Social Innovation as Valuation and Outcome Category of SNSF-funded Research

Report

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Social Innovation as Valuation and Outcome Category of SNSF-funded Research

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1) EXECUTIVE SUMMARY

The Swiss National Science Foundation (SNSF) asked for proposals to explore potential impact of research funded by the SNSF beyond purely scientific dimensions. In response, this study placed the concept of social innovation as an analytical starting point to trace contributions to social impact from SNSF-funded projects at the centre.

Social innovation is defined *as a new combination or figuration of practices in areas of social action, prompted by certain actors or constellations of actors with the goal of better coping with needs and problems than is possible by using existing practices. An innovation is therefore social to the extent that it varies social action and is socially accepted and diffused in society.*[1]

The study's empirical focus was on the (social) purpose orientation of the SNSF funded projects, and the extent of the Principal Investigators' (PIs') intention to contribute to the development of better solutions to (social) problems. It also assessed the degree to which the generated findings and results are applied in non-academic practice and eventually leading to possible changes in social practices.

Empirically, the study built on two methodological pillars: first, a sample of 1000 projects concluded between 2015 and 2019 was drawn together with the SNSF and Principal Investigators (PIs) were invited to a survey. 361 PIs responded. Second, interviews with 47 PIs of SNSF-funded projects and with nine of their practice partners were conducted in winter 2021/2022.

To put key findings right up front: SNSF projects follow very different impact pathways, including contributions to social innovations. We identified numerous links in SNSF-funded projects to both the generation of social impact in general and the development of social innovation in particular. We could trace these links through the motivations of PIs, the research objectives and designs and the diverse transdisciplinary practices employed. We found evidence for the intentional pursuit of PIs to create outcomes beyond scientific impact, some of which are quite clearly aimed at improving the human condition and social welfare.

In order to first assess the applicability of our approach, we checked whether the PIs had a basic understanding of the concept of social innovation. 16 % of the PIs claimed to have a good or very good understanding of social innovation and 22 % indicated at least a basic idea. Of those respondents with at least average understanding (5 or higher on a 0-10 scale), almost half of them indicated that the contribution of their projects to social innovation was high to very high. Taken together, this is as much as 14 % of the total sample! While this may not seem high at first glance, it is a quite robust indication for a social impact dimension that focuses on the change of practices that should not be ignored.

Unsurprisingly, social innovation is primarily an impact category of the Social Sciences and Humanities (SSH) and the conceptual understanding of social innovation is highest there. Yet, it is not limited to this scientific domain, with some PIs of projects from the Life Sciences (LS) and Science, Technology, Engineering and Mathematics (STEM) also assessing their contribution to social innovation as high or very high. The study also confirms the claim often made in the literature on social innovation and so-called productive interactions, that transdisciplinary research is an important approach for research aimed at achieving social impacts and especially social innovations. Transdisciplinary research is defined as a research process that includes non-academic knowledge embedded in non-academic actors in a consultative, contributory, cooperative or co-creating way.

Transdisciplinary research is lived practice in many SNSF projects, especially in the SSH and the Life Sciences, as is interdisciplinary cooperation. 48 % of the survey respondents indicated

[1] http://www.si-drive.eu/; accessed on 12 November 2020.

a high to very high transdisciplinary research experience and another 26 % fed back a moderate experience. Still, it must be noted that the involvement of non-academic groups in the projects was predominantly of a consultative or contributory nature, while collaborative or even co-creation engagement approaches were significantly less frequent.

During the proposal phase of the surveyed projects, the most important advantages of including non-academic actors relate to the development of the project idea, the refinement of the proposal, the access to "insider knowledge" from a certain field of practice, and the establishment of contacts, which were perceived as important for project execution. During the implementation phase, the contribution of non-academic actors in data collection, in adaptation of the research design, in provision of resources, and in provision of field access were perceived as most advantageous by the PIs. Finally, during the exploitation phase, the feedback of non-academic actors on achieved project results, discussions and dialogue with them, sometimes even co-authoring, and their contributions to dissemination were seen by the interviewed PIs as main advantages of their involvement.

While being an important pathway to social innovation, transdisciplinary research was also considered challenging. Managing expectations was experienced as demanding by the PIs, since expectations often differed between the researchers and the practice partners. Especially practice partners expecting applicable solutions were partially disappointed. Moreover, tangible changes of social practices in the field could rarely be piloted within the analysed time frames of the projects. Instead, change was indicated mostly at the level of understanding and awareness-raising, skill development, the enlargement of networks, and at least thinking about possible changes in social practices based on the knowledge gained.

SNSF-funded projects are by no means confined to an "ivory-tower" mentality. On the contrary, they include various non-academic actors throughout the different phases of a project to increase their relevance and potential outcome. More than 60% of the surveyed SNSF-funded projects have at least a moderate intention to create benefits outside of academia. A quarter of all surveyed PIs deliberately designed their projects to a major extent in a way to generate an immediate and intended benefit for either the general population or a specific non-academic target group.

45 % of all survey respondents indicated a high to very high motivation to improve the human condition/welfare already at the design stage of their projects. The motivation to improve the human condition correlates significantly with the capacity of transdisciplinary research experience. This high level of motivation to improve human condition/welfare shows that SNSF projects, although predominantly committed to do fundamental research, are not one-dimensionally motivated by scientific intentions only, but have the motivational potential to contribute to innovation and change more directly, including social innovation.

The intended social purpose expressed by the PIs is achieved through several pathways. Mostly, PIs aim to better understand a research phenomenon, followed by the aim to prevent certain situations or circumstances (often related to illnesses), and to improve a specific practice or situation. A third of all PIs, who explicitly targeted a defined social group, even aimed to contribute to changes in attitude or behaviour, i.e. action-oriented change categories. 18% of the PIs indicated that their targeted groups have gained capabilities to tackle similar existing or upcoming issues and around 7 % of the PIs claimed that their SNSF-funded projects contributed highly to an emancipatory impact/role for the target groups or the mitigation of a social issue. All these claims indicate an orientation toward social innovation.

A quite high proportion of survey respondents (18%) also stated that the level of contributions from their SNSF-funded projects to new or better services, products or processes was high or very high. Many of these respondents argued with a potential benefit for policy-makers, public administration or governmental agencies. Some indicated also high levels of benefit for welfare and educational institutions or for businesses. 17 % of the surveyed PIs confirmed at least a

moderate uptake of project results by policy-makers, mostly in how policies or related measures are designed and implemented.

The SNSF's first duty is supporting basic research. Innovation, whether technical-economic or social, is usually not a directly observable result of such research. Hence, social innovations as ready-made cases, tested during the projects and then directly applied in practice, are rare. We were only able to distil a handful of examples from the interviews. Rather, we found that PIs are engaged in a wide range of research efforts to contribute to social (as well as technical, environmental and economic) developments through a better understanding of complex issues. In addition, many projects explicitly address also social problems and some projects even make numerous efforts to contribute to improvements in practice. Finally, the interviewed PIs mentioned several points to support the creation of social impact in SNSF-funded projects, which were distilled into five core recommendations laid out in Chapter 7.

2) BACKGROUND, STUDY DESIGN AND METHODOLOGY

2.1 Rational and background of this study

The motivation of the Swiss National Science Foundation (SNSF), who commissioned this study, was to explore potential impact dimensions of research funded by SNSF beyond pure scientific ones. By placing the concept of social innovation at the centre of this study, we aimed in particular to identify and analyse relevant conditions processes of knowledge creation within research projects that tend to contribute to social impact.

The research policy debate on social innovation has gained in importance over the past 15-20 years. In this period, social innovation as a transversal topic seems to have increasingly moved from the margins of research closer to the centre although national research funding still lags behind this development[2]. However, the published findings are still inconclusive and, above all, there is a lack of larger empirical studies investigating the nexus between scientific research and contributions to social innovation[3]. In particular, the question of 'how much social innovation is triggered or influenced by research projects' has hardly been robustly empirically investigated up to now, although in theory, contributions to social innovation can be one of several impact dimensions of research (Bornstein et al., 2014). The reasons for this deficiency lie, on the one hand, in the obvious vagueness and epistemological fuzziness of the term "social innovation" (Schuch and Šalamon, 2021; Cunha and Benneworth 2013; Pol and Ville, 2008) and, on the other hand, in the difficult access to a sufficiently large empirical database of either social innovation research projects or social innovation cases.

Furthermore, there are also findings indicating that research has so far paid quite little attention to the development of social innovation, particularly in terms of empirical productive interactions (Howaldt, 2019; Schuch, 2019; Brundenius, 2017; Cunha and Benneworth, 2013).

We also face a measurement problem in measuring the impact of social innovation in general (Lee et al. 2021; Mildenberger, Schimpf and Streicher, 2020; Costa and Pesci, 2016; Antadze and Westley, 2012; Mulgan, 2010) and in tracing the contribution of scientific research to social innovation in particular (Streicher et al., 2021; Moulaert et al., 2017). Conceptual and epistemological uncertainties are great and, as a result, we still know little about the relationship between the work of research communities and the topic of social innovation.

Our aim was to use this project to develop a better understanding of how, if at all, social innovation is taken-up and approached by (basic) research. The underlying assumption was that social innovation as an anticipated impact dimension of some scholars funded by SNSF is already manifest.

Our specific research objectives were

*First***,** to identify scope, scale and limitations of SNSF-funded projects contributing to the development of social innovation

*Second***,** to assess the extent of productive interactions within SNSF-funded projects with non-academic stakeholders and/or beneficiaries and their operational limits, and

[2] A remarkable exception at national level is Germany. There social innovation was included in Germany's high tech-strategy and several programmes were initiated respectively enlarged to fund social innovation generation with support of research (Edler, Ostertag, Schuler, forthcoming; Deutsche Bundesregierung, 2021a, Deutsche Bundesregierung, 2021b; BMBF, 2021; BMBF, 2020, Hassel et al. 2019). Social innovation as an object of study was taken up in the EU's 7th Framework Programme for Research, Technology and Development and since then included in many calls as potential pathway to generate social impact (Fougèrge, Segercrantz, Seek, 2017; Kropp, 2017).

[33] A notable exception, for example, is the SI-DRIVE project funded by the European Commission in FP7: https://www.si-drive.eu/; accessed on 26. June 2022.

*Third***,** to critical reflect and structure the value of social innovation for generating social impact through SNSF-funded research.

With our approach, we referred to the second research question *("national and international exchange of knowledge"*) stipulated by SNSF in its *"Invitation to Submit Study Drafts: Analyzing the "Value of SNSF-funded research"* from 6th October 2020. One of our central starting points was that knowledge gains resulting from research are a product of constant and dynamic exchange between researchers and other stakeholders involving a multitude of iterative and incremental steps, which are not done in isolation, but build on or are influenced by past or parallel contributions. We also wanted to provide an answer to the question asked by SNSF to *what extent and how do SNSF-funded researchers facilitate access to and development of new knowledge through knowledge exchange*, with a particular emphasis on exchanges between the domain of research and non-academic domains. We further aimed to provide an answer to the raised questions *„to what extent and how is knowledge obtained by exchange and encouraged through SNSF funding taken up, utilised and further developed in Swiss academia, business, society, environment or culture? Which kinds of benefits can be observed?"* Thus, we specifically aimed to explore the extent to which interactions with non-academic stakeholders have already found their way into the actual research processes in projects funded by the SNSF, i.e. have not only taken place afterwards - in the sense of an ex-post dissemination of the results. Here, the 'productive interactions' (Spaapen and Drooge, 2011) concept comes into play.

We also took up an implicit aspect that resonated in the first question postulated by the SNSF[4], namely how the interplay between open, hardly restricted research and the demand for social relevance is shaped, and how to understand and characterise the dynamic processes of value creation within academia and beyond. In other words, is the support and freedom offered by SNSF sufficient to achieve the intended research objectives on one hand but also to make meaningful contributions on the pathways to social impact generation? Or is additional support needed (and if so, what kind of support) to contribute to a higher social impact of SNSF-funded research.

2.2 Operationalisation of social innovation

The term "social innovation" is neither new nor undisputed. It can be traced back to the early 19th century (Godin and Schubert, 2021; Godin, 2012). References are made to eminent scholars such as Gabriel Tarde (Howaldt, Kopp and Schwarz, 2015), Karl Polanyi or Joseph Schumpeter (Moulaert et al., 2013), Lester Ward, Albert Wolfe, William Fielding Ogburn, Wilbert Moore and Peter Drucker (Godin and Schubert, 2021), but until today there is no commonly shared understanding of social innovation. Likewise, there are only first attempts of integrating social innovation in a comprehensive innovation policy theorem (Howaldt et al., 2014).

Also the conditions under which social innovations develop, flourish and finally increase their social impact are still far from being crystal-clear (Howald, 2019). Lizuka (2013) argues that the scope of social innovation suffers from a number of conceptual overlaps. Pol and Ville (2008) mentioned that some analysts consider social innovation not more than a buzzword, which would be too vague to be usefully applied to academic scholarship. It needs to be mentioned, however, that Pol and Ville were opposing this dismissive attitude. They themselves provided several inspiring arguments for a meaningful and research-guiding epistemological concept of social innovation. Also Moulaert et al. (2013) argue that the term 'social innovation' is often over-simplistically used as a buzzword by laypersons, but has analytical substance for researching social change in society.

[4] SNSF (2021), Invitation to Submit Study Draft: Analyzing the "Value of SNSF-funded research", p. 2f.

When we speak about social innovation, we explicitly refer to the definition developed by the SI-DRIVE project funded by the EC under FP7. It defines social innovation *as a new combination or figuration of practices in areas of social action, prompted by certain actors or constellations of actors with the goal of better coping with needs and problems than is possible by using existing practices. An innovation is therefore social to the extent that it varies social action and is socially accepted and diffused in society.*[5]

To make this definition less abstract, social innovation can be put in analogy to techno-economic innovation (i.e. the successful introduction of a new technology or product in a certain market segment, which corresponds in the case of social innovation to the successful introduction of a new social practice in society or a part of it). Changed practices can also happen in the domain of research for instance to increase the probability of kick-starting new social practices in the society. These can consist of changed practices of production, changed practices of consumption, changed practices of policy-making, changed practices of cultural expression, changed practices of how society interacts with environment etc. For the generation of social impact through changing practices, many authors assume that transdisciplinary approaches, action research and/or productive interactions with non-academic actors are helpful in this regard (Spaapen and van Drooge, 2011; Kalliomäki, Ruoppila and Airaksinen, 2021).

While this may sound still very abstract, we attempted with this study an operationalisation to trace changed social practices within the research process intended to kick-start in the longer run new social practices in the society (or more likely in segments of it). Thus we did not look at the actual innovations (i.e. the changed practices in society), from which we could maybe investigate any links to upstream research (if there are any), but rather took a downstream view that starts from the research process. However, in doing so, we encountered the problem - as in conventional innovation research - that the result of research is very rarely a concrete innovation, but usually only a building block in a cumulative body of knowledge that could actually or potentially contribute to an innovation in the longer run. Even in transdisciplinary research projects, the output of research usually manifests itself in a scientific article, rarely in a patent, even more rarely in an intermediate product or an immediate (social) application context. Moreover, researchers can hardly, if ever say with certainty what technical-economic innovation or social innovation their research may have contributed to or led to after one, five, ten or twenty years. This has not only to do with the perceptual horizon of researchers and time lags, but also with a profound attribution problem.

The definition of social innovation, which we use in this project has a few important properties that provide epistemological and analytical orientation, which we adopted for the analytical categorisation process for studying the projects funded by SNSF. These properties, taken from Schuch and Šalamon (2021) are summarised in Table 1 and discussed further below in detail.

First of all, the definition aims at changing *social practices* and not per se of producing or using a new technology in an economy context. The expression *"new practices in areas of social action"* sounds presumably vague and 'sociologically' for a definition that struggles for exhaustion, because *"social action"* refers probably to all sorts of human action and interactions (also with the environment and artefacts; see Degelsegger and Kesselring, 2012). The important issue here is that the changed social practice becomes the object of innovation and not a new technology incorporated in a new product or production process.

Secondly, the definition does not include all social practices, but is limiting them to *new* social practices without, however, offering a measurement indication, how 'new' a novelty can be in order to be labelled a 'social innovation'.[6] But like in 'classical' innovation research, most innovations are only relatively new to a specific context or actor and not uniquely new; what is new in a certain context could be a 'normal' practice in another. Absolutely 'new' innovations

[5] http://www.si-drive.eu/; accessed on 12 November 2020. See also Howaldt and Schwarz, 2016, p. 6.
[6] The European Innovation Survey, for example, which is targeting companies, always asks about innovations in the last three years.

might be more exciting than those diffused to new contexts (e.g. new to the firm or new to a specific part of a society), but it is the diffusion which contributes mostly to the overall changes in economy respectively society.

Table 1: Analytical dimensions of the applied social innovation definition

Analytical dimensions	1. Social innovation results in a *changed social practice* (= object of a social innovation).
	2. A social innovation must be *new in a specific context or for a specific actor.*
	3. A social innovation is *developed to fulfil a social purpose* in that sense that it aims to better cope with needs and problems than is possible by using existing practices
	4. Social innovations are *intentionally solution-oriented and prompted by actors or a constellation of actors*. They do not just happen and they are not the same as social change, but they can contribute to it.
	5. A social innovation is more than an idea and must be *put into practice* (i.e. difference between idea, invention and innovation in analogy with techno-economic innovation)

Source: Schuch and Šalamon, 2021.

