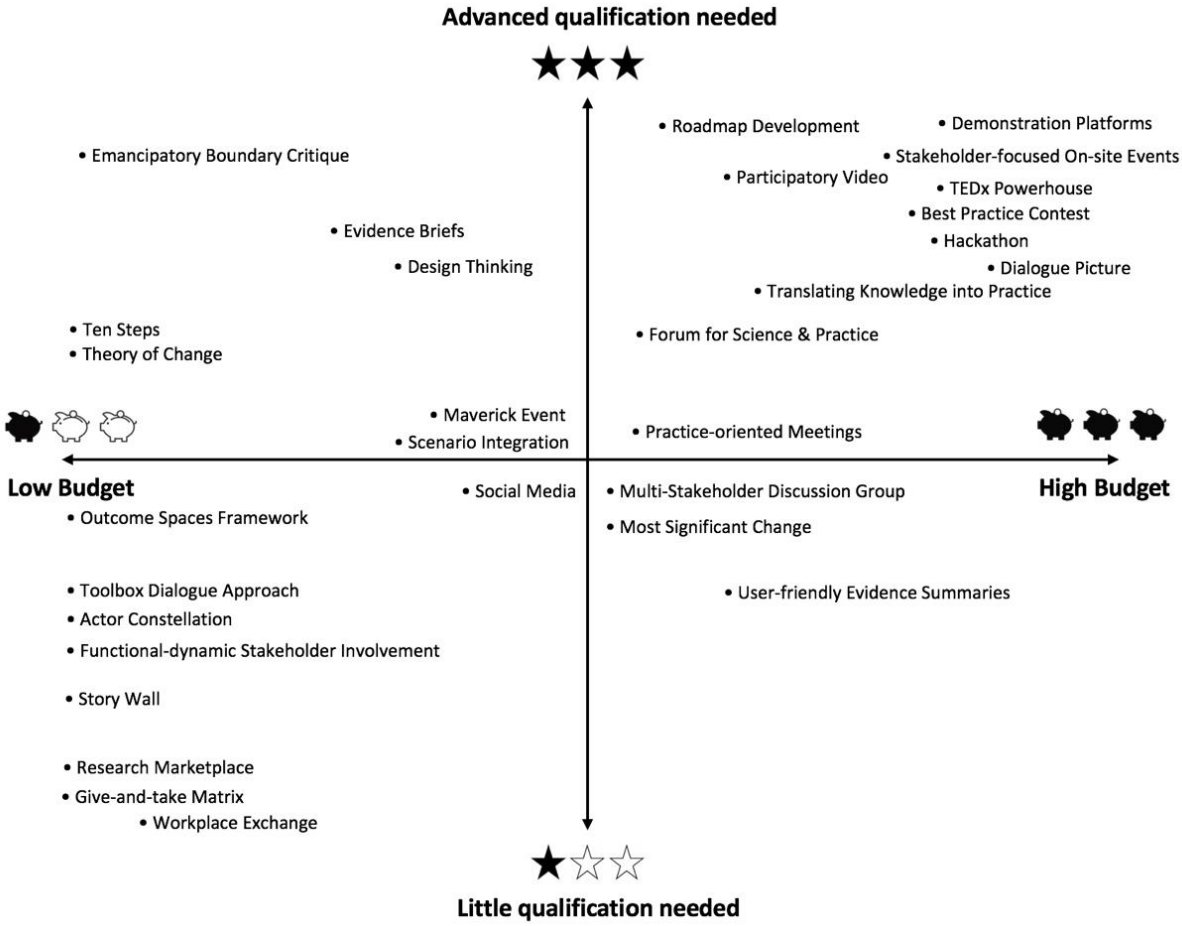


Figure 12: For quick orientation, the tools are visualized along the criteria “qualification” and “budget”.