Thirdly, the definition postulates that social innovations have foremost a *'social purpose'* or in other words (Pol and Ville, 2008) should explicitly refer to some sort of human welfare enhancement. The term *"social purpose",* especially in combination with the *'goal of better coping with needs and problems than is possible by using existing practices'*, might sound irritating or even daunting to many scientists, because of its normative stance. What a social purpose is and what is good or even better depends on many aspects, not at least of interests, power and ideology. As (social) scientists, we are reflexively alerted when we are confronted with normative statements. Critical questioning is what sets us apart. In order to save the honour of the chosen definition, it must be said that - in contrast to some other definitions of social innovation, which postulate the 'good' (i.e. the just cause) almost as a teleological goal – the applied definition does not prescribe a normative postulate. The definition only points to improved solutions or social practices, which of course can also have their downsides, because interests can be very different. What fits nicely to one social group, might be seen as cutback or deterioration by another. In addition, rebound effects of social innovations can occur.

Another problem with the term "social purpose" is that also business innovations rightfully claim to meet a social need or – perhaps more likely - 'a social want'[7]. The often-used argument that the underlying intention (on the one hand an interest in profit generation and on the other hand an interest in satisfying a sometimes difficult to define social need that overall contributes to human welfare enhancement) as the decisive differentiating factor, falls too short in our opinion. This argument is also often used to differentiate social entrepreneurship from 'normal' entrepreneurship. It seems to us more decisive that some social innovations simply do not require any market logic and can life without business and that some businesses are too distant from the pretence of human welfare enhancement. In practice, however, there is numerous overlapping and intersection between the sets of social and business innovation (see also Pol

[7] Businesses often create the 'social wants' themselves through clever marketing and advertising strategies.

and Ville, 2008), which one can consider an epistemological shortcoming, but remains an empirical fact.

Fourthly, social innovations focus on the provision of solutions to improve social practice. Judgments on the value of social scientific research for society vary even among social scientists (Reale et al., 2018). While social sciences and humanities scholarship is often committed to do research for the good of society, the interest of researchers is mostly not oriented towards producing usable results, let alone actual solutions, but rather to raise awareness and influence society to create capabilities of self-understanding in different contexts (Reale et al., 2018; Benneworth, 2015; Nussbaum, 2010).

The intentional *solution-orientation*, however, helps us to isolate the object of social innovation and to distinguish it from 'normal' social practice and social change. As outlined before, the provision of a solution to a certain problem needs to be new in a specific context; otherwise it would not be an innovation. We have to be aware that most innovations are small in the beginning. Many remain small and many are just incremental. Social innovation is not social change. Social innovations can contribute to social change, but social change does not necessarily need social innovation.

Our applied definition of social innovation also calls for *an agent or actor*, who kicks-off and promotes a social innovation and thus contributes to some sort of social change (be it limited or extensive). The presence of an agent helps us not to lump every social phenomenon together. Said definition of social innovation postulates clearly that a social innovation has to be *intentional* and *prompted by certain actors or constellations of actors*. Contrarily, we would talk about social change if the observed changes in society are not directly intentional or at least cannot be traced back to certain agents or if the agent's landscape becomes blurred and unclear, or when the phenomenon already became a dynamic of its own.

The problematic epistemological issue with the important reference to an *actor or a constellation of actors* is, that in theory this can be everybody. While the measurement of techno-economical innovation is usually confined to business (Oslo Manual of the OECD), there is no restrictive indication, who potentially could be an actor for social innovation. This is due to the nature of social innovation, i.e. to change social practices, which can be prompted by NGOs, companies, social entrepreneurs, social groups, public administrations, policy-makers or even researchers. That does not make the operationalisation and measurement of social innovation any easier.

Fifthly, a social innovation must be more than just a brilliant idea; at the very end it has to be *put into practice*. Like any innovation, also a social innovation needs to be accepted and used. Like any innovation to which research findings contribute, they usually manifest themselves (long) after the provision of the research input.

Contrary to techno-economical innovations, which are diffused in businesses or parts of it, social innovations are diffused in society or parts of it (including business). The scale of social acceptability and use may vary from case to case, but this applies to techno-economical innovations too. Some social innovations target only local groups of a few people, while others potentially address hundreds of thousands.

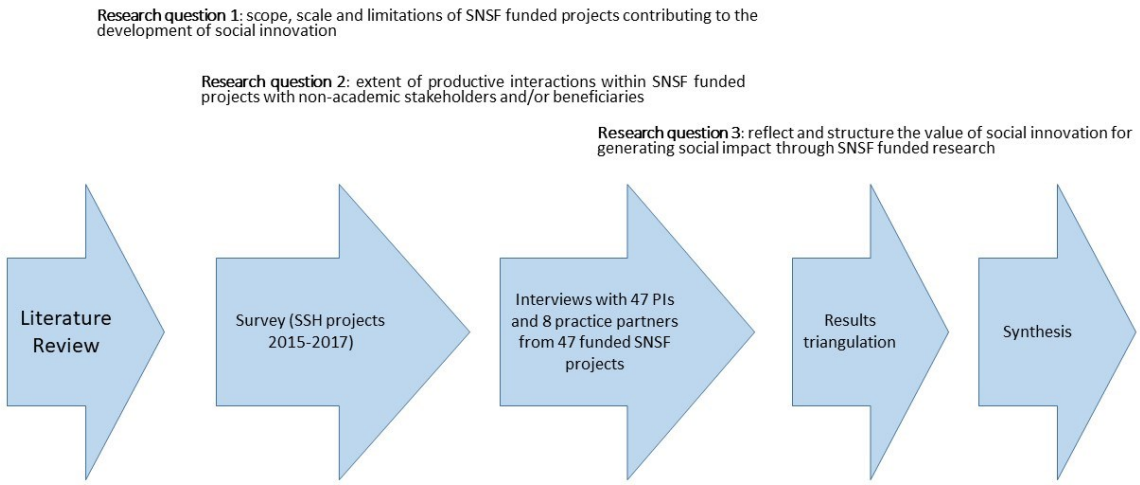
Although there are still epistemological shortcomings and especially problems related to measurement, we have developed a conceptual understanding, which builds on the five building blocks mentioned above, that guides this empirical study.

Since we understand research as an upstream process that might contribute to innovations or not, we are not approaching the contribution of research to social innovation from its end but from its scientific inputs, as shown in the next subchapter.

2.3 Study design and applied methods

Figure 1 provides an overview of the research process. Empirically it consisted of two major steps, namely the launching of a survey to 1000 principal investigators (PIs) of projects funded by the Swiss National Science Foundations (SNSF) during the years 2015-2019 and the conduct of 55 Interviews.

Figure 1: Overview of the research process



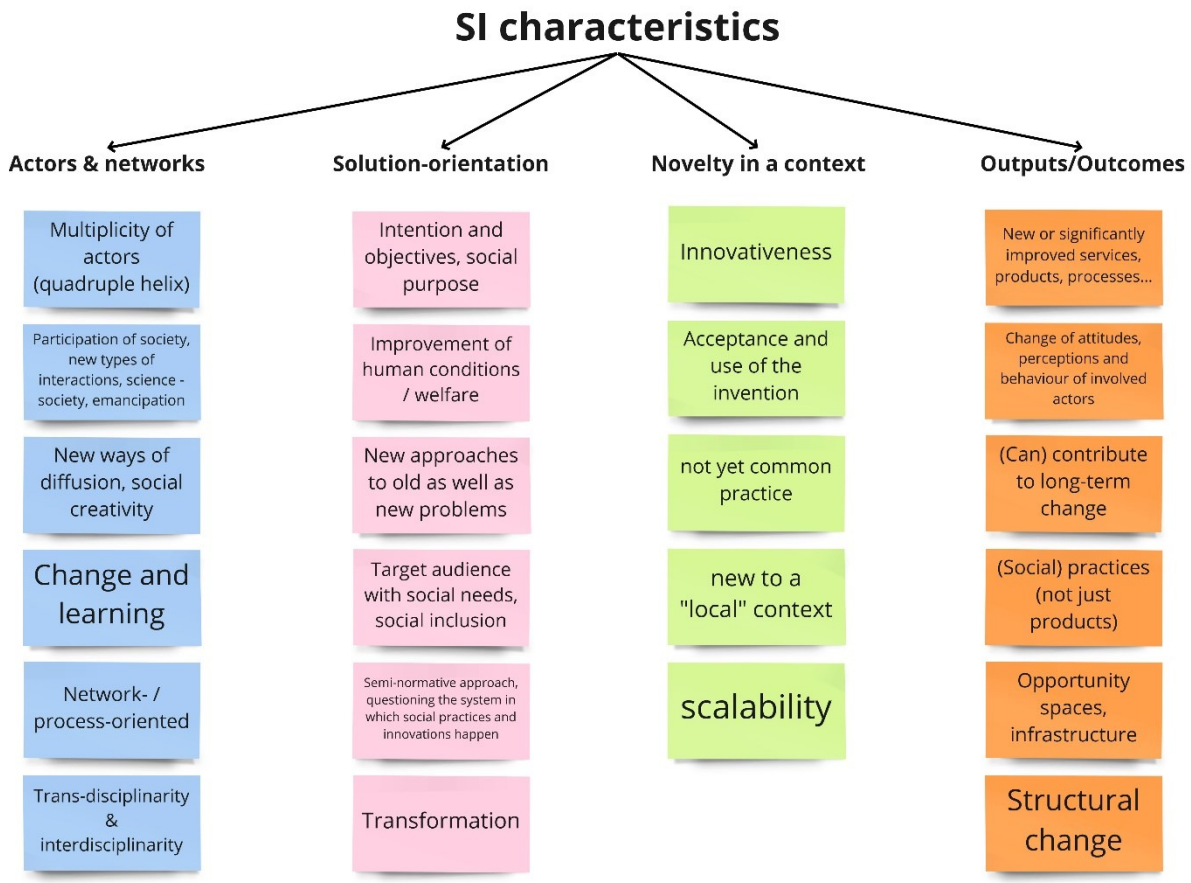
During the project implementation, we have interacted with SNSF at various points to steer the process:

- to kick-off the project (establishment of a common understanding; inclusion of special points that were important to the client)
- to draw the sample (1000 projects funded by the Swiss National Science Foundations (SNSF) during the years 2015 – 2019)
- to discuss the questionnaire
- to present the preliminary findings from the survey
- to inform about the interview guide and to report about the further process
- to disclose initial testimonials for use in SNSF's public relations work
- to discuss the final findings in a workshop with SNSF

The empirical basis for our study were a few hundred randomly selected research projects funded by the Swiss National Science Foundations (SNSF) during the years 2015 - 2019.

Based on the properties of the used SI definition (see Table 1) and the literature on social innovation, several characteristics of SI were distilled in an internal workshop. These were clustered into four main dimensions, although overlaps could not be entirely avoided. These dimensions were "actors & networks", which centres on issues of participation and transdisciplinarity, "solution-orientation", which includes several motivational aspects and aspects of agency, "novelty in a specific context" and "Outputs & Outcomes" at different scale and aggregates (see Figure 2).

Figure 2: Characteristics of social innovation operationalised in the questionnaire



The survey itself was then further structured in the following building blocks

- demographic information about the principal investigators (PIs)
- familiarity with social innovation (SI)
- solution-orientation (intention and agency to contribute to impacts beyond scientific ones)
- actors and networks incl. extent of transdisciplinary engagement
- issues of novelty and regulatory issues
- outcomes and change orientation
- dissemination and exploitation
- closing

To ensure comprehensibility, consistency and a logic structure of the online survey, *a cognitive pre-test* (Prüfer and Rexroth, 2005) was performed with five people from the target population of the survey (i.e. the PIs). The survey was subsequently slightly adapted according to the findings of these cognitive pre-tests. Most important was the identification and subsequent improvement of fuzzy concepts and misleading thought patterns.

The finalised survey was set-up online with the survey tool LimeSurvey. Based on the database of the SNSF, a personalised link to the online survey was sent out to the PIs. This personalised link (token) allowed tracking of who responded while ensuring the anonymity of the answers given by the respondents. To ensure a high response rate two reminders were sent out to those who did not answer yet. The data collected on LimeSurvey was saved on the servers of ZSI ensuring data protection in line with the GDPR (personal data and collected data are saved separately).

It is worthwhile to note that we addressed all three major scientific domains (SSH, life sciences and natural and engineering sciences) approached by SNSF. Although social innovation is a concept that is grounded in the domain of humanities and social sciences (SSH), we deliberately considered that contributions to social innovation can also come from projects anchored in the other scientific domains.

It is important to note, that the respondents were asked to provide information on one of their specific SNSF-funded projects (which was also named in the survey) and not to provide feedback on their research in general.

To ensure a representative sample of projects, the following criteria were taken into consideration:

- *Gender*
- *Scientific domain*
- *Funding instrument*[8]
- *Institution Type*
- *Year of completion*

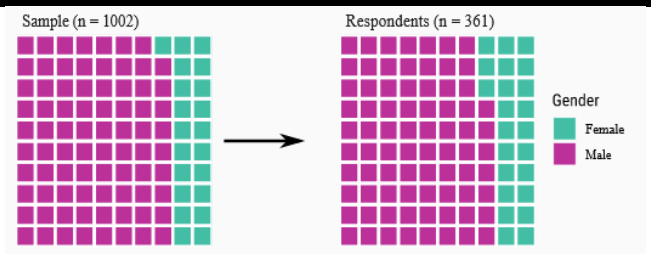
The last item, i. e. the *year of completion*, was not a sampling criterion in the strict sense; its main purpose was to increase the number of insights that can potentially be gained from the surveyed principal investigators. The specific period (2015 to 2019) of the SNSF-funded projects to be scrutinised was jointly determined by the SNSF and the study team, based on the assumption that the sampled projects were recent enough that the interviewees would remember the specifics, but long enough in the past that conclusions regarding potential (non-academic) *project outcomes* can be drawn.

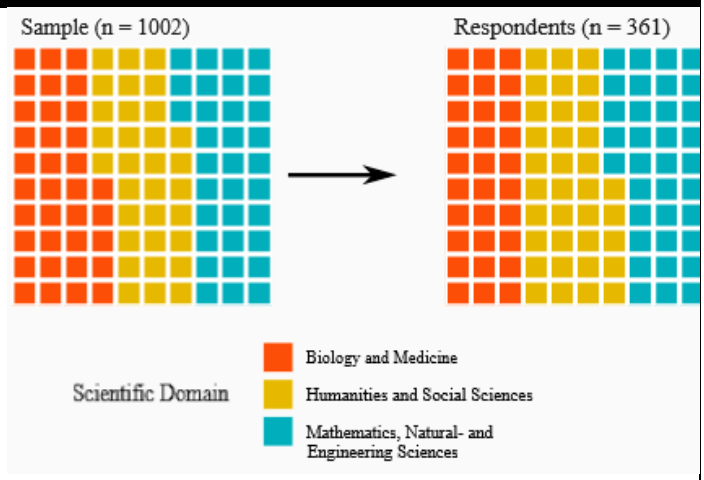
Another joint decision concerned the share of sampled projects per SNSF Instrument. It was deemed an acceptable compromise to have a slight over-representation of *Sinergia* projects. Projects belonging to this funding instrument tend to have a wider participation in terms of involved stakeholder groups than the regular projects, while still being fairly evenly distributed across the three scientific domains.

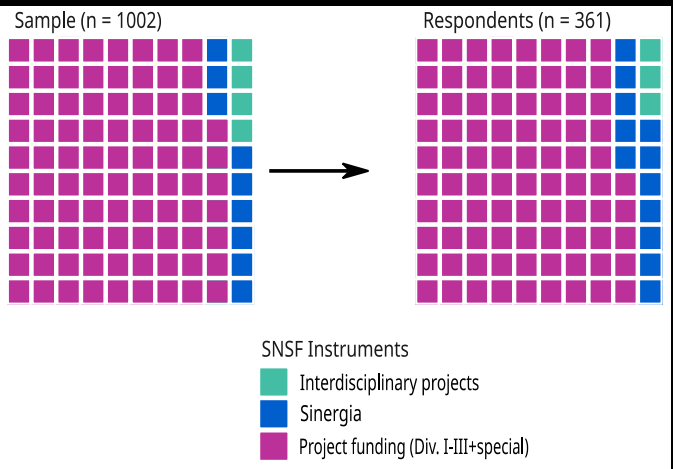
The survey was launched in September 2021. The response rate was 36 %. The gender-related shares, the shares related to the scientific domains, and the shares related to the SNSF Instruments found in the sample are reflected among the survey respondents (see Table 2).

[8] The selection was limited to the largest bottom-up instruments, i. e. *project funding* (*Div. I-III* and *special*), *Sinergia*, and *Interdisciplinary projects*.

Table 2: Comparison of the sample and survey respondents in terms of gender, scientific domains, and SNSF instruments

Gender	Sample (n = 1002)	Respon-dents (n = 361)	Visualisation
Female	21 %	23 %	
Male	79 %	77 %	

Scientific Domain	Sample (n = 1002)	Respon-dents (n = 361)	Visualisation
Biology and Medicine	35 %	30 %	
Humanities and Social Sciences	32 %	35 %	
Math., Nature, and Engineering Sciences	33 %	35 %	

SNSF Instrument	Sample (n = 1002)	Respon-dents (n = 361)	Visualisation
Project funding	87 %	85 %	
Sinergia	9 %	12 %	
Inter-disciplinary projects	4 %	3 %	

For the survey data analysis, the hypothesis testing, as well as the visualisation of results, the statistical programming language R was used, as well as occasional Python scripting.