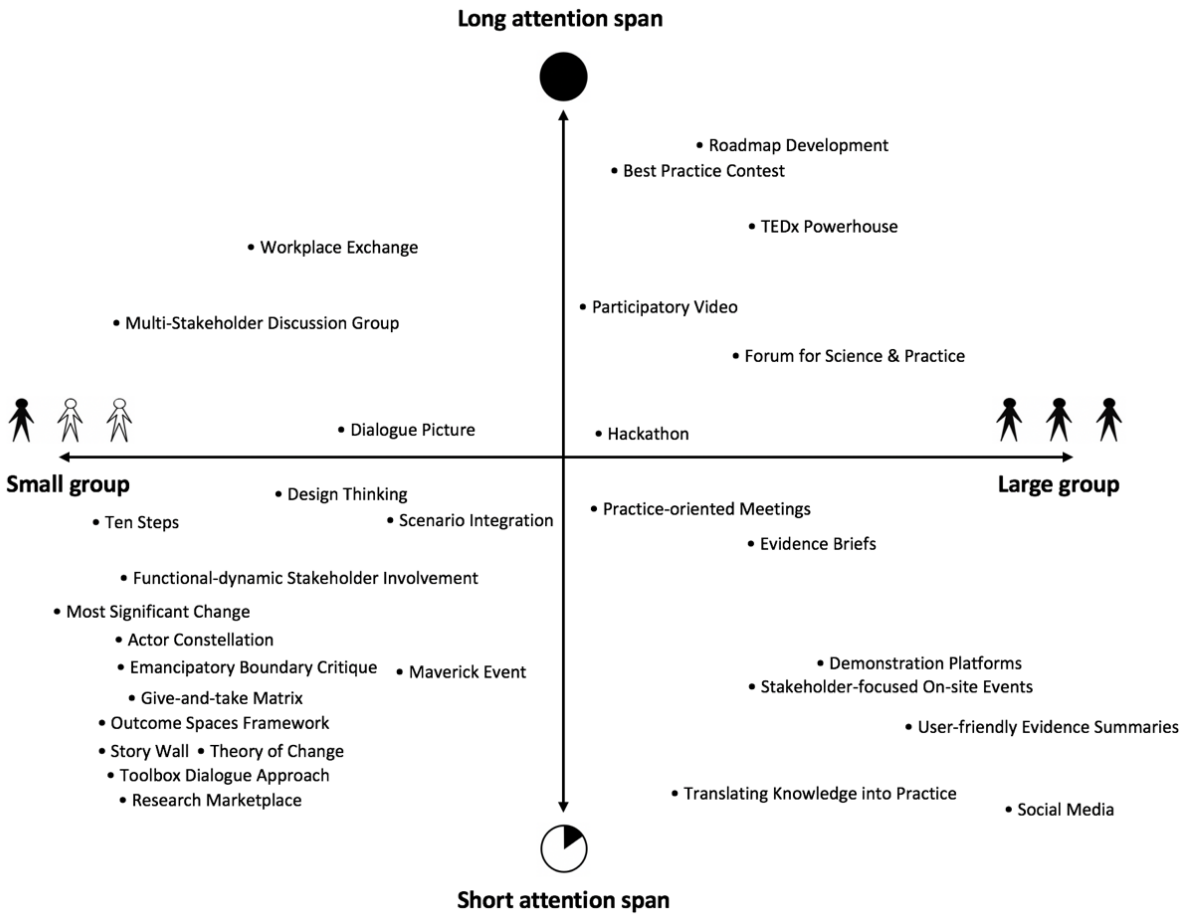


Figure 13: For quick orientation, the tools are visualized along the criteria “attention span” and “target group size”.

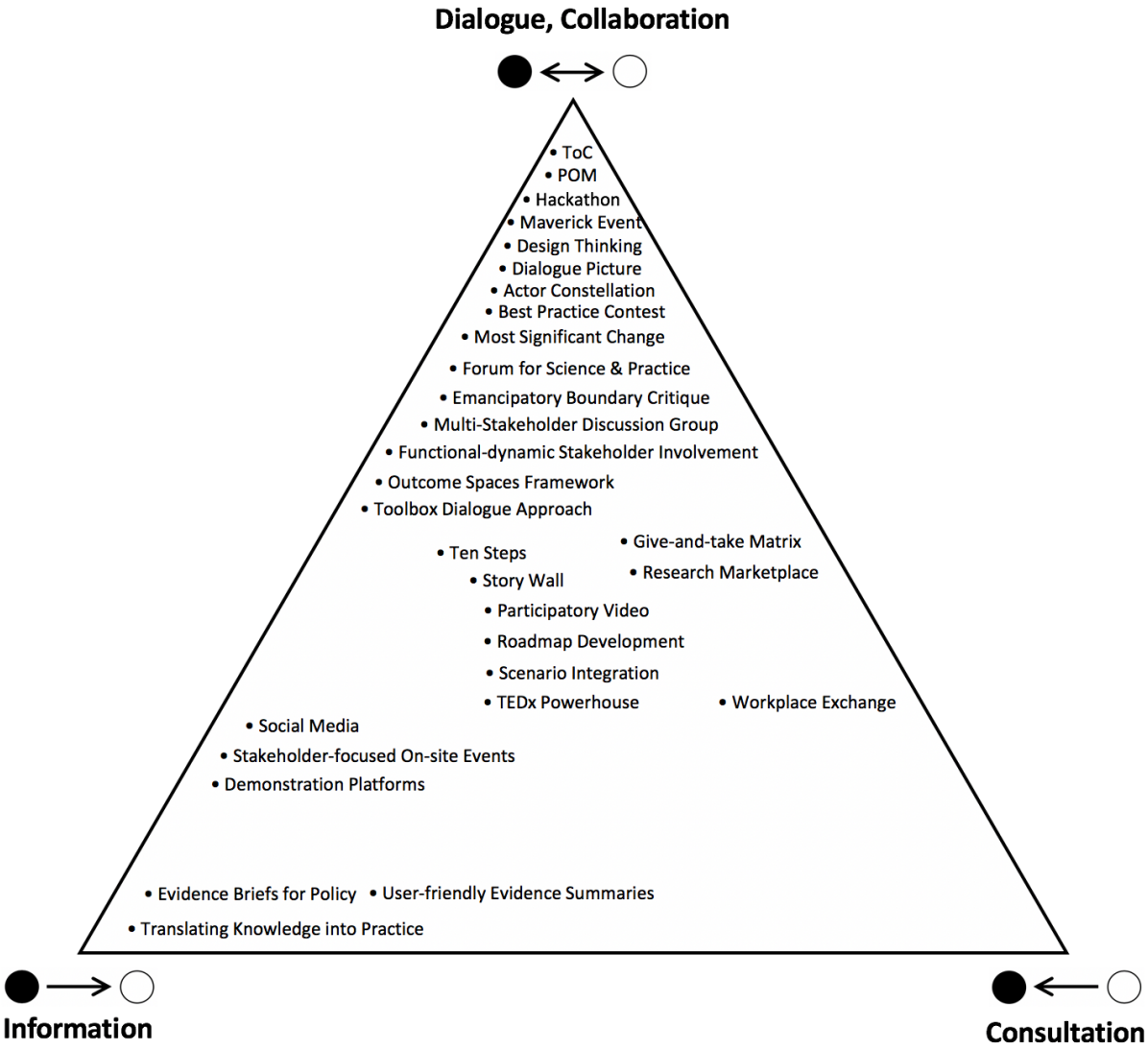


Figure 14: For quick orientation, the tools are visualized along the criteria attention information flow.

The visualization makes clear that numerous tools in the toolbox can be assigned to the category “Dialogue, Collaboration”. These are tools for co-producing knowledge, hence, useful for bringing together different perspectives on a problem, recognizing that not only individuals but also social groups have different ways of thinking about issues” (see GAIA, Toolkits for Transdisciplinarity). These tools are well suited for knowledge and technology transfer, depending on which stakeholders are involved in the dialogue process. They are important for SWEET because co-producing knowledge is often neglected in everyday research. The social and economic processes to be triggered by SWEET research programs - which ultimately strive for an energy transformation - can only be realized through an intensive and continuous dialogue between the various stakeholders.

For this very reason, the “Consultation” corner of the triangle remains relatively empty. Surveys and interviews are the most common tools to elicit information from stakeholders. Although such tools are very important in a science context and can also be relevant for setting up practice-oriented research projects, the toolbox shall promote in the first instance tools going beyond the sole extraction of information.

4.5. Think outside the toolbox

The KTT toolbox presented above displays a limited number of tools. It aims to provide a first entry point for KTT officers to explore better options for collaboration and knowledge integration with reasonable effort. The morphological box, the tools and the various classification layouts are intended to motivate and support the KTT officers and researchers so that their work becomes more effective and successful. Naturally, the selected 30 tools do not represent the full range of possibilities. The collection is work in progress and can be expanded by the users.

Many "established" tools have not been included in the toolbox, primarily, as they are well known and widely applied in everyday research:

- Further research, PhD, Postdoc, etc.
- Annual conferences and scientific workshops
- Key notes, lectures, participation in panels
- Conference papers
- Scientific publications, conference papers
- Practice-oriented articles in magazines, newspapers
- Press release, media network and contacts
- Project factsheets, brochures, websites
- Newsletters, internal for consortia, external for stakeholders
- White papers
- Interviews
- Videos, blogs

Box 8: My favorite KTT tool(s) is/are ...

... fairs & conferences
... graphics and visuals
... networking
... workshops & discussion groups
... feasibility studies
... the dialog platform
... blog posts
... information exchange, talking to each other!

Source: Spontaneous answers of participants of the 14th KTT Meeting "Go public with failure", 3 Nov 2020.

On the part of industry, SMEs and markets other technology-targeted tools are important. In the following section we describe and discuss some selected technology transfer tools without claiming to be exhaustive:

- TRL Assessment
- Absorption Capacity
- Intellectual Property Rights Protection
- Spin-offs and start-ups

Technology Readiness Level (TRL) assessment is a systematic, metrics-based process that evaluates the maturity of, and the risk associated with critical technologies under development. It is a commonly accepted approach used in a number of industry and government organizations to communicate between technologists and managers. For more information see, for instance, the Penn State TRL Calculator (Link).

What is the *absorption capacity* of an organization? Exploitation of knowledge and new technical abilities is rooted in the ability to absorb these contents and create new products and services. Especially SMEs depending on size and structure show a large variation in the receptivity and processability of inputs coming from partner organizations i.e. research institutions.

The absorption capacity can be assessed looking at four capacities: Acquisition, Assimilation, Transformation, and Exploitation. For more Information see Absorption capacity (Wikipedia Link), Towards a method for measuring Absorptive Capacity in firms (Link), Measurement of absorptive capacity (Link).

Intellectual Property (IP) can be protected so that innovations and creations become a tradeable commodity. IP rights are i) trademark protection, ii) patent protection, iii) design protection, and iv) copyright. Because IP is an important value driver and creates strategic advantages in both national and international markets, it is important to manage intellectual property into a company's strategic process at an early stage. For more Information see ETH transfer (Technology transfer office ETHZ), Technology Transfer Office EPFL, Technology Transfer PSI. Technology Transfer Office Empa, IGE (Institut für Geistiges Eigentum), Intellectual Property. Marketplace for sustainable technology WIPO GREEN by World Intellectual Property Organization (WIPO).

Spin-offs and start-ups are not listed as KTT tools in the above collection. Corresponding references are the established, institutional contact points of ETH Zurich, EPFL, PSI and Empa.

As this report highlights *how* KTT is done rather than *what* has been achieved, the actual results or outcome of the transfer (products, standards, services but also societal activities or policy change) are not subject of this report.

A *Data Management Plan* (DMP) is often mentioned as a specific KTT tool. As we consider a DMP a central element of any SWEET endeavor, we have listed it as a task with high priority in the recommendations for the SFOE. This coincides with the recommendations for the SCCERs (Hammer et al. 2018), where data management plans seem to have hardly been implemented or not at all. A good DMP is clearly structured, e.g. as a table of numbered data types, and uses existing metadata standards to ensure that data are findable. A list of technical metadata standards is available at the Metadata Directory (Link).