In order to dig deeper into the matter, we then conducted online interviews with principal investigators from 47 SNSF projects as well as with some of their practice partners (8 interviews). The interviews focussed on

- scope of social innovation research;
- contribution of research to the development of social innovation and analysis of path-ways;
- identification of milestones and critical incidents in the research process with regard to the development of social innovations and the role of productive interactions;
- limits of contribution (in operational and epistemological terms);
- use of social innovation as an outcome and valuation category for accountability pur-poses.

Based on the responses from the online-survey, the PIs interviewed were selected either because of their affinity for social innovation (knowledge of the concept or high social innovation output) or the intensive transdisciplinary focus of their projects. This selection bias was intentionally accepted in order to be able to obtain a more comprehensive information content about the object of investigation of this project. Again, it is important to emphasise that not only SSH projects were selected, but interviews were conducted with PIs from all three scientific domains.

We use the document analysis (final reports, project proposals and CVs if available) to prepare for the interviews.

The interviews were conducted between December 2021 and March 2022. The online interviews (either by skype, gotomeeting, webex, zoom, or jitsi meet) were held in English, German or French, depending on the preference of the interviewees. Informed consents were obtained from all interview partners in advance. Each interview was recorded and transcribed into English. For the thematic analysis of the transcripts, coding processes were implemented with the help of MaxQda.

The obtained findings from the survey and the interview were then triangulated in the form of an interpretive synthesis in internal workshops under the supervision of the Team Leader. These joint reflections form the grid and basis of the report at hand.

It should be noted again, that our project centred primarily on the identification of potential social impact generation to which SNSF-funded projects made contributions (in particular the contribution to social change). In the few cases when we talk about effects of research, we consciously differentiate the term "outcome", which characterises the intended and usually shorter-term effect of an intervention (e.g. a project or a programme) on its - often diverse - target groups from the term "impact". The latter refers to the intended and non-intended usually long-term positive or negative effects to the target group(s) and beyond. Attributions from research to impacts are fuzzy and difficult to trace and value (if at all).

3) SOCIAL INNOVATION IN SNSF-FUNDED PROJECTS

Both the survey directed to a representative sample of the SNSF-funded PIs as well as the follow-up interviews with a subset of survey participants were geared towards extracting SI related aspects in SNSF-funded projects. This chapter discusses three main parts of the analysis, namely;

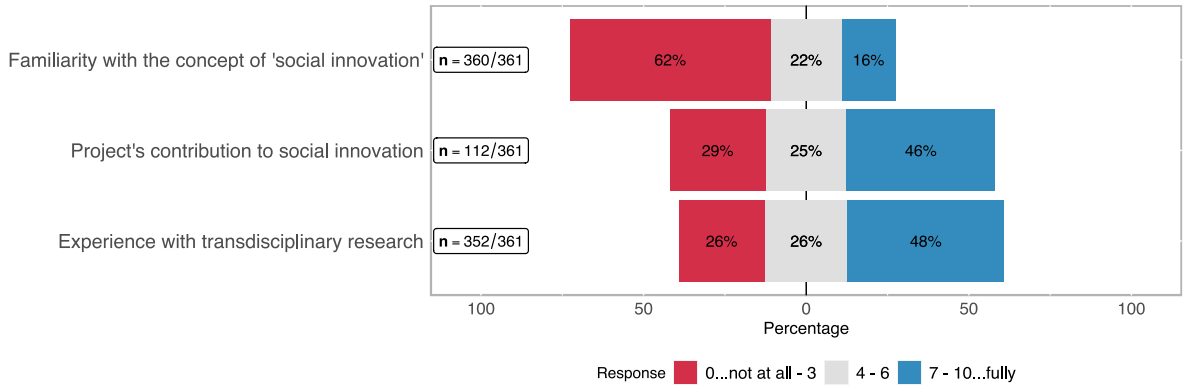
- self-reflection of the SNSF-funded Principal Investigators (PIs) regarding their familiarity with SI and transdisciplinarity as well as their self-assessment of social innovation contributions of their research projects,
- transdisciplinarity involvement of non-academic actors in the SNSF-funded projects,
- perceived challenges respectively attempted solutions in creating and maintaining "productive interactions" with non-academic actors.

3.1 Familiarity and self-assessment – a first approximation

The first step of capturing social innovation (SI) in SNSF-funded research projects was to gather researchers' perception of their own familiarity with the topic and their projects' relation to social innovation. This reflection has been addressed both in the survey and the follow-up interviews with SNSF-funded PIs.

62 % of the Principal Investigators (PIs) of SNSF-funded project responded that they are *not at all* to *barely* **familiar with the concept of social innovation** (3 and below on a 0-10 scale), roughly 22 % consider themselves as moderately familiar (4-6 on that scale), and 16 % as *high* to *highly familiar*. Overall, we can summarise that a solid conceptual understanding of SI is not (yet) widely known in the SNSF-funded research community. Figure 3 (first row) provides a visual overview on this distribution.

Figure 3: SI-familiarity, familiarity with transdisciplinarity, and project's contribution to SI (self-assessment)



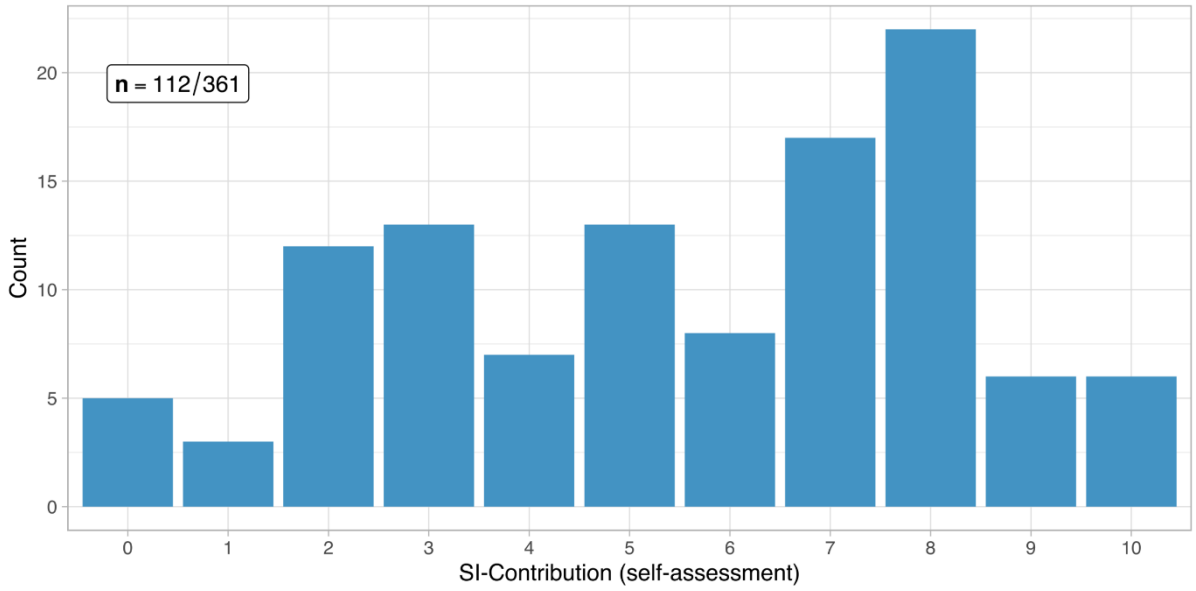
Out of the 113 *eligible*[9] participants, i.e. those who believe to be more familiar with SI (5 or higher on a scale from 0 to 10), 112 chose to answer the question regarding the ***contribution of their specific SNSF-funded project to SI*** (see second row of Figure 2). Of those, 29 % stated that their project contributed little to nothing to SI (3 and below on a 0-10 scale), while

[9] To reduce the overall time needed to fill in the online questionnaire, filters based on responses to previous questions were used. This is an example of such a filter – only those participants would actually get to self-assess their project's contribution to SI who were at least moderately familiar with the concept of SI (5 or higher).

46 % stated that their projects contribution to SI was high to very high (7 or higher on a 0-10 scale).

If we combine the number of PIs with a self-assessment of an average or higher familiarity with the concept of SI (5 or higher on a scale from 0 to 10) (n= 113) with the number of PIs who perceived that the contributions of their SNSF-funded projects for SI were high or very high (n= 51), than we can conclude that 14.1 % of all scrutinised SNSF-funded projects (n= 360) have a clear attribution to SI. In other words, 14.1 % of all responding PIs from SNSF-funded projects are characterised by a sufficient understanding of the concept of SI and a high outcome-orientation towards SI. Although this share of PIs is overall not large, it is definitely not a negligible group!

Figure 4: Distribution of self-assessed SI-Contribution



Note: The question was only asked to those who gave at least a value of 5 on the scale of 0-10 in relation to their familiarity with the concept of social innovation, i.e. who were at least somewhat familiar with it. This was done to improve the quality of the answers.

Figure 4 shows the self-assessment of those PIs, who are at least somewhat familiar with the concept of social innovation (5 or higher on a 0-10 scale) as regards their project's contribution to social innovation. We can identify lower numbers at the extremes (i.e. no/very low contribution or very high contribution), and higher numbers among those who self-assess their project's contributions to social innovation as rather high.

This variable is particularly interesting when further analysing whether researchers from a particular scientific domain contribute more to social innovations than researchers from another scientific domain. Table 3 delivers answers this specific question. The results vary greatly between the scientific domains. Over 50 % of the respondents from the natural and engineering sciences, who have at least a basic understanding of the concept of social innovation, fed back that their project's contribution to social innovation was zero or very marginal. On the other hand, around 50 % of the PIs from the field of SSH responded a high to very high contribution to social innovation. The share of PIs from the life sciences, who responded a high to very high contribution to social innovation, was around 44 % (see Table 3).

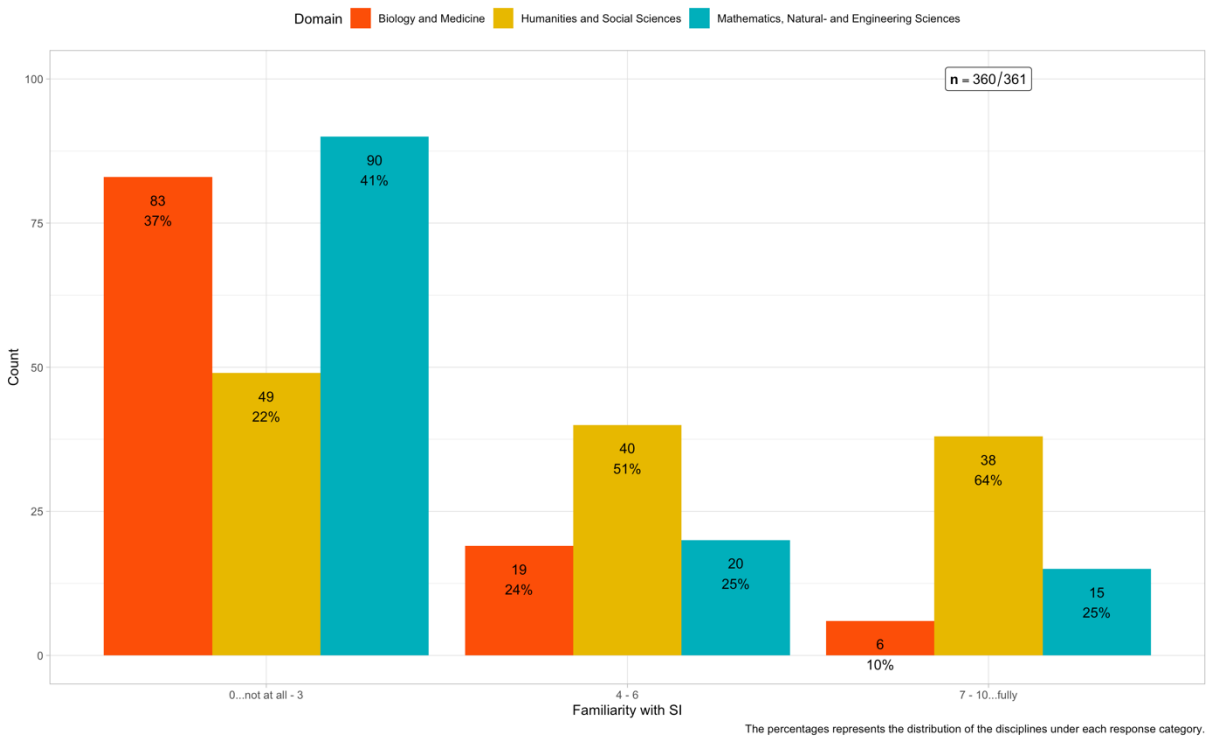
Table 3: Distribution of project's contribution of SI (self-assessment) among scientific domains

rating	Biology and Medicine (n=18)		Humanities and Social Sci. (n=67)		Math., Nat. and Engi. Sci. (n=24)	
0..lowest 10..highest	**abs**	**%**	**abs**	**%**	**abs**	**%**
0 – 3	5	27.77%	14	10.89%	14	51.85%
4 - 6	5	27.77%	18	26.86%	5	18.51%
7 - 10	8	44.44%	35	52.23%	8	29.62%
Total	18	100%	67	100%	27	100%

Note: The question was only asked to those who gave at least a value of 5 on the scale of 0-10 in relation to their familiarity with the concept of social innovation, i.e. who were at least somewhat familiar with it. This was done to improve the quality of the answers.

We further explored if there is a difference between scientific domains when it comes to the familiarity of researchers with the concept of SI. The distribution of survey participants in our sample across the three domains is balanced, each represents roughly one third of the overall number of SNSF-funded PI. As Figure 5 shows, the share of researchers from the Humanities and Social Sciences increases with each higher degree of *familiarity with SI* while the share of the other two domains dwindles in comparison.

Figure 5: Distribution of the familiarity with SI



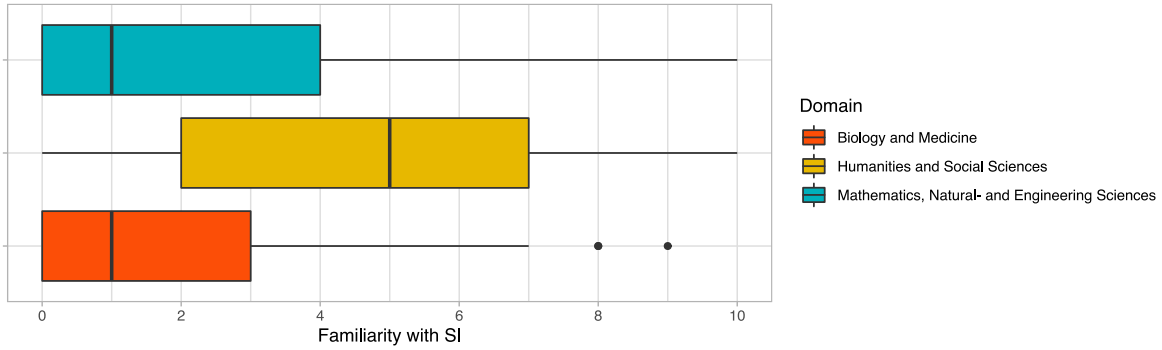
Following the literature on SI characteristics in varying research domains (Schuch 2019; Planes-Satorra and Paunov 2017)[10], we were assuming that

- H_1: *the familiarity with SI* depends on the *research domain*.

The analysis of the survey results yielded a statistically significant difference in SI-familiarity between the scrutinised three major scientific domains applied by SNSF (Kruskal-Wallis[11] [K-W] rank-sum test; $\chi^2 = 45.7$, df = 2, p-value < 0.05).

Figure 6 suggests that *Humanities and Social Sciences (SSH)* show a generally higher *familiarity with SI* than the two other scientific domains. A post-hoc test (see Table 14 in Annex-II) confirmed a statistically significant difference compared to the other two domains (Pairwise comparisons using Wilcoxon [P-W] rank-sum test[12] with Bonferroni correction, p-value < 0.05 for each pairing). On the other hand, the domains Mathematics, Natural -, & Engineering Sciences and Biology & Medicine do not differ from each other significantly with regards to the SI-Familiarity ([P-W] p-value > 0.05).

Figure 6: Distribution of the familiarity with SI between different scientific domains



We can thus confirm that the concept of Social Innovation is significantly more known in the domain of SSH than in the other two SNSF domains. However, SI itself is not a category limited to SSH, but occurs throughout all three SNSF domains, predominately in SSH.

Finally, we scrutinised the PIs *experience with transdisciplinary research*. There are several ways to understand the concept of transdisciplinarity. In the context of this study, we depart from the Swiss Academy of Sciences' definition[13] of *transdisciplinary research* as a "[…] *societal problem solving with scientific knowledge production in a process of co-producing knowledge*." Following-up this definition, we define transdisciplinary research as a research process that includes non-academic knowledge embedded in non-academic actors in a consultative, contributory, cooperative or co-creating way. With this definition, we refer to Shirk et al. (2012), who differentiate five ways of participation of non-academic actors in research:

a) contractual projects (professional researchers are commissioned by citizens, public authorities, municipalities or other organisations)

b) contributory projects (citizens collect data for scientific projects)

[10] See Schuch (2019), 94–97. for an analysis of the contribution SSH fields offer to SI and Panes-Satorra and Paunov (2017) for different types of contributions from different disciplines to innovation in a broader sense.
[11] The Kruskal-Wallis method is a non-parametric alternative to ANOVA
[12] Pairwise Wilcoxon rank sum test is a non-parametric substitute to the pairwise t-test.
[13] cf. *What is transdisciplinary research?* at https://naturalsciences.ch/transdisciplinarity [last accessed: March 2022]

c) collaborative projects (citizens not only collect data, but also help refine the study design, analyse data and / or disseminate results)

d) co-created projects (which are designed jointly by researchers and the public and for which at least some of the citizens are actively involved in aspects of the research process), and finally

e) collegial contributions (where people without academic qualifications carry out independent research and share their results with researchers).

The general background for this understanding is the insight that research, which is early and continuously involving non-academic actors with a specific purpose, has positive effects both on conducting more user-centred research and on the impact of research (Staley, 2009)[14]. There is well-established knowledge that 'public engagement' is suitable for various RTI[15]-political issues, not at least in cases of scientific and technology conflicts or related value conflicts. Public involvement enables alternative rationalities, problem perspectives and solution preferences to be taken into account. It contributes to the democratisation of scientific and technological developments, enables knowledge transfer (in both directions) and creates awareness (Schuch et al., 2016)[16].

At this point, however, it has to be noted, that also possible disadvantages or risks might occur: 'involvement' generally connotes terms of inclusion, openness and democratisation. Nevertheless, the associated processes and activities may include also ethical risks of exploitation, manipulation and control. Moreover, not infrequently, the definition of the terms 'participation', 'engagement' or 'involvement' is diffuse. Public participation[17] is often understood as umbrella term. The *functional understanding of public participation* has different granularities and ranges from information, inclusion, participation, co-creation, to co-determination. In this broad sense, participation fulfils several functions that are oriented towards the degree of involvement and empowerment of the public: information function, consultation function, involvement function, collaboration function and empowerment function.

In view of social innovation (SI), scholarly literature goes as far as stating that *transdisciplinary aspects* are central (and necessary) to SI-related research. Murray et al. (2010, p. 3) define SI *as social in their ends and their means*. By *social in their means,* the authors refer to an inclusive approach that not only reaches out, but also includes the target groups or beneficiaries of a social innovation in an intervention. Thus, it can be argued that *transdisciplinarity* needs to be regarded as a centrally important indicator for SI-relevant endeavours. In contrast to this notion, however, our theoretical framework does not consider *transdisciplinary involvement* as sine qua non (i.e. as a necessary prerequisite) for research projects to contribute to SI. That said, we still expect it to be more influential than other factors.

When asked about their ***experience with transdisciplinary research***, 48 % of respondents to the survey (n= 352) stated that they are experienced with transdisciplinary research (7 and higher on a 0-10 scale; 10 being the maximum), and 26 % replied to be somewhat experienced. Another 26 % responded that they were not experienced (3 and below; 0 being the minimum).

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[14] Staley, K. (2009). Exploring impact: public involvement in NHS, public health and social care research. INVOLVE. NHS; https://www.invo.org.uk/posttypepublication/exploring-impact-public-involvement-in-nhs-public-health-and-social-care-research/; accessed on 10 August 2020.

[15] RTI abbr. Research, Technology and Innovation

[16] Schuch et al. (2016). RRI in Österreich. Positionspapier ‚Verantwortungsbewusste Forschung und Innovation'. Begriffsbestimmung, Herausforderungen, Handlungsempfehlungen. Plattform RRI Österreich. (Engagement chapter written by K. Schuch). https://www.rri-plattform.at/index.php/activities/; accessed on 11 August 2020.

[17] Public participation i soften understood as citizen participation, which in no way means a restriction to formal representative democratic forms of participation. Participation can mean the involvement of stakeholders (e.g. interest groups), but also the participation of people who are usually not involved in RTI-relevant processes of decision-making (so-called laypersons). Such people are sometimes seen as experts in their own 'Lebenswelt'. Different participation processes can also be classified according to other dimensions, such as the type of representation (laypersons, stakeholders, experts), the way they are addressed (value, interests, knowledge) and the form of political action (exploratory, framework-setting) (Schuch et al, 2016).

Figure 2 (third row) provides a visual overview on this distribution. We can thus conclude that a high share of PIs funded by SNSF are experienced with transdisciplinary research. Please note, however, that experience with transdisciplinary research does not automatically mean, that transdisciplinary practices were employed in the projects scrutinised by our survey.

Although the distribution of transdisciplinary experience (0…10 from lowest to highest) by age group showed some variance, a general trend was not visible. Even the younger age groups among the PIs are spread across a spectrum from low to high degree of transdisciplinary research experience.

Table 4 differentiates transdisciplinary experience between the three major scientific domains. More than 60 % of the PIs from SSH responded, that they have a high to very high transdisciplinary experience. For the other two domains, the respective share is only around 40 %. Only 18 % of respondents from SSH fed back, that they do not have such an experience, the share of non-experienced among the other two domains is around 30 %.

Table 4: Distribution of transdisciplinary experience among scientific domains

rating	Life Sciences (Biology and Medicine) (n=106)		Humanities and Social Sci. (n=126)		Math., Nat. and Engi. Sci. (n=124)	
0..lowest 10..highest	**abs**	**%**	**abs**	**%**	**abs**	**%**
0 – 3	34	32.07%	23	18.25%	36	29.03%
4 - 6	29	27.35%	26	20.63%	35	28.22%
7 - 10	43	40.56%	77	61.11%	49	39.51%
Total	106	100%	126	100%	124	100%
no resp.	2		2		5	

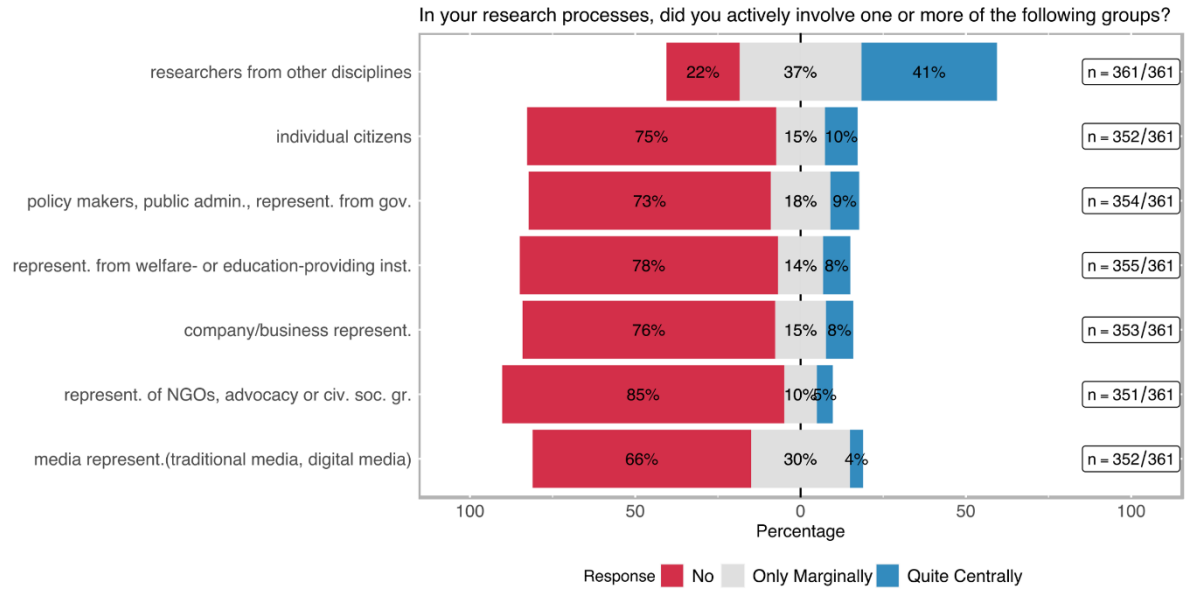
3.2 Extent of transdisciplinarity in SNSF-funded projects

We measured *transdisciplinary involvement* by levels pf inclusion of different types of societal actors and groups in the research process. Although by far not as central as the *interdisciplinary* cooperation (i.e. the cooperation of different disciplines within a SNSF-funded research project), different types of transdisciplinary engagement constitute a noteworthy part of SNSF-funded research projects.

As shown in Figure 7 transdisciplinary involvement of societal actors and groups such as *citizens*; *policy makers and representatives of public administration and governmental agencies*; *institutions providing welfare or education*; or *companies*, yield somewhat similar distributions among the surveyed projects (22 % - 27 % of marginal to high involvement). An exception to this rather equal distribution is media, which was quite often integrated in SNSF projects, but rarely centrally. Thus, we assume that media was mainly engaged for pure dissemination purposes.

Survey results show that interdisciplinary cooperation is already common in the majority of projects funded by the SNSF. 41 % of the respondents even noted that the involvement of researchers from other disciplines was quite central to their specific project (see Figure 7). In total 78 % of the projects were carried out in collaboration with researchers from other disciplines.

Figure 7: Interdisciplinary and transdisciplinary involvement in SNSF-funded projects



For around 8-10 % of the respondents, the involvement of individual citizens (e.g. as beneficiaries, customers, or concerned persons); policy makers, representatives from public administrations and governmental agencies; company/business representatives (incl. farmers) or representatives from welfare- or education-providing institutions (such as schools, kindergartens, hospitals, or care centres) was quite central. The involvement of representatives of NGOs, advocacy or other civil society groups was quite central to only 4.8 % of the respondents (see Figure 7). It should be noted, that multiple answering to the question of involvement of various societal actors and groups in one project was possible.

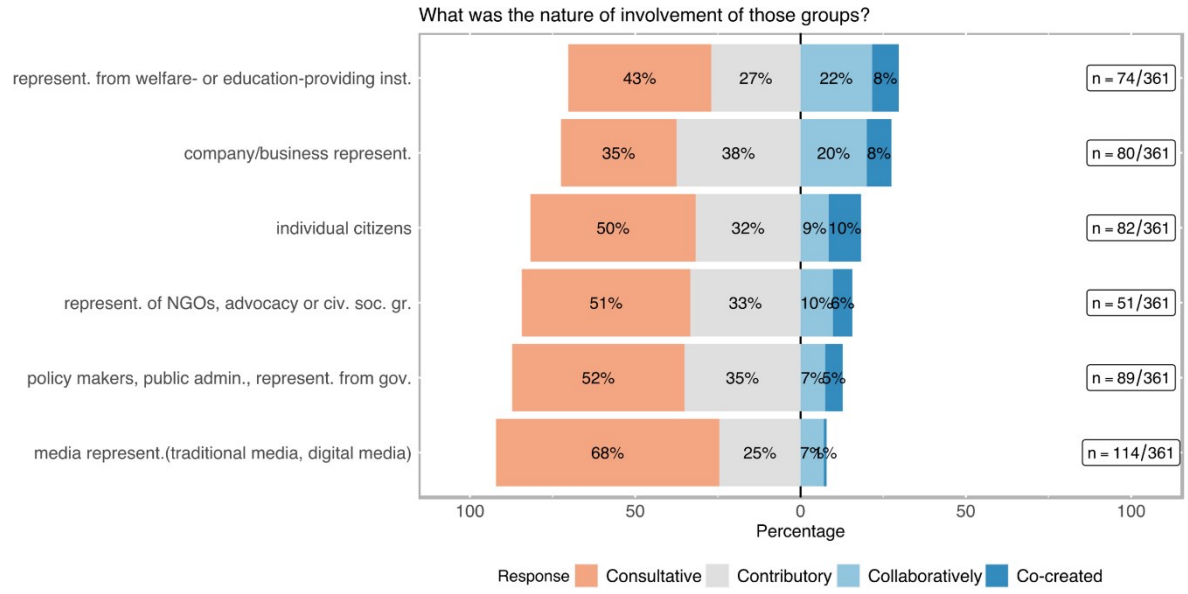
Only 39.4 % of the scrutinised projects did not include non-academic actors or societal groups. This means on the other side, that more than 60 % of SNSF-funded projects involved non-academic actors at least marginally in their research process. In fact, the share of projects that include at least one, two or three different non-academic actors or groups amounts to 50.6 %; 9.9% % of the surveyed projects include even more than 3 (out of 6) different types of non-academic actors or groups.[18]

The centrality of the involvement of non-academic actors and groups indicates to which extent specific groups were involved in the project. We approximate centrality with the nature of involvement (indicated with the labels; consultative, contributory, collaboratively, co-created as explained in section 4.1).

Figure 8 shows that transdisciplinary involvement is mostly consultative or contributory. Collaborative transdisciplinary involvement is more likely employed when welfare/education institutions or company/business representatives are involved in the project (20 % and 22 % respectively). A co-creation approach is rarely being followed in the SNSF-funded projects: the highest co-creative involvement belongs to projects that include individual citizens (10 %).

[18] Figure 30 in the ANNEX-2 provides a graphical presentation of this distribution.

Figure 8: Nature of transdisciplinary involvement per stakeholder group



Literature suggests that a deliberate planning of benefits for non-academic groups correlates positively with the exercised nature of their involvement in research processes (Schäfer and Kieslinger, 2016; Mauser et al., 2013). Therefore, we tested the following hypothesis by selecting three different societal groups, namely (i) *citizens*, (ii) *civil society organisations & NGOs*, and (iii) *welfare & educational institutions.*

- H_2 *the level of the deliberate planning of benefits for non-academic target group(s)* correlates positively with the nature of their involvement in research processes

Figure 9: Relation between the deliberate design for benefits for and the nature of involvement of target groups outside academia in the research process

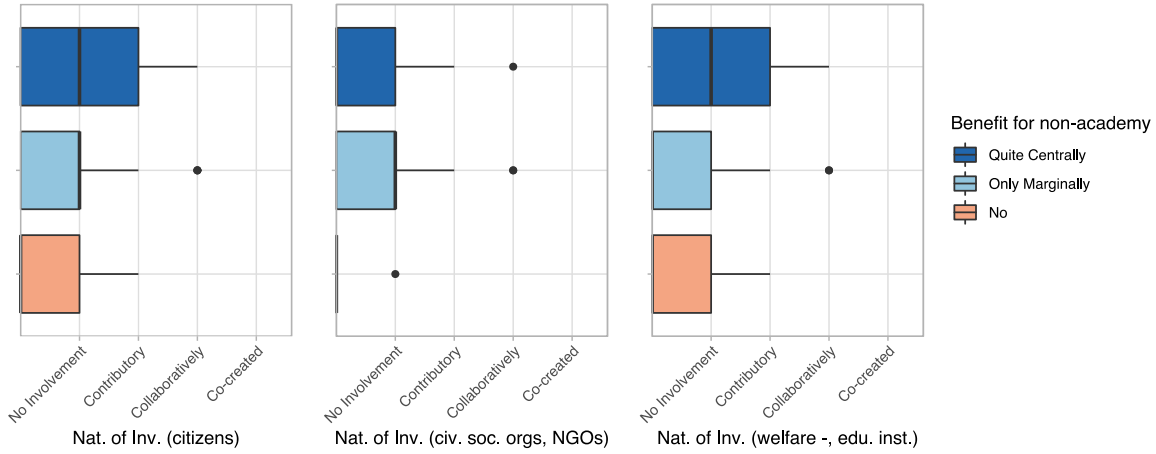


Figure 9 suggests no or only a small correlation between the intent to create direct *benefits for target groups* on the one hand and the *nature of involvement* of those target groups in research processes on the other hand. Looking more closely at the three selected societal target groups, it turns out that the correlation between deliberate benefit-orientation and the *nature of involvement* of **citizens** as well as **civil society organisations & NGOs** in the research process is weak (rho < 0.15 for each; relation is displayed in Table 15 in Annex-II) and not

statistically significant (p-value > 0.05 for each pairing). Only the relation between the *nature of involvement* of the **representatives of welfare and educational institutions** in the research processes and the benefit-orientation of the project design is significant; still displaying only a weak correlation (rho ≈ 0.3).

Although we can observe a modest relation, a deliberate design to benefit specific societal groups does not seem to correlate overall with a deeper level of involvement of societal groups in research processes. In other words, the intention to create benefits for specific selected groups does not necessarily correlate with more intense engagement practices. Maybe the *welfare and education* sector is an exception to this, because one can speculate that deep engagement practices with stakeholders from these two sectors are practiced more often already. Another explanation attempt is that the welfare and education sectors are more formalised (and thus easier to handle) than the other scrutinised sectors of NGOs and citizens, which are certainly characterised by a higher variability and a lower possibility of standardising transdisciplinary collaboration.

Through the interviews, we could further identify that for many principal investigators (PIs) inter- and transdisciplinary research designs and implementation practices were considered as a central element of novelty in their research. While novelty is usually related to scientific discoveries, new scientific methods, innovative research questions or academically induced innovations, several interviewees reported that the novel part of their research was the way they approached the project by applying new concepts or techniques that were either new for them or for their respective fields.