Box 9: The best KTT ideas emerge …

… during a walk in the forest
… when jogging and in the evening
… in the shower
… at 4am, in bed
… in spontaneous exchange with colleagues
… in the bathroom, in the shower, on the toilet
… outdoors while walking

Source: Spontaneous answers of participants of the 14th KTT Meeting "Go public with failure", 3 Nov 2020.

5. Conclusion

This report contains a number of very clear recommendations and some more subtle suggestions how to render KTT more effective in Swiss energy research, ultimately aiming at moving the implementation of the Swiss Energy Strategy 2050 forward. To create such impact, i.e. to capitalize on the ample research results of the SCCERs and the new endeavors in the framework of SWEET, this report appeals to energy research actors, in particular scientists and SWEET Program Coordinators, to realign their focus:

Shifting attention from "what?" to "how?". The latter includes also the questions of "when?", "with whom?" and "why?". While the research community is strong in detecting research gaps, in identifying emerging topics or in developing innovative technologies, many scientists are at loss when it comes to fine-tuning research questions to real-world problems or setting up a partnership with stakeholders. Here we need better skills.

Allocating sufficient resources for KTT. This obviously applies to financial resources, but equally to human resources in terms of personnel, smart brains, and time. Trust-building, finding a common language and agreeing on common goals are time-demanding activities. Although they can be supported and made more efficient by selecting the right KTT tools, they still require time. This needs to be planned for.

Reframing the KTT concept. KTT in energy research can do better! The mental walk through the morphological box should equip program and project collaborators with clarity about the KTT needs and opportunities in their respective research fields or projects. Applying them, with or without external help, will yield success - and possibly failures. The latter should be taken as a wonderful learning opportunity.

Transparency, inspiration and fun. With this report the authors aimed at heightening awareness for the potential of KTT in Swiss energy research. By articulating the silent knowledge of the working group "KTT in large energy research programs", the report wants to make this knowledge, now codified or explicit, available to a larger readership to stimulate and facilitate change. Change is needed in both research and the Swiss energy system.

Let's start!

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Build on mutual trust - share information and develop networks - create transparency

Thank you very much for that!

SFOE Experts

The project was accompanied by the following experts at the SFOE:

- Faes, Annina (Project Manager for Knowledge and Technology Transfer)
- Müller, Philippe (Co-Head of Energy Research and Cleantech)
- Castiglioni, Luca (Manager of Mobility Division and Program)
- Maus, Katja (CORE Secretary)
- Rüegg, Nathalie (Specialist SWEET Office)

Active Members of KTT Group

Active Members of the Working Group “KTT in large Energy Research Programs 2015-2020”:

- Biollaz, Serge (SCCER BIOSWEET)
- Fahlbusch, Stefan (SCCER FEEB&D)
- Haselbacher, Andreas (ETH Energy Science Center)
- Hoffmann, Sabine (eawag WINGS)
- Kienast, Pascal (SCCER CREST)
- Kobe, Carmen (SCCER CREST)
- Maag, Simon (Parlamentsdienste Bund)
- Nanzer, Simone (SCCER BIOSWEET)
- Paulsen, Theres (NFP 70/71)
- Romera, Gloria (SCCER Mobility)
- Roth, Jörg (SCCER HaE)
- Sarantakos, Georgios (SCCER FURIES)
- Sulzer, Sabine (SCCER FEEB&D)
- Wieland, Ueli (SCCER SoE)
- Zeifang, Markus (SCCER BIOSWEET)

KTT Workshop Participants

On September 7th, 2020 we conducted a workshop in Brugg to present a first version of the morphological box which was then critically discussed and further elaborated.

- Castiglioni, Luca (Bundesamt für Energie BFE)
- Faes, Annina (Bundesamt für Energie BFE)
- Gabor, Oliver (dot consulting AG)
- Gantenbein, Annina (Energy Science Center ETHZ)
- Gerber, Marc (Innosuisse)
- Hoffmann, Sabine (Eawag)
- Holenstein, Matthias (Stiftung Risiko-Dialog)

- Kienast, Pascal (zhaw)
- Maus, Katja (Bundesamt für Energie BFE)
- Nanzer, Simone (ETH Zürich)
- Plan, Eric (CleantechAlps)
- Queloz, Pierre (Bundesamt für Umwelt BAFU)
- Rothen, Andreas (act/CORE)
- Riedel Riley, Simone (Emerald Technology Ventures)
- Schmitt, Ruth (FHNW)
- Sulzer, Sabine (HSLU)
- Würthner, Christina (KMU Consulting & Investment)

The same participants shared their knowledge and experiences on the topics of "Favorite KTT Tools" (Figure 15) and "KTT dead ends & failures" (Figure 16). Various feedbacks and suggestions have been integrated in this report.