Some interviewees highlighted that by simply introducing aspects from other disciplines into their research, the potential impact of the results and findings for academics and practitioners alike multiplied. Other interviewees mentioned that "minor" adjustments in research designs drastically affected the outcomes of projects. Similarly, it was emphasised that while interdisciplinarity is common in many research fields, some PIs decided to incorporate interdisciplinary aspects, albeit uncommon in their specific field, because they believed that such an approach could contribute to a more holistic perspective on the researched topics, e.g. at the interface between fundamental and applied research but also at the interface between natural and social sciences. Overcoming disciplinary boundaries and designing research projects not only according to the standards of one field but two or more was perceived as very innovative with a potential to lead to higher impact both in and outside of academia.

Almost half of the interviewed PIs reported that the novel aspect of their research was the contribution to practice, for example, the improvement of teachers' training or medical treatment. Other interviewees argued that their innovative aspects lay within the transdisciplinary aspects of their research designs. However, not all of the interviewees who identified relevance for practice, applied transdisciplinary elements in their research. On the other hand, all of the interviewees who conducted transdisciplinary research argued that their research projects were tied to phenomena in the practical world.

Interview partners argued that there is a "feedback loop" between academia and practice, which offers a ground for learning. One interviewee recounted that while practitioners can learn from academic knowledge, researchers can benefit from incorporating "practical knowledge" into their projects.

"First of all, we describe what the professionals do because, in the institutions, we often don't know what the professionals do. There is a diversity of practices, so it is really important to go to the institutions, to go to the field, to describe what professionals do. And there is a knowledge that is built up among social workers - so this is something that is attributed to all professionals, but in social work, as it is highly experimental, it is even stronger. There is something of an invention in the work. So, it's very important to be able to produce knowledge for that. Already for professional training, there is something of social innovation, because the idea is to allow the training of social workers to be nourished by the new knowledge that is built up in the field. Because obviously, in the institutions, in addition, the problems evolve. They evolve all the time. There is this basic innovative side." Interviewee 1

Furthermore, some interviewees mentioned that although their research is generally more theoretical and fundamental, they understand their scientific activity always as related to practice. While some interviewees claimed that the boundaries and limits of fundamental research are its limited impact outside of academia, others highlighted that these boundaries can be overcome by incorporating translational science aspects into the project from the start but also at later stages, e.g., by flexibly including stakeholders, pursuing dissemination strategies or undertaking exploitation activities.

Involvement of non-academic actors in different project phases

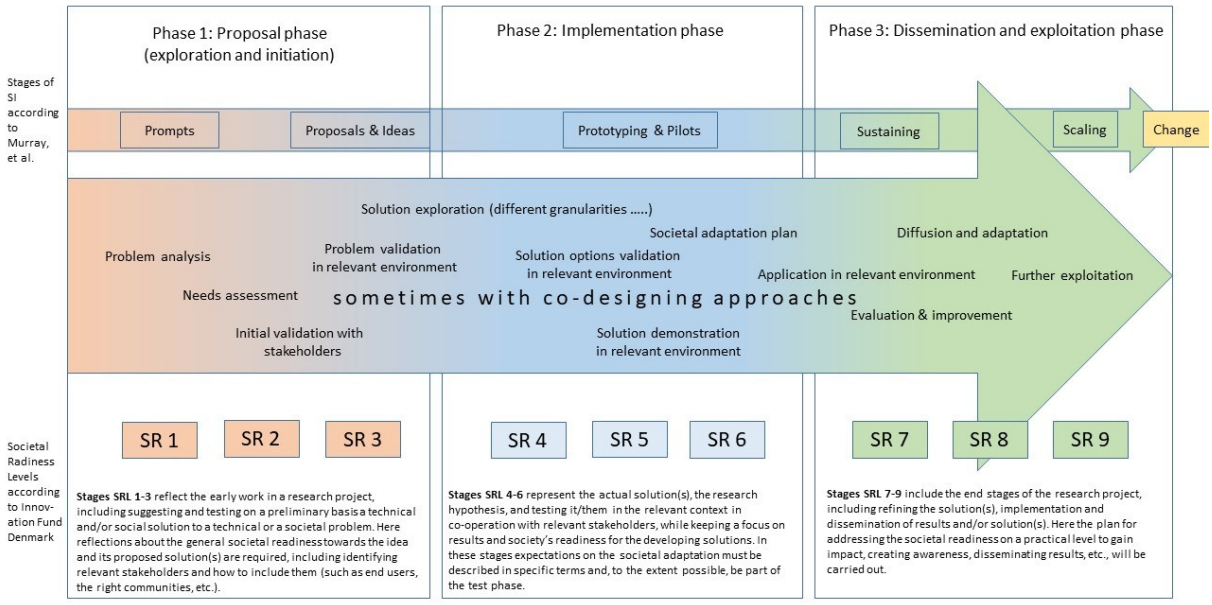
We also aimed to understand in which phases of the project non-academic actors and/or social groups have been involved. We differentiate between three different project phases.

1. Firstly, the proposal phase, which is defined as the stage during which the project plan and research design is developed, and the application to the SNSF is initiated. Sometimes, exchanges with non-academic actors or groups went back to a time when the concrete project idea was not mature. Yet, some of these interactions may prove to be invaluable for the project outline and the subsequent execution.

2. The second phase is the implementation phase. This stage refers to the period where a project has already started and tasks (e.g. data collection) aimed at achieving the projects' objectives are undertaken.

3. The third and last phase of a project is the exploitation phase, where results are prepared in a way to facilitate uptake and use (e.g. by patenting) and dissemination activities are carried out (see Figure 10).

Figure 10: R&D phases and procedures for (social) impact generation



Source: Own illustration based on the stages of SI according to Murray et al. (2010) and the Societal Readiness Levels Concept of the Innovation Fund Denmark (https://innovationsfonden.dk/sites/default/files/2019-03/societal_readiness_levels_-_srl.pdf; accessed on 28 June 2022).

Our interviews with a selected subset of survey participants also focused on these different phases of potential transdisciplinary involvement. Most interviewees[19] reported interactions with non-academic actors. Most often, their transdisciplinary approach was intentionally included in the research design. In some cases, the communication and exchange with actors outside of academia emerged during the research implementation when interviewees noticed that a particular aspect of an issue could only be solved in conjuncture with others. However, there were also cases where the exchange took only place with other researchers.

In the following paragraphs the findings from the interviews are structured along identified non-academic groups involved in SNSF projects (media; project specific target groups; practitioners; businesses; other researchers; wider public; political actors and policy-makers; NGOs, civil actors and interest groups; foundations, association and museums), acknowledging however that some of these groups overlap.

1. **Media:** Interactions with the media mostly occurred during the exploitation phase. In most cases, this happened incrementally instead of being planned as part of the research project. Interviewees highlighted that in order to reach a wider audience, it was crucial to publish in non-academic media too. However, exchanges with media can also be problematic since a researcher has less control over what is being transmitted. One interviewee mentioned that although he wanted to raise awareness amongst society, he tried to communicate the outcomes in a very neutral way.

"I think, in everything that I said, I try always to stick very closely to what we have done in our study and what findings we have. I think that was helpful in the sense that, I was not commenting on some general refugee issues, but "this is the study we have conducted. It has all these limitations, but that is what we found." And that minimises the risk of being instrumentalised from any party." Interviewee 6

   One interviewee highlighted that it is helpful to know someone who works at a media outlet and to develop a network of journalists. This way, researchers can benefit from a greater involvement and can thus be ascertained that their findings are communicated in a value-free way. Furthermore, it was emphasised that researchers often are not skilled in communicating with the public. They often use too scientific vocabulary and miss rhetorical skills. Hence, working with journalists can both extend the audience as well as overcome deficient communication skills.

   Other researchers spoke to specific media that reach out to certain target groups, e.g. people with certain illnesses or handicaps. Another interviewee reported that he talked to a university magazine, which – in his opinion - had two main advantages. Firstly, such a channel operates on a less normative basis and communicates more value-free than certain daily newspapers. Secondly, university magazines are aimed at students who hence get the opportunity to read about the research that was undertaken at the university. This can help arouse interest for research projects amongst students in general as well as communicate subject-relevant information without the learning character of classroom teaching.

   Only one interviewee reported that interactions with the media took place before the exploitation phase of the Project. Accordingly, his team worked together with journalists in order to recruit people for their experiment.

2. **Target group**: Exchanges with a project's specific target group mostly happened during the implementation phase. Most often, target groups were included in the project

[19] Note that an interview bias exists, because we selected interviewees based on their proximity to familiarity with understanding the concept of social innovation and/or transdisciplinary research experience to harvest information from those who have the deepest record of understanding of these two items.

through data collection (e.g., interviews or surveys). However, the degree of inclusion differed greatly between projects. While some project teams talked to their target group solely for the purpose of data acquisition, others continued working with them throughout the project. Several interviewees emphasised the need to empower the target group and to ensure that relevant stakeholders, i.e., practitioners and policy-makers, hear them. Yet, all interviewees who worked with their target group(s) stressed that it is crucial to talk to affected people when writing about them. Otherwise, as expressed by one interviewee, social science misses its goal to deliver outcomes that are as close as possible to the reality of those affected. But also researchers who did not have a social science background argued similarly. One natural scientist highlighted that as soon as science affects one or several groups of people, they should be given a chance to participate in the project and express themselves.

Some interview partners also mentioned interactions with target groups already in the proposal phase. For example, one PI recounted that before the project started, his team talked to acquaintances who could be possible project participants to better understand the phenomenon under scrutiny. Accordingly, this enabled the concerned researchers to adapt the proposal as well as to refer back to an already existing pool of project participants, which saved time during the project implementation phase.

In a few circumstances, the target group was also included in the exploitation phase of a project. One interviewee reported that she consulted her target group while simultaneously talking to practitioners and decision-makers in order to assure that the target group is not misrepresented.

Another interview partner reported that his team included participants even in the writing process:

"[A]s regards the extracts from interviews that we inserted into scientific productions, we always sent the articles back to the people concerned. They had the whole article, not just their quotes, and we told them that's what we said, and some of them gave us feedback on their quotes but also on the article itself, by providing clarifications, explaining such and such a thing that they thought we might have misunderstood. It's very interesting because we're used to feedback from colleagues, everyone knows that, it's very interesting too, but the fact that we also have feedback from the actors themselves is quite interesting." Interviewee 7

3. **Practitioners:** Practitioners were included in all project phases. Some PIs reported that they talked to practitioners in the proposal phase to ensure their participation in the later stages of the project. It was highlighted several times that practitioners can contribute to the proposal by expressing their more applied and practical knowledge, which generates several benefits: First, the proposal incorporates several perspectives making the research propositions more holistic. Second, it increases the chances of the proposal to be funded, as funding organisations allegedly often value a transdisciplinary research design. Third, it makes the undertakings more applicable to "the real world" and, subsequently, outcomes more usable for experts outside academia. Fourth, practitioners can give valuable feedback to a proposal, which enables researchers to make necessary adjustments. One interviewee for example, who spoke to a Swiss association for retirement during the proposal phase noted that this exchange improved her proposal significantly and helped to sharpen her research question. Fifth, the early inclusion of practitioners could even change the direction of a research project more drastically as practitioners raise researcher's attention to certain problems that appear in their work. Early interactions with practitioners can touch upon issues that have hardly been considered in research so far.

   Several interview partners highlighted the continuous contact with practitioners, which allows them to revert to a network of practice partners who might be interested in conducting projects together. Exchanges during the proposal phase can facilitate later access to the practice field, as practitioners potentially have contacts that they can pass on. This may sometimes put them in the role of gatekeepers.

In many cases, practitioners were also consulted during the implementation phase. They helped with data collection either directly by participating in interviews or indirectly by providing secondary data. In other contexts, practitioners supported researchers with the planning and refinement of their method (e.g., drafting questions for surveys). There were also interactions beyond the immediate data collection and analysis phase:

"So, perhaps it should be said that during the project, we are not in an approach where we come to the field, we collect the data and we leave. When the data is collected, there is also a whole restitution process, which takes place during the project. Every three or four months. Afterwards, it depends on the project. The idea is: during the course of the project, between the beginning, the collection of data and the end of the analysis, there are moments of intermediate feedback. We are also in the process of giving the teams our understanding, our working hypotheses and how we understand them. If they don't validate, we say to ourselves that there is something we haven't understood. So, participation is important. It is really important." Interviewee 1

Some interview partners confirmed interactions with practitioners in the exploitation phase and even after the end of the project. In many cases, these exchanges took place within the scope of conferences or events, when findings were presented and discussed. In some circumstances, feedback regarding the interpretation of results was obtained. One interviewee claimed that when he discussed the results of the project, praxis partners provided criticism and their perceptions, which partly changed his view of the results. Generally, contact with practitioners during the exploitation phase seems to foster discussions and dialogue. Five interviewees mentioned that they included professionals from practice in the writing process, for example as co-authors of scientific publications. One interviewee claimed that this also helps with dissemination outside academia because practitioners carry project outcomes into their specific practice fields and communicate them to other professionals.

While in most circumstances, interactions with practitioners prevailed throughout the course of the projects, some PIs said that interactions with new practitioners took place at the end of their projects. For example, one researcher said that once the results of the project were available, the project team approached practitioners directly in order to share insights and to provide data.

4. **Industry/Businesses:** Only natural and engineering science projects exhibited exchanges with companies or industry representatives. Six interviewees reported that they reached out to businesses. Mostly, these interactions took place in the exploitation phase. All of these interviewees claimed that it is essential to build relationships with industrial partners in their field to make project results usable. A few interviewees also mentioned that in order to make a project usable, commercialisation is crucial. This, however, is only possible with the support of industry partners and, more specifically, with larger investments. In some cases, research agreements were made after the SNSF-funded project ended. According to the interviewees, such agreements benefited both sides as researchers obtain further funding for their research, and businesses benefit from research undertaken in their niche. However, it was emphasised that such agreements can be difficult and time-consuming to negotiate and do not always succeed.

   Another aspect is the explicit search for investors or venture capitalists. One interviewee, for example, reported that after the successful end of his project, he wanted to make his product more accessible by entering the market. In order to make his product ready for the market, he needed considerable investments, which he hoped to raise by specifically approaching businesses.

   Some of these interviewees also mentioned exchanges during the implementation phase with industry. These interactions comprised mainly the provision of resources and technical discussions. It was highlighted that most often links to businesses are already established when working in a field for several years. Hence, interviewees referred to a

"successful synergy" between researchers and companies who continuously work together and benefit from the resources and knowledge of the respective partner.

5. **Other researchers:** Many interviewees reported interactions with other researchers during the proposal phase. For example, one PI highlighted that in order to better understand the issue at stake, it was crucial to incorporate different perspectives early on. While in some cases other researchers were only consulted, others worked on the proposal collaboratively. It was also noted that the proposal phase is vital for building a consortium of research partners. According to several interviewees, if a research design is supposed to be interdisciplinary, collaboration with other researchers should begin during the proposal phase to ensure that competencies are mobilised, and research partners have the chance to get to know each other as early as possible.

   Interactions with other researchers during the implementation phase can be divided into two main categories. Firstly, exchanges limited to discussions at infrequent meetings. In these cases, the goal of exchange was to share and examine preliminary findings with other researchers who were otherwise not involved in the project. Contrarily, some interactions took place more synergistically, mostly with researchers who participated directly in the project. Meetings then took place more frequently and updates and feedback were provided more in detail.

   During the exploitation stage, formal interactions with other researchers happened mostly at conferences. Some interviewees also mentioned that apart from conferences, they approached or were approached by other researchers with the objective to talk about future research collaborations.

   When it comes to informal exchanges, interviewees stressed that they talked a lot to colleagues from the same organisations, which in many cases also proved to be fruitful for further cooperation and knowledge transfer.

6. **Wider public:** All interactions with the wider public took place during the exploitation phase. These interactions happened within the scope of non-scientific conferences, conventions or specific events. One interviewee reported that his project team engaged in discussions with citizens not only at public events but also in everyday life. The aim of these discussions was to raise awareness of the research topic and to get insights into the public's perspectives.

7. **Political actors and policy-makers:** Almost three quarters of the interviewees interacted with policy-makers at some stage of their project. During the proposal phase, most interactions regarded the presentation of the project idea and discussions for further collaboration. One interviewee mentioned that she found it essential to include decision-makers early on and to keep them updated about the project in order to achieve a shift in perspectives. Similarly, others highlighted that interactions with policy-makers were useful to prove the practice-relevance of the project idea and to get people on board who are directly confronted with specific issues. Another interview partner claimed that policy-makers are essential to promote the project and its implementation in a larger context, which is why they should already be involved in the proposal phase.

   During the implementation phase, interactions were more restricted than in the proposal phase. Three main reasons for interacting with policy-makers during the implementation phase could be identified. First, some researchers engaged with policy-makers for feedback reasons. More specifically, interactions took place in order to provide updates to political actors and to obtain guidance and recommendations. Second, policy-makers

were contacted with the aim of receiving resources or data. Thirdly, decision-makers were actively involved in the data collection process, e.g., by participating in interviews.

In the dissemination phase of the projects, interactions with policy-makers took mostly place in the form of presentations. While this is an important aspect of dissemination, one interviewee stressed that the informal aspects of such meetings are almost more important than the formal ones. Accordingly, coffee breaks are helpful to widen one's network, talk about more details of the project as well as discuss further collaborations. In some cases, the dissemination only occurred through the delivery of a report, which, according to two interviewed PIs, reduced the impact the results could have. Other interviewees stressed that while there was indicated interest of policy-makers at earlier stages of the projects, no final meetings were scheduled.