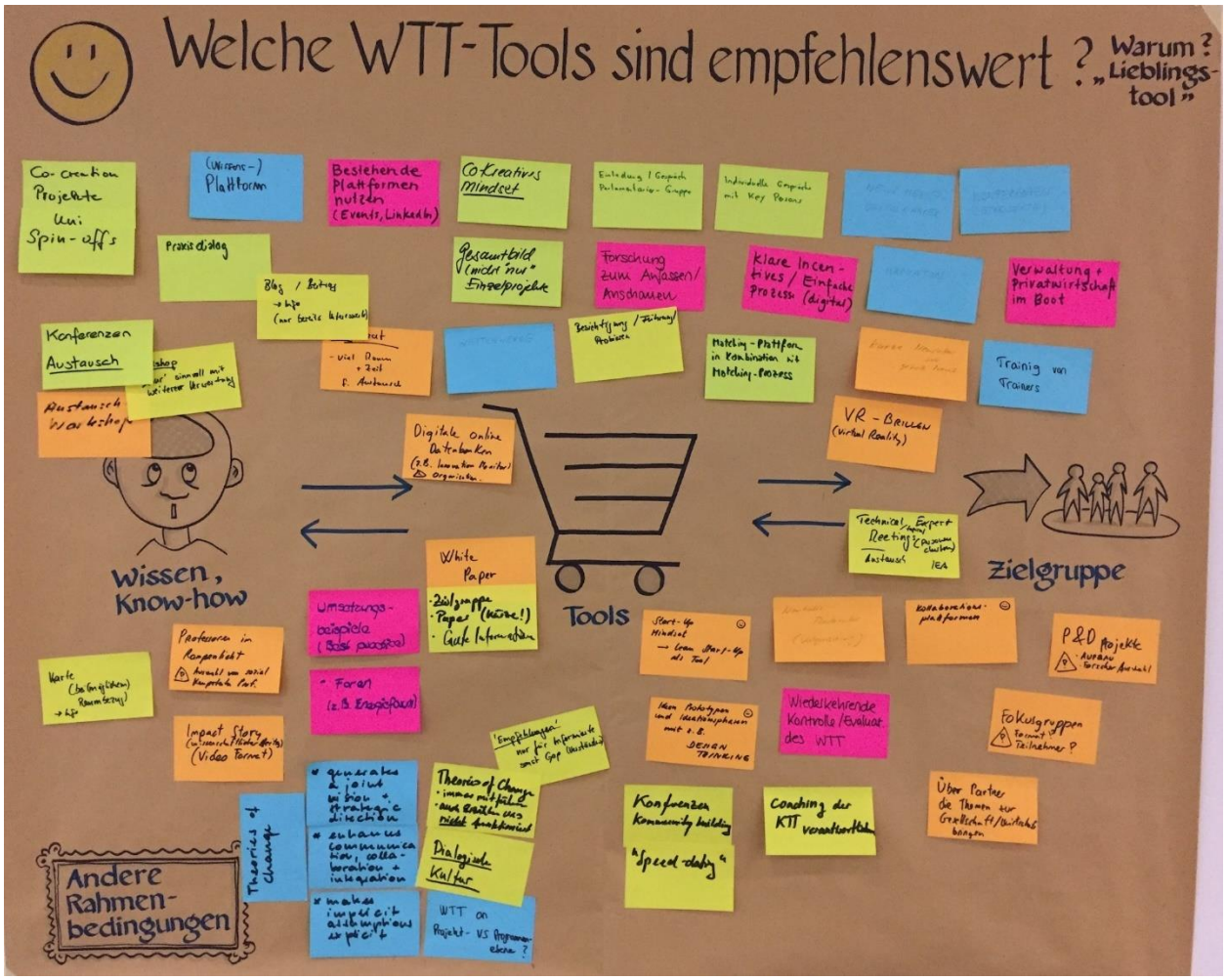

Figure 15: Favorite KTT tools of participants in the KTT Workshop in Brugg, September 7th, 2020.

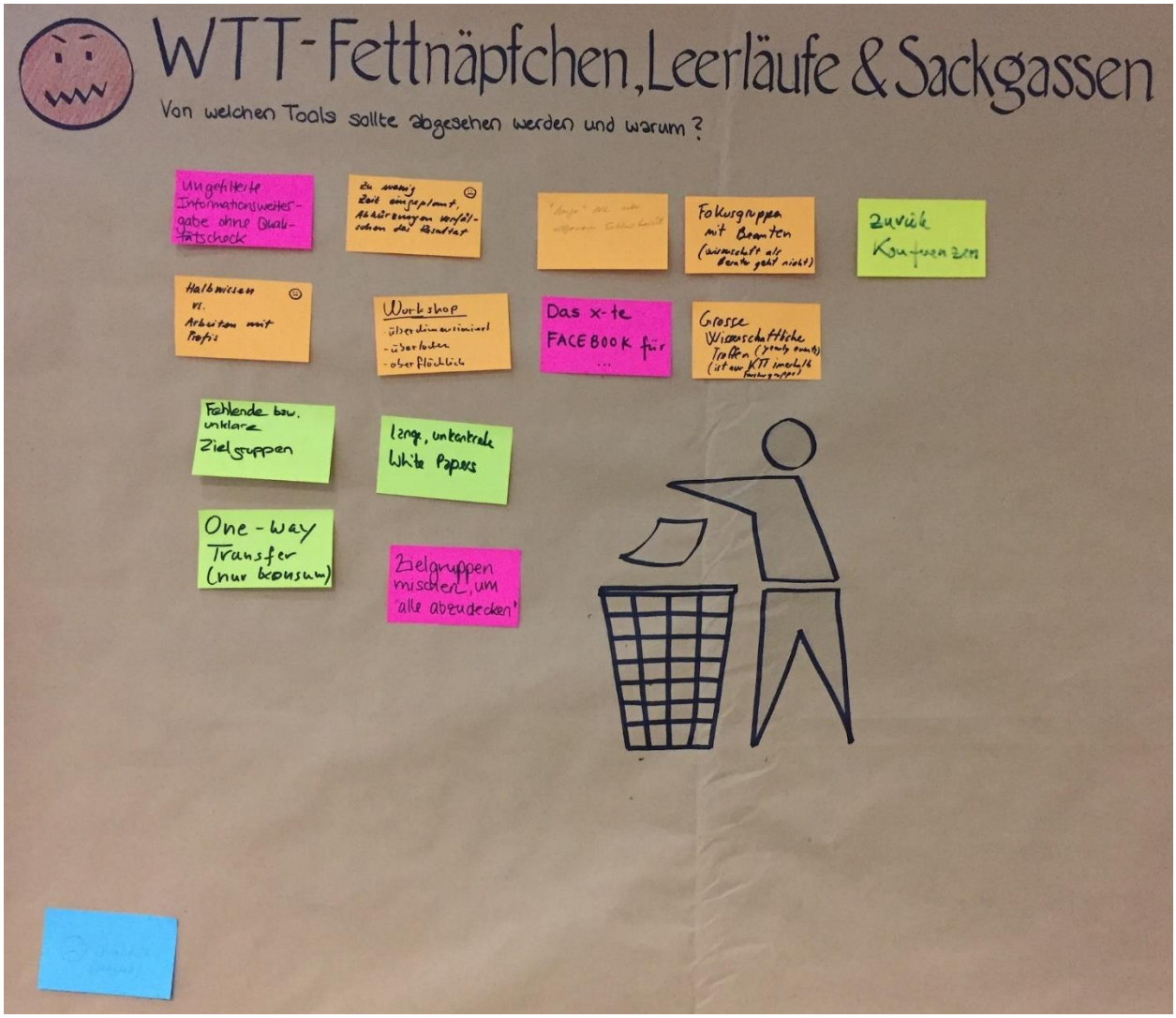

Figure 16: KTT dead ends & failures of Participants in the KTT Workshop in Brugg, September 7th, 2020.

Further Persons

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- Sibylle Studer (td-net)
- Regina Flury von Arx (novatlantis)

Appendix

A. The KTT Group

Overview of activities and topics of the Group "KTT in large Energy Research Programs 2015-2020":

Date Host	Internal Coordination & Training	External guest speakers
13.1.2015 WSL	**Get to know your KTT peers!** • Who we are? What we do? Typical characteristics of KTT officers.	None
10.3.2015 ETH Zürich	**Departure points and future objectives** • What is our KTT mandate and frame conditions? • How do we implement KTT and how to perform better?	None
31.8.2015 ETH Zürich	**The Swiss Energy Research KTT Landscape I** • Existing KTT networks and institutions and what we can learn from them? • Setting up a KTT learning series for the group: Internal and external resources	**Josef Känzig**: Erfolgsrezepte und Stolpersteine **Katja Maus**: Die Energieforschungskonferenz Schweiz **Esther Koller**: SATW Transferkolleg **Beat Hotz-Hart**: Kommunikation an der Schnittstelle zur Energieforschung
10.11.2015 Eawag	**The Swiss Energy Research KTT Landscape II** • Reflecting the results of the internal survey of KTT-activities • Assessing the Innosuisse NTN tool for KTT • KTT principles and best practices?	**Catherine Kroll**: WTT-Landschaft Schweiz, Best practices und WTT-Prinzipien
5.4.2016 EPFL	**KTT: Insights from the industry** • Current KTT status, plans and achievements	**Arnoud Bifrare**: Expectation of the industry **Laura Erickson**: North-North KTT between US and CH **Fruzsina Homolka**: North-South KTT between CH and DCs
29.9.2016 novatlantis FHNW Brugg	**KTT: Insights from enterprises** • Inputs for the NTN proposal oikos-e	**Manuel Frey**: Bedürfnisse eines Baudienstleisters **Christina Würthner**: WTT aus Sicht eines IT-Unternehmens **Antonios Papaemmanouil**: WTT-Aktivitäten, R&D und Stossrichtungen **Men Wirz**: P&D und Leuchtturmprojekte
28.3.2017 ZHAW	**KTT and Communication** • What is the interface between KTT and communication? • Mid-term self-evaluation: Where to go next?	**Christian Huggenberg**: How to write a good "White paper"? **Manuel Martin**: How to bring research to the media and public? **Franz Lehner**: From applied research to commercialisation

Date Host	Internal Coordination & Training	External guest speakers
24.10.2017 Akademien Schweiz Bern	**Policy Dialog, a blind spot** • Thoughts on our attempts to establish a policy dialogue	**Claudia Appenzeller**: The academies as dialogue partner for science and society **Urs Neu**: Formats of knowledge communication **Ivo Widmer**: Market place for research questions **Karin Ammon**: Climate and energy and policy dialogue: Practical experience
23.3.2018 PSI	**KTT Concepts** • What KTT concepts have been applied in SCCERs, what was new/successful or not, and what was the feedback from Innosuisse?	**John Millard**: Technology Transfer group PSI **Francesco Colonna**: Introducing the Park Innovaare
23.10.2018 eawag	**Connecting KTT to the real world and indicators for success** • Do we do things right and do we do the right things? • Can we measure the performance of KTT officers?	**Christian Pohl**: Ten reflective steps for rendering research societally relevant **Simon Maag**: Indicators for measuring the contributions of individual knowledge brokers
22.3.2019 HSLU	**Energizing TEDxZurich and beyond** • Learning about different TEDx concepts and possible applications in the energy research context • How to render a TED event useful for KTT?	**Peter Morf**: Smart City Flagship project
24.9.2019 Empa	**Making knowledge tangible: Digital and empirical platform** • Follow-up on TEDxEnergy and Smart City Flagship	**Andreas Haselbacher**: Renewable management and real-time control platform ReMaP **Rainer Klose**: NEST guided tour **Carina Doll**: WaterHub at NEST
23.4.2020 Hightech Zentrum Aargau (digital)	**KTT SWEET and Future of the Working Group** • Joint KTT activities or interests towards the end of the SCCERs? • Future of the KTT group and how to capitalize on the experience and material collected?	**Annina Faes**: SFOE Update on KTT & SWEET
3.11.2020 Zoom	**Go public with failure!** A mental walk covering our “biggest failures” along 3 questions: • Which activities required high inputs while returns where low? • Which tools did not deliver the expected results? • What did not work and why?	None