8. **NGOs, civil actors, interest groups:** Ten interviewees reported interactions with either NGOs, civil actors or interest groups. While most of these exchanges happened during the later stages of the projects, some PIs contacted this stakeholder group before the official start of the project. Two interviewees stressed that communication with NGOs during the finalisation of the proposal was crucial for the idea development. Another interviewee said that he contacted an NGO in order to ensure further cooperation during project implementation, which then ultimately led to a collaboration agreement.

   After the proposal phase, NGOs and civil actors were included in the projects mainly with respect to two aspects. Firstly, they provided field access to the research teams. This was especially important for projects that worked with vulnerable groups or that were implemented in other (mostly developing) countries. Since NGOs usually operate on a very immediate level and know the field very well, researchers that come from different backgrounds are enabled through the cooperation to acquire knowledge about the specific context as well as to build a relationship with people from this field. Secondly, NGOs were also consulted for data collection (e.g., field studies, interviews) and participation in workshops. Beyond these two main aspects, a few interviewees also stressed the continuous feedback they got from NGOs. This led to the refinement of the project orientation and sharpened the implementation plan.

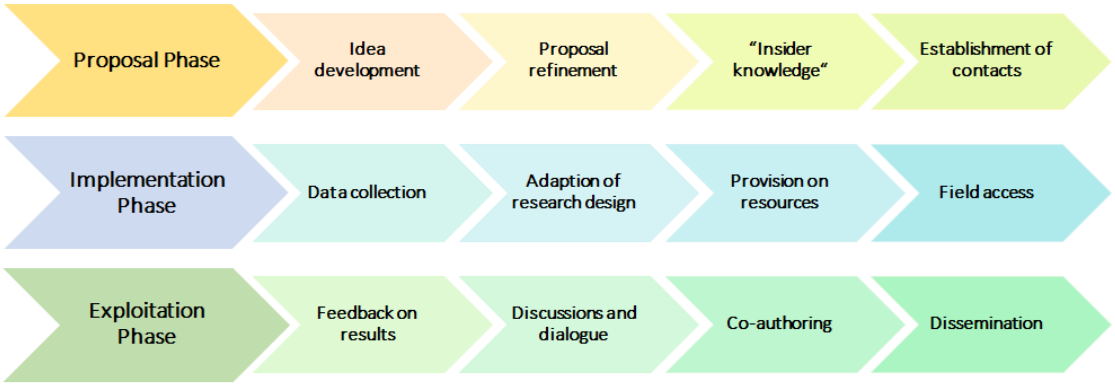
   During the exploitation phase, NGOs, civil actors and interest groups were mainly involved in the dissemination of results at conferences or meetings. While most of these interactions ended after the project completion, two interviewees underlined that there are still ongoing collaborations with NGOs.

9. **Foundations, associations and museums:** Lastly, also institutions and organisations such as foundations, associations and museums were identified as actors within SNSF-funded projects. However, interactions with this stakeholder group were only marginal. Two interviewees reported that they contacted associations operating in their field during the proposal phase in order to receive contacts to other stakeholders (e.g., the target group). Another interviewee mentioned that he used the interaction with an association for the revision of his proposal. Generally, there were no exchanges with such institutions or organisations during the implementation phase. During the final stage of the projects, some interviewees communicated with foundations and museums to enhance the circulation of their findings.

In general, our findings highlight important advantages for inclusion of non-academic actors and/or groups in the different phases of a research project (see Figure 11). These include in the proposal phase contributions to idea development, proposal refinement, access to "insider

knowledge" and establishment of useful contacts. In the implementation phase the advantages centre around aspects such as support in data collection, adaptation of research designs, provision of external resources and field access. In the exploitation phase the main advantages consist of feedback on results, discussions and dialogue, co-authoring and dissemination through more general as well as more specific communication channels. We can also conclude that many SNSF-funded projects are by no means confined to an "ivory-tower" mentality. On contrary, they include various non-academic actors throughout the different phases of a project to increase the relevance and potential outcome of their projects.

Figure 11: Transdisciplinary advantages during project phases



3.3 Productive interactions: challenges and attempted solutions

When asked about challenges that PIs experienced during transdisciplinary research processes and ways how they aimed to overcome them, the identified challenges and attempted solutions and skills were manifold. We have summarised them according to the following grouping:

Challenges of transdisciplinarity

1. **Systematic and regulative challenges:** In some cases, interviewees experienced systematic barriers when interacting with non-academic stakeholders. This was especially the case when researchers mainly worked abroad and were confronted with regulations unknown in Switzerland. Additionally, some research institutions in Switzerland (e.g., Pädagogische Hochschule, Art Universities), which are not allowed to award their own PhDs, found it difficult to act within the SNSF project framework as they depend on other institutions with regard to PhD students.

2. **Certain Stakeholders are hard to reach:**

    - It was reported that stakeholders belonging to institutions like official authorities, public administration, or other actors within the political and legal system, are more interested in controlling and delivering their own narratives than being questioned in the context of a research project.

- Institutions like hospitals or schools are usually very busy with tight schedules, which makes it difficult to recruit anyone for a research project. Moreover, managing a hospital (or other state-funded welfare providing institutions) also has a lot to do with politics. In complex institutions like schools and hospitals, multiple stakeholders with multiple interests are involved, who sometimes try to implement their own interests and downsize interests diametric to their own.
- Interviewed PIs reported, that accessing and approaching non-academic groups belonging to a marginalised group or groups in precarious situations is difficult. These groups often have little motivation to talk about their situation to outsiders or/and are too busy taking care of their own problems and thus are often not ready to deal with requests from researchers. Marginalised groups also often hold a defensive stance because of their precarious situation, so that even talking about their situation becomes challenge on its own.

"Of course, not all groups of people can be approached with the same ease, and there is of course what we find is, that above all, the people who are actually most affected, namely those in economically and socially precarious situations […]" Interviewee 5

"On the other hand, it is […] difficult to approach the really precarious people, people in precarious situations, excuse me, because of course they often see themselves pushed on the defensive by their precarious situation to such an extent that they don't feel like it at all, having to talk about it." Interviewee 3

- Interviewees also reported that some interest groups and associations (e.g. patient associations) tend to be sometimes suspicious vis-a-vis a research project and question the researchers' 'true/hidden' intentions.

3. **Challenges in communication:** Communication between academic and non-academic stakeholders can be challenging due to different knowledge, different practices or norms, different priorities or perspectives regarding the same topic or because they simply seem to speak different languages.

"The point is to make it possible to communicate to someone exactly what was actually relevant in the project, that is, this transferability of what one has actually experienced and worked out philosophically or politically, philosophically or literary-theoretically, whatever one may call it." Interviewee 9

4. **Different knowledge ….**
    - **… about scientific or methodological concepts:** One PI described issues in presenting generalised statistical results. Single practice partners involved in data collection did not feel represented and felt like their own experience was not reflected in those statistical results. On the other hand, we also learned that presentations for practice partners who have sufficient experience in statistics should not be too simplified.
    - **… about the prevalence of issues or disorders:** One interviewee involved in medical research reported that the medical practitioners underestimated the relevance of the research topic. They did neither understand nor listen when they were told about it because they were differently trained in dealing with this particular issue.
    - **… about how scientific investigations can be relevant in practice and everyday life:** As one interviewee elaborated, it is also part of a researcher's job to establish connections to increase relevance for non-academic audiences. Accordingly, it is essential to make abstract concepts accessible and concrete. However, it is often difficult to communicate this relevance not at least because the languages of the researchers and the practice partners can differ greatly (see below for a more detailed discussion).

- **…. theories and representations of phenomena:** Practice partners develop their own explanations of the issues they encounter every day (e.g. why a child acts in a certain way) and can have different representations of certain issues and concepts than researchers have. The confrontation of these differences can result in conflict, and connecting such different theoretical explanation attempts can become difficult.

"And I think such differences in perspective and also differences in, so to speak, theorising of the whole, simply has its potential for conflict." Interviewee 20

5. Also **different practices in decision-making** by public institutions or policy-makers can hamper productive interactions and prompt researchers to find a work-around, e.g. by talking to an NGO instead of the public administration to reach their goal. In particular, in political and legal research, practices and norms are highly dependent on political interests and political majorities, which can also fluctuate over the course of one research project.

6. **Different practices in using results:** While researchers are encouraged (by SNSF, their university, and the whole of the scientific community) to publish a lot and in particular in open access formats, this is disadvantageous for industry partners, who aim to protect a result and keep it to themselves in order to profit from it.

7. Sometimes practice partners seem to get the feeling that researchers are **criticising their practices** simply by investigating these practices, which can result in conflict. This is particularly difficult as researchers often depend on existing practice contacts to gain access to the field and to certain gatekeeper institutions. Thus, they could become reluctant in challenging their practice partners. To maintain balance between doing rigorous and independent research and keeping contacts for further studies was experienced as challenging by some interviewed PIs.

"There's this feeling of someone stepping on their toes, pointing out what was wrong." Interviewee 4

8. **Different priorities, interests and perspectives:** When interacting with non-academic practice partners and contacts, interviewed PIs were confronted with many different expectations of what their research should achieve. The scientific aspect of producing and disseminating knowledge can easily collide with the interests of practitioners, the industry, or the media, which sometimes are detrimental to rigorous scientific processes. We identified several areas of (potential and sometimes real) conflict of interests:

    a. **Producing knowledge vs. solving practical problems:** Researchers and practice partners often have different interests. Researchers want to focus on research, while practice partners want to solve their problems. Research takes a long time, is meticulous, and it is often unclear whether it will actually result in anything useful as the primary purpose of research is to produce knowledge (also knowledge about things that do not work). Practice partners often have the expectation that research can solve their current problems by providing specific solutions. This can result in a mismatch of expectations. In addition, the problems researchers identify in their projects might differ from what practitioners experience as problems, which can also lead to the rejection of results. Convincing practitioners of scientific results that are not in line with their everyday experience is a challenge.

"[…] the expectation, an excessive expectation of research, that it can solve problems that research doesn't actually solve at all, because it primarily produces knowledge." Interviewee 9

b. **Producing knowledge vs. making profit:** Similarly, researchers and practice partners from industry sometimes differ in their interests. Since industry partners focus on getting a product ready for market entry and making a profit, they are more focused on certain usable parts of the project and not necessarily on the overall research process. Additionally, they might differ in their conclusions and have different ideas of how to utilise the results.

"I think the main challenges for me was that we, me and my researcher, we were always thinking at the modelling level - let us say, how could these things better capture what we wanted to capture, while at the company level, if I remember, the interest was much more - how easily can we implement this, how fast they can go." Interviewee 19

c. **Producing new knowledge vs. sticking to own practice:** Phenomena investigated in research projects are often complex and multi-faceted. Some of the interviewed PIs encountered challenges in the communication with non-academic partners, especially when they were not interested in experiencing new facets of the phenomenon at study but rather stuck to their area of expertise or were discussing the phenomenon from a perspective irrelevant to the researcher. Some of the interviewees experienced a certain unwillingness of those non-academic partners in engaging in a discussion about new insights concerning a specific topic. This reluctance might be caused by the effort it takes to include these new insights into practice: the new insights might require changing protocols and routines, but they might also take more time and investments of already scarce resources.

"So, clinicians can be very reluctant to get into research issues, because they don't think that's their goal. They don't want to add preparatory time, they don't want to complicate clinical protocols." Interviewee 7

d. **Accuracy vs. catchy headlines:** Some of the interviewed PIs were in contact with media representatives, e.g. journalists, who interviewed them. They reported that they aimed to present their research accurately and objectively, whereas journalists were allegedly more interested in generating a catchy headline to spike interest. Particularly in research with vulnerable groups, PIs were concerned that these would be exploited or put at risk in exchange for a catchy headline.

"It is clear to me that the newspapers have a certain way of reporting the news that is not necessarily convertible for us or should be." Interviewee 10

"The media are of course looking for the catch, i.e. the headline they can make of it, that was / sometimes you have to swallow a bit and accept that they are looking for headlines, but that's okay." Interviewee 6

e. **Conflicting relationships with stakeholders:** It is important to realise that various different stakeholders associated with a research project can also have conflicting relationships with each other, for example through diverging interests, or because they are embedded in a hierarchy defined by different priorities and perspectives. Negotiating these relationships and deciding on which interests to focus can be a challenge for researchers.

"You always will have different groups of people and probably this raises the problem of who are the stakeholders, so, when in social innovations teams they say, "oh make it usable for stakeholders", okay, but who are the stakeholders, are there conflicts within the stakeholders, are hierarchical effects in the sense that, for example very clearly in the kind of work that I do." Interviewee 2

f. **Negotiating:** If practice partners are more strongly involved in the planning and or implementation of a research project, challenges can arise when negotiating the terms of joint contracts or agreements with them as there are different understandings of the phases in a project and research cycles or what to conclude from research results.

9. **Different terminology** – different terms, concepts, horizons of understanding: Some of the interviewed PIs expressed challenges regarding the use of a certain professional language, which hampers understanding, both in the sense of country-related language issues and discipline/field-related issues. This includes the naming or mentioning of specific acronyms, names, and terms that are used in certain disciplines or sectors.

    - Especially when dealing with highly formalised institutions such as political, legal or administrative actors, who have their own formal "language", conflicts and frustration can arise when the communication does not work, which can also lead to withdrawing of partners.

"And then also to understand the whole language of the administration, so to speak, and the whole language of the political structure in general, we have seen that, with all the good will that is present, there are also a lot of areas of friction, there are a lot of misunderstandings, there are a lot of people who get out of this process relatively quickly in frustration." Interviewee 8

    - In some practice contexts, non-academic partners have difficulties in understanding scientific terms and concepts. Sometimes they show a general reluctance towards "scientific language", as they feel it is too abstract and too distant from their everyday work.

"Perhaps the scientific language is not understood, or no attempt is made to understand it, that there is a certain defensive attitude towards research, the findings from science, that is complicated and has little to do with my practice." Interviewee 11

    - Language difficulties not only arise when communicating with practice partners but also with researchers from other disciplines. It can be a challenge to find a common terminology and jointly identify common goals and strategies in interdisciplinary settings. Collaboration between disciplines thus requires that researchers listen to each other, teach each other, and learn together. These challenges are relevant because – according to the interviewees - funding schemes increasingly require or foster interdisciplinary projects and teams. Still, this is experienced as very difficult for some researchers.

    - Researchers also need to adapt their behaviour and communication towards practice partners, as pointed out by one interviewee. It is not helpful if researchers tell practice partners what to do, because they know very well which problems they experience. Communication should rather be approached as joint development of ideas and solutions. At the same time, presentations of research results should be adapted to the level of knowledge and usual language of the audience.

"[…] who are really far away from an academic education, and you want to somehow sensitise them to the topic, but at the same time present serious research - and that is sometimes not so easy." Interviewee 3

    - Some PIs also experienced language barriers when dealing with international practice partners or stakeholders. These barriers can result in missing some subtleties when conducting interviews in qualitative research but also when interacting and networking. This makes accurately communicating exhaustively difficult and sometimes excludes stakeholders and potential beneficiaries from benefiting from research.

10. **Resistance and opposition:** Some researchers experienced resistance and opposition to their project in discussions with non-academic partners or contacts. One interviewee mentioned that they felt offended by the research activities (e.g. questioning a concept, evaluating the success or failure of activities). This resistance came from people who felt attacked; they started to avoid interactions and questioned the meaningfulness of the project.

Skills for transdisciplinary research

The interviewed PIs identified skills, which they regarded as essential to enhance the cooperation and facilitate exchange with non-academic stakeholders.

1. **Value-free communication:** Several interviewees stressed that value-free communication can facilitate the exchange with stakeholders, especially when dealing with controversial topics. According to one PI, this is particularly crucial when talking to the media since statements might be used out of context to emphasise the media's narrative around a certain topic. Another interviewee stressed that while it is common in her field to have a normative perspective on the topic, she tried to stay as objective as possible in order not to bias the research. It was also stressed that value-free communication is helpful to break down barriers between two opposing sides who might have remarkably different opinions on the research phenomena under scrutiny.

"If you (…) have an interest in seeing it through, then you know, it is part of developing relationships, right, with these individuals, and multiple meetings and engagements, and so after a while you start to learn their language and, you know, how they are approaching a problem, and they start to learn yours, and what you can do or cannot do. And then you start to appreciate when they are uncomfortable, because they do not quite understand what you are saying. And they appreciate when you are uncomfortable, because you do not understand quite what is involved, right. So, it may be uncomfortable, but it is part of the fun of breaking out of your box, and in this case, with the purpose of engaging in a project that would have greater societal innovation" Interviewee 12

2. **Concreteness:** Similar to the issues of value-free communication, some interviewees mentioned concreteness as a useful skill for interactions with actors outside academia. A message should be as clear and easily understandable as possible not to leave room for misinterpretation, which could create problems for both parties, sometimes even leading to conflicts. One interviewee claimed that in order to talk to decision-makers or businesses, he tries to avoid "irrelevant information" and always uses facts and figures to underline his main points. Another interviewed PI stressed that vagueness causes uncertainty, which leads to inefficient communication. This can, inter alia, be avoided by using examples.