Table 2: The KTT Group: overview of activities and topics 2015-2020

B. Quick guide for a KTT concept

What content must a KTT concept have? This of course depends on the specific framework conditions of the project or consortium and in particular on the goals. Nevertheless, a quick guide, inspired by several sources found in the bibliography and adapted for this report, may help to define the right content. A convincing KTT concept should address the following areas of activity:

1. Project achievements
The proposal explains the concept and goals intended to achieve within the consortia/projects.
• Focus on the effectiveness of the proposed measures • Ensure to build a sound intellectual property management • Reveal the results' exploitation strategy • Show the concrete measures to enhance the integration of new knowledge and the innovation capacity • Display how to assure in general the innovation potential of the project

2. Linked plans and measures
Comprehensive proposal plans for communication, dissemination and exploitation are linked.
• Show the link between the proposed plans and especially between the measures • Show the expected impact of the project • Recover measures to be implemented both during and after the project • Address potential end-users and uses of the results that will be generated

3. Iterative plans
The proposal plans for communication as well as for dissemination and exploitation are not the final ones. Therefore, having separate deliverables for communication plan, dissemination plan and exploitation plan is a recommended good practice.
• Update the plans according to the progress and emerging results of the projects • Consider changes in the stakeholders, work context and potential use of results during the project lifetime • Report on the updates periodically1 during the project implementation

4. Plan for dissemination and exploitation (PDE)
The draft plan for the dissemination and exploitation of the consortium's results must formally contain the three work packages communication, dissemination and exploitation.
• Define clear objectives adapted to the relevant target users • Set up a concrete communication, dissemination and exploitation strategy • Set up a concrete protection strategy • Describe the planned project activities

[1] See SWEET Recommendations: Annual monitoring of KTT process & results. Self-evaluation (reporting) based on selected indicators proposed by Simon Maag et al. in 2018

5. Key elements of dissemination and exploitation strategy

At the proposal stage applicants in SWEET are not expected to describe in detail their planned dissemination and exploitation activities, a draft plan (PDE) is sufficient. However, relevant information covering key elements of the exploitation and dissemination strategy should be provided.

- Clarify potential geographical coverage and economic size of the target markets where project results will be exploited and disseminated
- Name potential users
- Specify main competitors and competitive advantages
- Analyze the state of the art and describe the planned developments and differences from existing competing knowledge, products, and services
- Analyze the intellectual property that is needed and will be brought to the project
- Include facts and figures on the planned exploitable results and their areas of application and intellectual property protection
- Specify relevant elements that will allow the evaluation of the project's potential impact
- Describe the exploitation roadmap and business model (e.g. proof of concept, prototyping, demonstration of cost effectiveness, standardization issues, potential regulatory, safety barriers and how to overcome them)
- Give a timeline of the planned dissemination and exploitation activities

6. Forms of protection

Any tangible or intangible output could be generated under the SWEET consortia/projects.

- Clarify the form or nature of the output like data, knowledge, or information
- Clarify whether the output can be protected or not
- Clarify whether the likely protected outputs are industrial and intellectual property rights (e.g. patents, trade marks, design rights, copyright)
- Clarify whether business information or valuable know-how can be protected via contractual mechanisms (e.g. non-disclosure agreements or trade secret)
- Clarify questions on the ownership of results especially in multi-beneficiary projects
- Address IP issues in detail within the Consortium Agreement

7. Management structures and procedures

Communication, dissemination and exploitation strategies are part of the management structures, procedures and responsibilities.

- Submit a clear description of the planned management structures and procedures (including governance, policies, systems, structures, operational processes, and risk management)
- Define who will be involved in the exploitation and dissemination activities
- Outline how the exploitation and dissemination activities will be managed

8. Periodic and final reports

The SWEET proposals include - as a criteria for admissibility - a draft plan for dissemination and exploitation (PDE) as well as a plan for communication activities. It is self-evident, that these plans do not have a fixed content. Indeed, they evolve and become more precise and substantial during the lifespan of the consortia/projects, reflecting the steps undertaken to communicate, disseminate, exploit and protect the generated results.