3. **Making a topic accessible:** Another related aspect to those mentioned above is the skill to make a research topic as accessible as possible. Several PIs stressed that different stakeholder groups have different knowledge of and interests in the researched issue. Hence, in order to ensure the participation of and effective communication with stakeholders, the topic should be apprehensible for as many stakeholders as possible. The interviewees highlighted that different ways of communication tailored to a certain target audience are useful to make the discourse around a project as inclusive as possible.

4. **Practice experience:** Additionally, a few interviewees stressed that their previous experience of working with non-academics had helped them to acquire skills needed for transdisciplinary research. Two interviewees, who also work at non-academic institutions, underlined that this allows them to gain knowledge from inside the field as well as constant feedback from practice partners. Others highlighted that the success of transdisciplinary exchange strongly depends on the level of experience in communicating with non-academic stakeholders.

5. **Staying in discussion:** In order to facilitate communication with stakeholders, many interviewees emphasised the need to create long-term contacts. Although this is not possible for some stakeholder groups (e.g. society at large), staying in touch with

professionals, institutions or civil actors can help build up trust and maintain and deepen relationships in the field. One interviewee summarised this the following way:

"So, it is an evolutive thing, but I understand that [in] a continuous trust relationship, [i.e. a] relationship where people from one session to the other, one meeting to the other, one gathering to the other, […] get to know you better; and I talk abundantly about what I am doing and in a way that evolves also in time, it is very informal, but I think it is central for the circulation of ideas." Interviewee 2

Hence, preserving a network of relevant stakeholders can be beneficial in many ways. First, it eventually leads to more in-depth interactions as people get to know each other and build up trust. Second, the cultivation of productive relationships can stimulate the development of project ideas and future projects.

6. **Create knowledge transfer:** One central aspect that was highlighted by many interviewed PIs is the creation of knowledge transfer. This has several facets. Firstly, some interviewees claimed that including students (through teaching but also through inclusion in projects) is an essential way to transfer knowledge. Others stressed that dissemination at conferences and events fosters knowledge transfer between different universities but also different stakeholder groups.

   Some interviewees stressed that more support regarding the transfer of knowledge would be helpful to promote either internal exchange, inter-departmental exchange or transdisciplinary endeavours. One interviewee mentioned the concept of "open innovation" which fosters the circulation of knowledge instead of a *"one-sided, one-way transfer"*, where universities can play a key role.

7. **Personal commitment from partners:** A few interviewed PIs expressed the necessity of personal commitment from all sides. According to one interviewee, research is time and energy consuming, which is why efficient cooperation can reduce the workload for everyone involved. However, cooperation can also be very tiring, especially if partners are not fully committed. This unnecessarily consumes time and energy, which would be better needed to finish projects properly. Another interviewee criticised funding schemes where researchers are "forced" to collaborate because an international consortium is required. Accordingly, while this collaboration can work out very well, it can also go very wrong when people do not know each other and are *"pick'n'mixed".*

8. **Mediating role/broker:** The uptake of a mediating role can benefit transdisciplinary research. One interviewee who worked with stakeholders that had significantly opposing interests stressed the importance of *"sharing information, objectifying the debate and putting the arguments back on the table in a disciplined discourse".* Accordingly, researchers who bring together diverse stakeholders also need to be skilled in negotiating interests and de-escalating conflicts. Another interviewee claimed that in order to bring the practice and the academic side together, researchers have to take on a mediating function:

"And I think that from the point of view of communication, of course you have to, you have to try to shape communication in such a way that it is understood by the practice contexts. And that needs both sides. So for me, creating relevance to practice is actually the task of science and practice together. And that presupposes that one has an understanding of both worlds. So we often talk about a double competence profile that we want to bring along or develop." Interviewee 13

9. **Knowledge brokers:** Some researchers who experienced challenges in communication tried to facilitate communication through the help of third parties, which can be regarded as knowledge brokers. This can be NGOs, project partners, who also have experience in

applied fields, or well-meaning contacts from the practice field, who are in support of the research project under scrutiny. A knowledge broker should be someone who is familiar with the routines and practices of the respective institution, is familiar with the people that work there and are in charge, and can convey the project's relevance, thereby also implementing a first transfer of knowledge. However, a knowledge broker needs to be similarly acquainted with communicating with researchers too, meaning they need to understand the issue at hand, be familiar with research processes and research methodologies, and with academic discussions. Thus, a knowledge broker is a bridge that is firmly anchored in research and practice. They are especially important, when dealing with topics regarding more vulnerable or excluded groups. Then knowledge brokers also act as a voice representing them, if it is difficult for them to speak for themselves, for example, in the form of interest associations and NGOs. A second setting in which knowledge brokers are particularly important is politics and in exchange with public administration, where tacit knowledge is required for efficient communication and knowledge transfer.

"The first thing I have to do is, I have to, within each of these ministries or organisations, identify an "insight champion", someone who works in this ministry, who is convinced of the project and can convince his peers why this is a useful thing to try for the ministry. Because, these people are embedded in the organisation, speak the language of the organisation, and so are much more effective than I will ever be in making a case for trying that." Interviewee 9

4) TOWARDS NEW SOCIAL PRACTICES? MOTIVATION, INTENTION AND TARGETED OUTCOMES

4.1 Motivation and agency

Intention and agency are central elements of the applied definition of social innovation (see Table 1). The type of motivation that drives academics is important to understand the content orientation, the design, and the results orientation of the research project under scrutiny. While it can be assumed that the pursuit of knowledge per se is an important underlying motivation of researchers, alternative motivations beyond this, such as contributing to more immediate economic or social value, cannot be taken for granted. And even if this is the case, researchers set different boundaries in terms of the added value they want to bring to the economy or society, whether as a free will decision or as a requirement on the part of the research funder. While social sciences and humanities scholarship, for instance is often committed to do research for the good of society, the interest of SSH researchers is often not oriented towards producing usable results, let alone actual solutions, but rather to raise awareness and influence society to create capabilities of self-understanding in different contexts (Reale et al. 2019; Benneworth 2015; Nussbaum 2010).

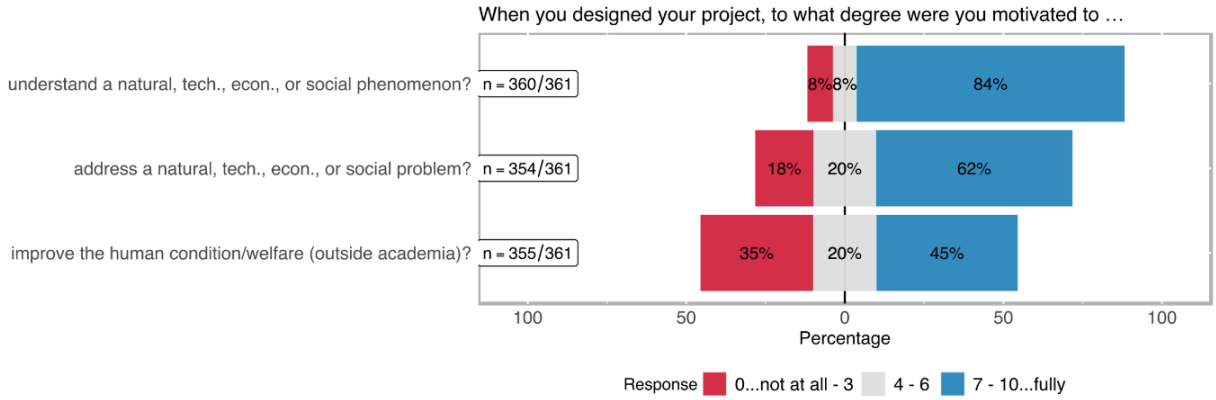
The initial motivation types measured through the survey consist of three main categories, namely,

a. motivation to *better understand a natural, technical, economic, or social phenomenon* (basic academic motivation that drives research),

b. to *directly address a natural, technical, economic, or social problem* (use-inspired research),

c. to *improve the human condition/welfare* (motivation to create change outside of academia).

Figure 12: Distribution of different motivation types



The basic academic motivation to better understand a natural, technical, economic or social phenomenon was strongly emphasised by the PIs in the survey (see Figure 12): 84 % of the survey respondents rated academic motivation greater or equal to 7 on a 0-10 scale. This was followed by the motivation to directly address a problem (64 % of the respondents noting equal or higher levels than 7). Improving the human condition/welfare, i. e. the motivation closest associated with social innovation, namely to cause change outside of academia, was more

balanced in comparison. 35 % of the respondents replied with levels equal to or smaller than 3 and 45 % with levels equal to or higher than 7. P

We can conclude that the motivation portfolio of SNSF-funded principal investigators (PIs) is not one-dimensionally oriented towards only the basic scientific motivation of better understanding a phenomenon, but includes also a remarkable share of problem-orientation and use-inspiration including a quite strongly expressed notion of doing well for human condition/welfare. A high proportion of SNSF-funded projects have thus the motivational potential to more directly contribute to innovation and change, including social innovation, through their research.

Table 5: Distribution of different motivation types

	better understand a natural, technical, economic, or social phenomenon? (n=360)		**directly address a natural, technical, economic, or social problem?** (n=354)		**improve the human condition/welfare (outside academia)?** (n=355)	
rating *0.. lowest 10.. highest*	**abs**	**%**	**abs**	**%**	**abs**	**%**
0	14	3.89%	23	6.50%	47	13.24%
1	1	0.28%	7	1.98%	23	6.48%
2	8	2.22%	25	7.06%	30	8.45%
3	6	1.67%	10	2.82%	26	7.32%
4	12	3.33%	16	4.52%	16	4.51%
5	9	2.50%	28	7.91%	43	12.11%
6	6	1.67%	26	7.34%	12	3.38%
7	17	4.72%	36	10.17%	41	11.55%
8	42	11.67%	56	15.82%	53	14.93%
9	38	10.56%	28	7.91%	15	4.23%
10	207	57.50%	99	27.97%	49	13.80%
no response	*1*		*7*		*6*	

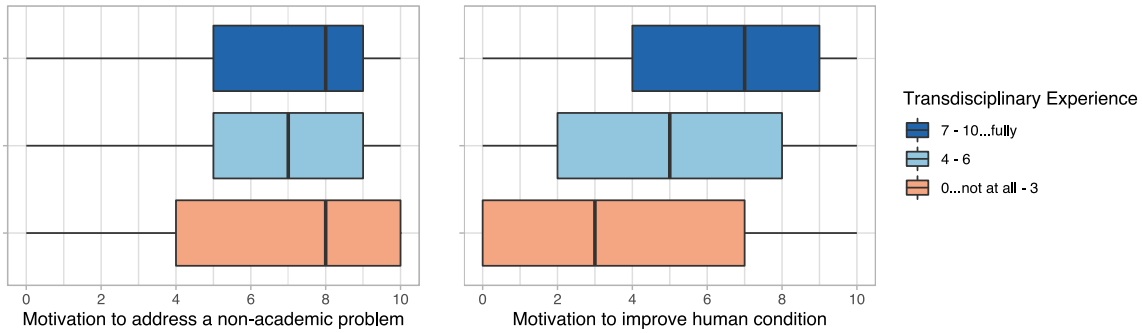
Table 5 details the results aggregated in Figure 12. The extreme values are interesting. Almost 58 % of the PIs who responded to the survey (n= 361), ranked the intrinsic scientific motivation to understand a phenomenon with the highest mark (i.e. 10 on a scale between 0 and 10). An explicit refusal of the motivation to improve human condition/welfare with the lowest mark was provided by roughly 13 % of the responding PIs, which is almost the same share as approvals with the highest mark.

In the academic literature, it is often pointed out that transdisciplinary research practice usually also aims to go beyond the pursuit of scientific understanding of a phenomenon, and in particular also pursues problem-solving objectives. Thus, one of our central hypotheses was to test if transdisciplinary research experience is in SNSF-funded projects strongly related to the willingness, firstly, to research real-life problems and, secondly, to contribute to the improvement of the human condition/welfare.

- H_3: the *transdisciplinary experience* of the interviewed researchers correlates with
    a) the *motivation to address a problem outside of academia*, and
    b) the *motivation to improve human condition/welfare*.

The analysis of the relation between *transdisciplinary experience* and *the motivation to address a (non-academic) problem* (see Figure 13) did not yield a statistically significant correlation (correlation coefficient rho[20] ~ 0.01 with a p-value > 0.05[21], see Table 16 in ANNEX-II for further details). This means that more *transdisciplinary experience* does not necessary imply a higher *motivation to address a problem outside of academia* [a] or vice-versa, the motivation to address a real-life problem is not necessarily based on transdisciplinary experiences.

Figure 13: Relation between transdisciplinary experience and the motivation to affect change outside academia



On the other hand, the *motivation to improve the human condition* correlates relatively stronger with *transdisciplinary experience*. Although it is statistically significant (p-value < 0.05), there is only a weak positive correlation (rho ≈ 0.33) between the two [b] (see Table 16 in ANNEX-II for further details). Still, researchers who explicitly want to improve the human condition/welfare, i.e. not only to investigate a technical, social, ecological or medical problem, but who aim to contribute to a change aspect (i.e. an improvement) are firmly based in transdisciplinary experience horizons. In more general words, a significant relationship between experience in dealing with transdisciplinary research and the intention to change exists. How far this intention to change is related to a change in social practices (or, for example, the provision of a better medicine to improve the life of a patient) was not further investigated in the survey.

Agency, however, has not only an intrinsic component (motivation), but can also be triggered by impulses from outside the academic world. Most of the impulses from the non-academic world that motivated the interviewed PIs to start their projects relate to specific health/medical problems (33 %), followed by specific societal problems (26 %) or specific technical problems (19 %) (see Table 6). The outside impulse least mentioned by the surveyed PIs was to tackle a specific economic problem (8 %).

[20] After the consideration of dominant variable types and distributions, as well as the often non-linear relationship between variables, the Spearman correlation method was chosen to test for correlations. The *correlation coefficient* is indicated by the English spelling of the common symbol of Spearman's rank correlation coefficient symbol **ρ**, i. e. **rho**. The reason for this is to clearly distinguish between the very similar-looking **ρ (rho)** and **p**, as in the **p-value** that is often shown in parentheses.
[21] Study-wide, the α value is 0.05.

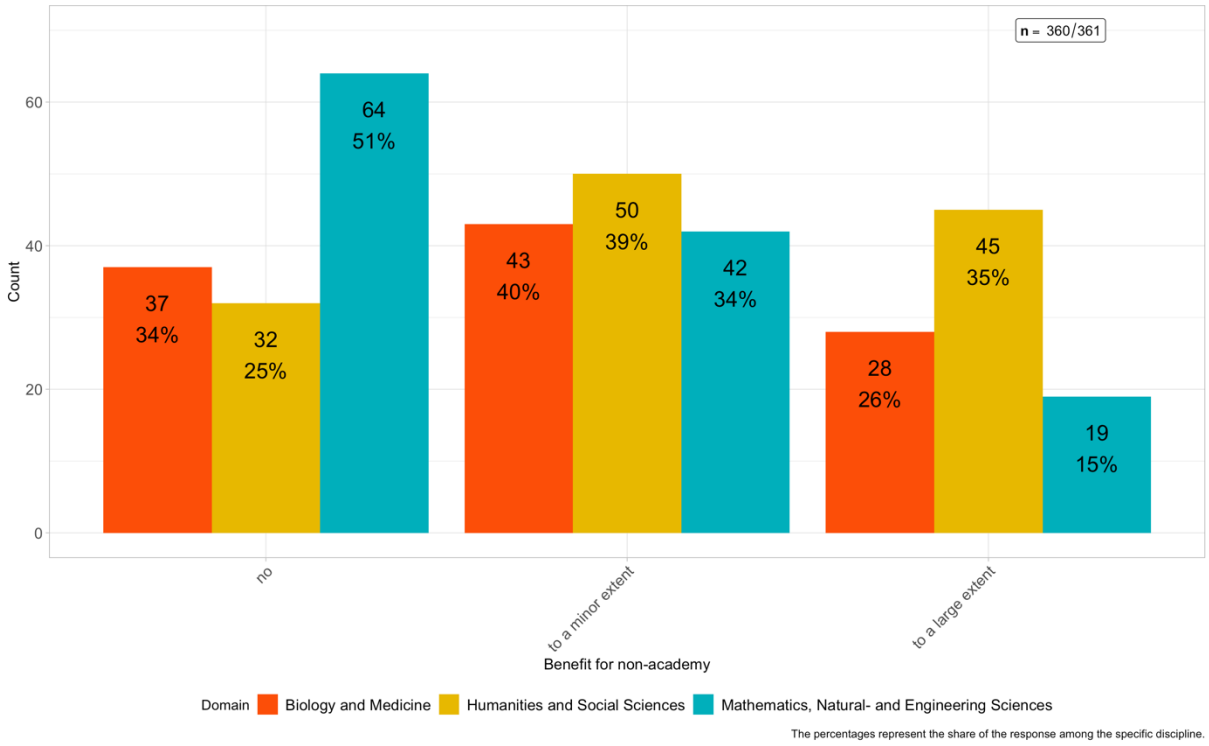
Table 6: Distribution of impulses from the non-academic world (multiple choice)

response	abs	%
a specific societal problem	94	26.04%
a specific economic problem	29	8.03%
a specific ecological/natural problem	53	14.68%
a specific health/medical problem	118	32.69%
a specific technical problem	70	19.39%
Other	62	17.17%

4.2 Intention to benefit social groups and tackle social purpose

As also evidenced by the interviews with PIs from SNSF-funded projects, a broad spectrum of social intentions of PIs with regard to benefiting the public exists. Nevertheless, approximately 37 % of the respondents reported that their projects were not specifically designed to benefit any social group outside the academic world. Almost exactly the same share responded that groups outside of academic world were targeted to a minor extent by their research projects. 25 % of the respondents finally noted that their projects were specifically designed to generate a benefit for the general population or a specific social group outside the academic world.[22]

Figure 14: Distribution of extent to benefit target groups outside the academic world across scientific domains



[22] See Figure 31 in ANNEX-II for a graphical representation of this distribution.