• Include updated or confirmed plans in both the periodic and final reports • Explain how achieved results have already been communicated, disseminated, exploited and protected • Record activities of communication, dissemination, exploitation, and protection that are still planned • Summarize the project's conclusions and its socio-economic impact

Table 3: KTT Concept: areas of activity

C. The morphological box

Typology of KTT Tools

	Categories	Variables						
Frame conditions	**Stage of project/program implementation**	Concept development	Project planning	Implementation	Mid-term evaluation	Final project phase	Dissemination, outreach	Post-project evaluation
	Level of readiness knowledge / technology	Basic research	Applied research	Pilot project	Demonstration project	Lighthouse project	Scaling up	(Market) Implementation
	Degree of disciplinarity	Single	Multi	Inter	Trans			
Target group characteristics	**Direction** of information flow	Information	Consultation	Dialogue, Collaboration				
	Type of external target group	Scientists	Politicians & parties	Authorities	Enterprises	Energy utilities	Consumers & prosumers	Citizens	NGOs	Associations	Education	Not yet defined
	Size of target group	Few persons <10	Small group about 20	Medium-size group about 50	Large group about 100	Large group >500	International group <50	International group >50
	Attention span of target group	30 seconds	Minutes	Hours	One day	Several days	Months	Years
Resources	**Average annual budget** allocated for KTT (CHF)	None	~ 500.-	~ 5'000.-	~ 50'000.-	~ 100'000.-	~ 0.5 Mio	Not yet defined
	Institutional settings Framework for KTT activities	Few persons <5	Small team about 20	Department, unit about 50	Institution 500-1000	Consortium e.g. SCCER	Several consortia	International consortia
	Human resources available for KTT	None	0.1-0.2 FTE	0.3-0.8 FTE	0.9-1.0 FTE	>1-5 FTE	>5 FTE	
	Qualifications & skills required for KTT	No qualification	Basics	Advanced	Expert			
	Knowledge exchange	Defining problem	Generating new knowledge	Assessing new knowledge	Disseminating new knowledge	Using new knowledge		

Figure 17: Typology of KTT tools in the style of the morphological toolbox (landscape format)

D. Project classifications with the morphological box

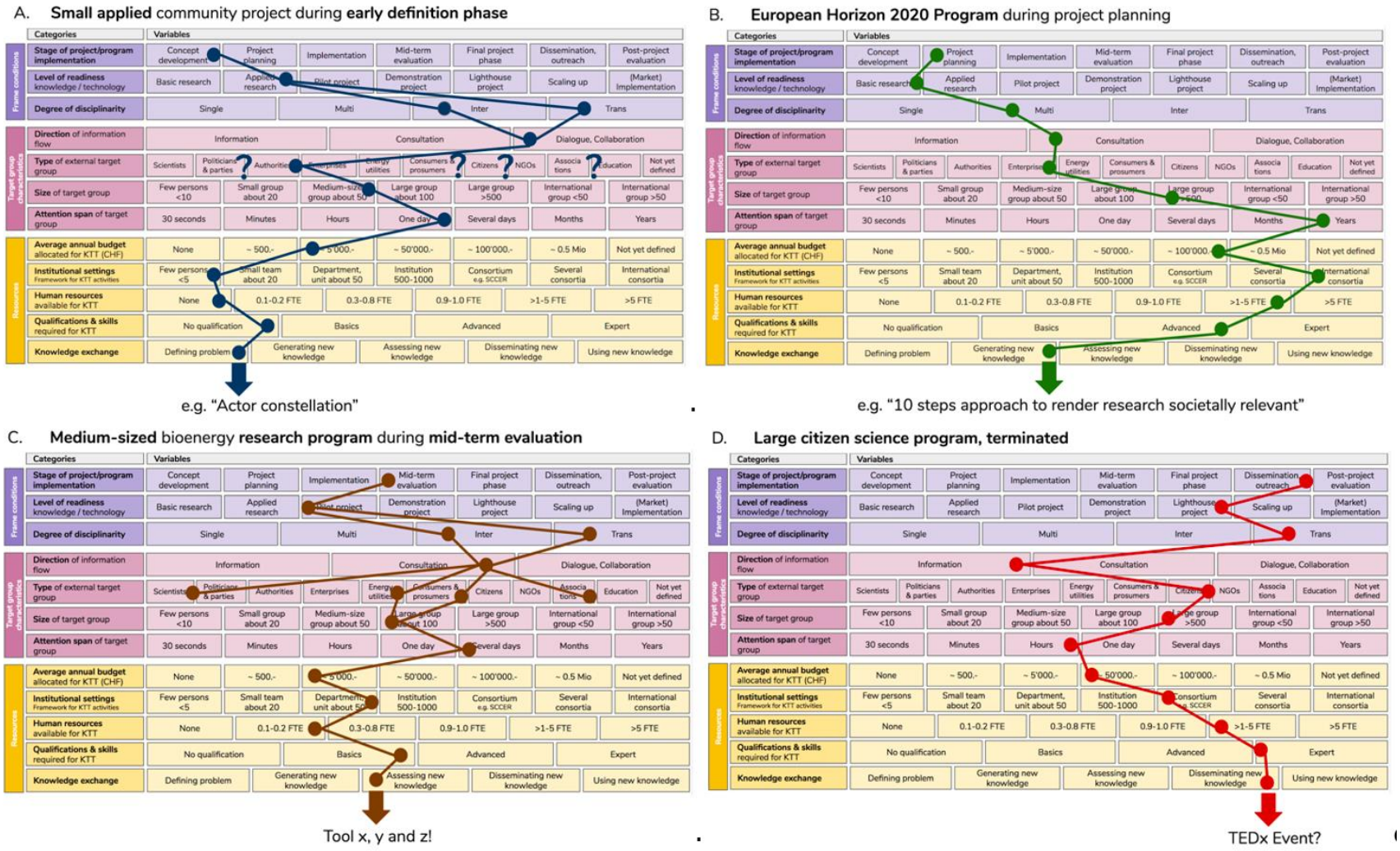

Figure 18: Example of 4 different project classifications with the help of the morphological box (landscape format)