Figure 14 breaks these numbers down by scientific domain. It clearly shows that *Mathematics, Natural- and Engineering Sciences* have the highest share of projects which do not intend to benefit any target groups outside academia. Among those projects which intend to contribute to a large extent to target groups outside academia, *Humanities and Social Sciences* make the highest claims. However, also 26% of all *Biology and Medicine* projects and 15% of all *Mathematics, Natural- and Engineering Sciences* projects intend to contribute to a large extent to target groups outside academia. Conversely, 25 % of SSH projects were so designed that they do not target a specific non-academic group.

Table 7 shows these values broken down by *funding instrument*. Apparently, none of the three scrutinised funding instruments of SNSF excels in terms of a considerably higher share of a response category compared to the overall distribution across categories. The exception seems to be *interdisciplinary projects* but their numbers in each of the response categories are too low to be considered solid evidence. In fact, this kind of distribution largely reflects the distribution by funding instruments across all further questions. Therefore, we refrain from presenting tables or figures on the distribution of items differentiated by funding instrument, which offer little information value.

Table 7: Distribution of impulses from the non-academic world (n = 360)

	Project funding		**Singergia**		**Interdisciplinary projects**	
response	abs	%	abs	%	abs	%
no	115	37%	15	33%	4	36%
to a minor extent	117	38%	18	40%	2	18%
to a large extent	75	24%	12	27%	5	45%
no response	*1*					

Before exploring in more detail the social purpose of the projects (if any), we were interested in exploring what kind of problems were addressed within the funded SNSF projects. As expected, every project had its unique problem focus, which however can be broadly classified into five categories:

1. Medical focus: e.g., medical treatment and better understanding of illnesses
2. Political focus: e.g., migration, democracy and political systems
3. Ecological focus: e.g., waste and air pollution, sustainable city planning
4. Social focus: e.g., education and training of teachers, unequal housing conditions; social work
5. Economic focus: e.g., market shocks and financial markets
6. Issues in humanities: e.g. art and theology

While the problems addressed in some SNSF-funded projects can be easily classified into one of the above groups, some fall into several categories. Correspondingly, some interviewees

argued that their research objectives touch upon several problem foci and are not entirely falling under just one category. One interviewee thus highlighted:

"I think my focus was more of an ecological nature, although of course that interacts, or the ecological and the social have very strong interactions, interrelationships."

During the interviews, we were also asking PIs if there was a social purpose in their research and whether this purpose was already there at the beginning or whether it emerged during the project. The existence of a social purpose as a driver for research is important, because as described in Section 3.2, it is one of the key factors defining social innovation.

More than half of the interviewed PIs identified a clear social purpose; half of these had a SSH background.[23] While most interviewees reported no change of the social purpose during their projects' duration, some stated that the social purpose intensified during the project implementation. One interviewee, for example, pointed out that the research team designed the project without having a precise social goal in mind. This then changed as more exchanges with stakeholders took place and dissemination activities started. Hence, communication and interaction can help alter perspectives and put research in a social context.

We were also interested in how the researchers aimed to achieve the intended social purpose through their projects. We distinguished the answers of the surveyed PIs into three categories:

1. **Prevention:** Some PIs noted that the main instrument for achieving the social aim of their project was to prevent certain situations or circumstances. In many cases, this was the prevention of an illness or psychological disorder.

2. **Better understanding:** This category was by far the most prominent feature of addressing a social purpose. It corresponds to the overall motivation pattern of SNSF-funded PIs as evidenced by the statistical results discussed above. Many interviewees highlighted that much was unknown in their research field, which made it necessary to delve deeper into details in order to better understand the research phenomena. It further became apparent that most often inter- or transdisciplinary research designs had the goal to conceive phenomena differently. By bringing different actors or disciplines together, research problems can be explored utilising the advantages of different angles. A few interviewed PIs also stressed that while their main goal was to better understand a research phenomenon, this was indirectly linked to the adjustment and improvement of practices. For instance, it was argued that providing new information for practitioners or the policy level presents the basis for action and decision-making. On the other hand, one interviewee stressed that the aim of fundamental research is to better understand a problem and not the creation of social impact.

"But our goal was first and foremost a scientific one in the sense that we wanted to develop a better understanding and explanations and not necessarily to change the world - that was not necessarily our primary goal." Interviewee 3

3. **Improvement of, e.g. practice of medical treatment, education, gender disparities:** Another means to achieve a social purpose is to work on the improvement of the issue that is researched. This purpose goes further than the aim to better understand a phenomenon, as it anticipates actions that need to be taken in order to achieve such an improvement. Here the purpose to contribute to change is clearly

[23] Please take not of the interview bias caused by the selection of interviewees (i.e. those with a high familiarity with SI or transdisciplinary research).

evident. The application areas, however, are very diverse and range from the improvement of a product to the improvement of medical treatment or the mitigation of gender disparities. Many interviewees who reported that their goal was to improve something also said that it is essential to first better understand the researched topic. One interviewee clearly stressed that while more detailed knowledge about a phenomenon is crucial, the motivation to improve the current situation is crucial for change or impact.

What became apparent is that many interviewees, irrespective of their research field, had not only a social purpose in a narrow sense but also other intentions in mind. Accordingly, some interviewees highlighted that it was crucial for their project not only to consider the narrow social aspects of the research topic but broader social aspects too, such as economic, ethical or legal aspects. Often these aspects seem intertwined and are essential to be acknowledged when aiming for societal impact.

"We knew, when we studied these particular files, that there were social elements. But we couldn't dissociate these social elements from the financial, technical and technological elements, which were completely integrated into these discussions." Interviewee 7

In other cases, interviewees highlighted no social purpose nor immediate social benefit or argued that the direct social aspect was not immediately recognisable. Several interviewed PIs then stressed that there might be a social benefit, but a rather indirect one or one that develops over a longer period of time. One interviewee reported that the research team realised after the project that the social potential of their research had not been exhausted, which then led to follow-up projects with a more specific and clearer social purpose orientation.

Intended change amongst whom?

To better understand projects' purposes for certain target groups, several true/false statements were posted in the survey (see Table 8).

Table 8: Distribution of target group goals

Goal	no		yes	
	abs	%	abs	%
targeted a group of people with specific social needs (n= 221)	151	68.33%	70	31.67%
included socially disadvantaged or marginalised people (n=219)	170	77.63%	49	22.37%
worked towards improving people's lives (n=222)	55	24.77%	167	75.23%
aimed at empowering people (in general or specific groups) (n=221)	131	59.28%	90	40.72%
enabled diversity and exchange of different perspectives (n=221)	108	48.87%	113	51.13%

Note: Shares do not relate to the overall survey population (n=361), but only to those with an intent to benefit non-academic target groups.

Most of the respondents to the survey who aimed to benefit non-academic target groups intentionally (i.e. by creating a deliberate research design to benefit non-academic target groups) (n= 227) had a rather universal view regarding the target groups of their research and responded that they work towards improving people's lives in general (see Table 8). These are 46 % of the total responding survey population (n= 361). 50 % of the surveyed PIs who aimed to benefit non-academic target groups had the objective to enable diversity and exchange of different perspectives, which is an important feature of awareness raising. This corresponds to 31 % of the total sample to the survey (n=361). 41% expressed an intention to empower

people in general or specific groups. This corresponds to 25 % % of the total sample to the survey (n=361). 32% of those who aimed to benefit non-academic groups, targeted a group of people with specific social needs and 22% even included a socially disadvantaged or marginalised group in their research (see Table 8). In terms of the overall survey population (n=361), these were 20% and 14% of the survey participants, respectively.

The interviews with PIs provided additional details, which are summarised below along the main target groups.

1. **Practitioners:** Approximately one-fourth of all interviewed PIs said the change they wanted to contribute to addressed practitioners. While practitioners differed vastly in their background, most PIs had a similar concept of including them in their study. It was stressed that when trying to achieve a change in practice, it is crucial to meet practitioners on an equal level. This encompasses transdisciplinary sills as already mentioned in Section 4.3, e.g. finding a common language, avoiding a too scientific narrative and building trust. Moreover, the exchange should be a mutual dialogue rather than a one-sided information provision. Hence, including practitioners in a project brings many challenges. Yet, all interviewees who included practitioners in their research projects emphasised this as a very effective way to achieve change as they directly influence structures within a system and most often have the power to influence both the discourse around a topic as well as other stakeholders.

2. **Policy- and decision-makers:** Policy- and decision-makers were also perceived as a target of intended change by some interviewed PIs. One interviewee highlighted that in order to change norms and attitudes in the "practical world", policy-makers need to be addressed directly as they significantly influence everyday practices by implementing policies and regulations. Similarly, several interviewees stressed that in many cases, structural change could only take place when politicians have a better understanding of the situation within institutions and organisations and "good policy-making" depends heavily on the information that decision-makers have.

   Many interviewees stated that intended change is directed at more than one group within the same project, some of which are easier to reach than others. One interviewee pointed out that it is necessary to bring the target group and decision-makers to the same table in order to be able to design needs-based policies. This demands a continuous dialogue, which is not easy to create and sustain:

"What we notice is that from all these discussions, at least on the part of the city, the question of how this whole communication process has to be designed has been discussed again and again, new formats have always been tried out, well, I can see that, that's it such a continuous process of dialogue between those doing the research on the one hand, those affected on the other and the city authorities on the third side, and I have already noticed that this/this feedback, the reflection, so to speak - what is happening there , which groups are there, why certain groups don't come to the events, why don't certain groups take part in the discussion, that this leads to the city thinking about this process relatively intensively." Interviewee 9

3. **Society:** While most interviewed PIs did not specifically mention the role of society in their projects at the beginning of the interviews, almost all of them mentioned later on that society was either directly or indirectly affected by their research. However, this effect might not be immediately visible. In many cases, society cannot be excluded from the broader picture as research phenomena do not only concern immediate stakeholders and target groups. One interviewee emphasised that while the direct aim of research was to change the practices of public authorities, it was also essential to raise awareness amongst the wider society as this is indirectly linked to what is seen as appropriate or inappropriate.

4. **Institutions/Organisations:** National and international organisations were also named as intended subjects of change. One interviewee, who dealt with pollution, stressed that international organisations (e.g. the UN) have enormous influence and power when it comes to norms and regulations on a global level. Including such organisations in a change process was regarded as extremely important by a few interviewed PIs. Another interviewee worked together with national associations with the aim to raise their awareness concerning intra-country disparities concerning field-specific practices in Swiss cantons. He stressed that often cantonal authorities are too busy to engage with what happens in other cantons, which leads to differing quality in service provision. Bringing these stakeholders together at conferences or colloquia can foster exchange and learning.

5. **Specific target group:** Transformative intentions can also be targeted at a projects' very specific target group. On the one hand, interviewees mentioned that projects could have an empowering element, through which their specific target groups are able to engage with other stakeholders and are ultimately part of the debate they are affected from. On the other hand, projects can have a reflexive element for participants. One interviewee reported that she presented the data (e.g., recorded videos) and preliminary findings to the participants of the projects to gain additional reflections.

"[P]articipation procedures made them think about that by themselves and this is a way that I would call that a form of empowerment in the sense, it is not me going to them and saying, "look, you are doing badly here", but I just show what they do, I show the consequences of, also minor details of their practice and their consequences and in general, this produces their own conclusions, or consequences, and I think that this is a way much better, because you keep them to analytical tools that they can a way apply to themselves, rather than giving them normative principles or normative recipes, and I always reframe from the / yes, recipes or prescription or this kind of things." Interviewee 2

6. **Media** was also identified as an important actor of change. Approaching them directly and trying to include them in the project can at least partly contribute to a communication based on scientific results. Moreover, the power of the media to influence society at large but also politicians was underlined. One interviewee mentioned that one way to change the practices of decision-makers is to bring the media to report about projects and academic insights in order to raise awareness and interest among policy-makers:

"[M]edia sometimes can exert pressure, at least by creating a debate and creating sometimes social movements, and so we always hope that this will exert some pressure on policymakers." Interviewee 3

7. **Industry:** A few PIs also intended to evoke change in the industry. Although it was emphasised that fundamental research has often limited direct impact on industry, it can offer essential insights that might, in the long run, result in changes within a certain industry. Furthermore, including industry partners as possible actors of change can benefit both sides. On the one side, understanding the needs and challenges industries face can advance academic research. On the other hand, industry can benefit both from academic knowledge directly but also from sustaining exchanges that might prove to be valuable for future projects.

8. **Scientific community:** Some interviewees also mentioned an intention to change parts of the ways academic research is conducted. One interviewee, for example, highlighted that one of the novelties of her project were the interdisciplinary aspects, which are not

common in her field. Accordingly, she made great efforts to spread the benefits of inter-disciplinary research amongst other scientists formally by giving talks at conferences but also informally by reporting about her experiences to colleagues whenever possible. Hence, transformative actions do not always need to be targeted at non-academic actors. A combination of changes within and outside of academia can prove successful when aiming for social innovation.

Intended change of what?

In the online survey, we asked about intended changes to approximate potential project outcomes, both in the long and short term. We differentiated four categories of effects:

(i) improving understanding as most generic effect of scientific research;

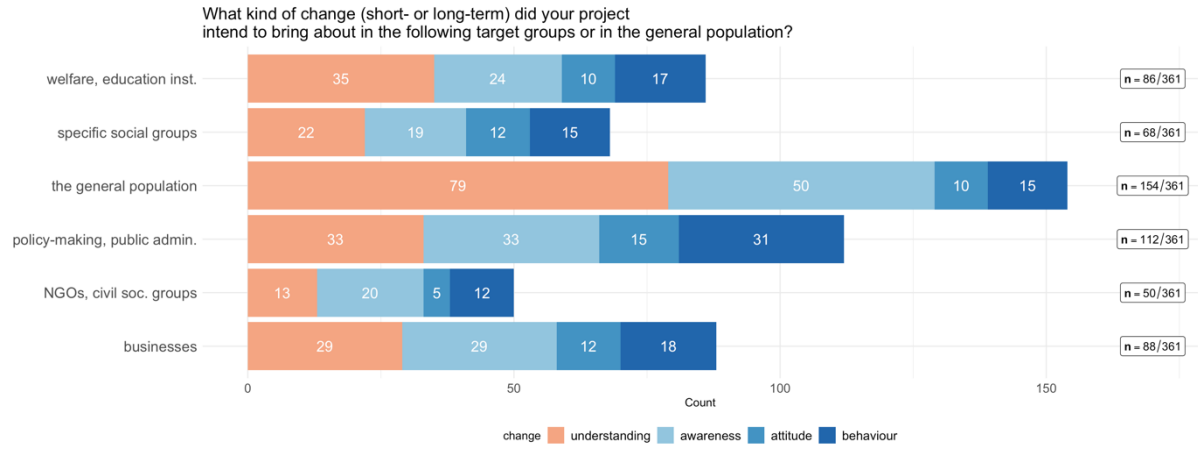
(ii) raising awareness of an issue;

(iii) changing attitude, which has a normative change connotation, and

(iv) changing behaviour, which has an action-oriented connotation.

Improving the understanding followed by *raising awareness* were the most frequently selected categories of the survey participants (see Figure 15). Other arguably stronger types with regards to changes in practice fields (i.e. attitude and behaviour) were less frequently mentioned. Interestingly, an intended change of behaviour was more often named than an intended change of attitude. Both can be regarded as proxies for at least an expected change in social practices, which is the central object of social innovation.

Figure 15: Distribution of intended change



Broken down by target groups[24], the principal investigators (PIs) mainly intended to generate change effects in the general population (mostly a change in understanding and awareness). The second largest target group for which change effects were intended by PIs were policy-makers and public administrations, followed by welfare and education institutions as well as businesses, specific social groups and – least – NGOs or civil society groups (see Figure 15). It is interesting to note that 31 PIs of SNSF-funded projects responded that the intended effect

[24] The target groups were "welfare and educational institutions", "specific social groups", "the general population", "policy-makers and public administration", "NGOs, civil society groups" and "businesses".

(or one of the intended effects) of their research project was a behavioural change among policymakers and/or public administration. This means that around 8 % of all scrutinised SNSF PIs have a clear policy action agenda.

The intentions to trigger a change of attitude or even a change of behaviour were highly expressed towards the target groups of "policy-makers and public administration" as mentioned above (39 % of those PIs who targeted this group intended to generate a change of attitude or behaviour among this target group), but also to "NGOs and civil society groups" (39 %), "specific social target groups" (37 %), "businesses" (30 %) and "welfare and educational institutions" (29 %). We can summarise that around a third of all PIs, who targeted a specific social group, did go beyond the intention to change understanding and/or to change awareness through their projects. In other words, quite a substantial part of SNSF-funded projects, which consider a target group for their projects, goes beyond a defensive stance in terms of intended change to be triggered by their projects.

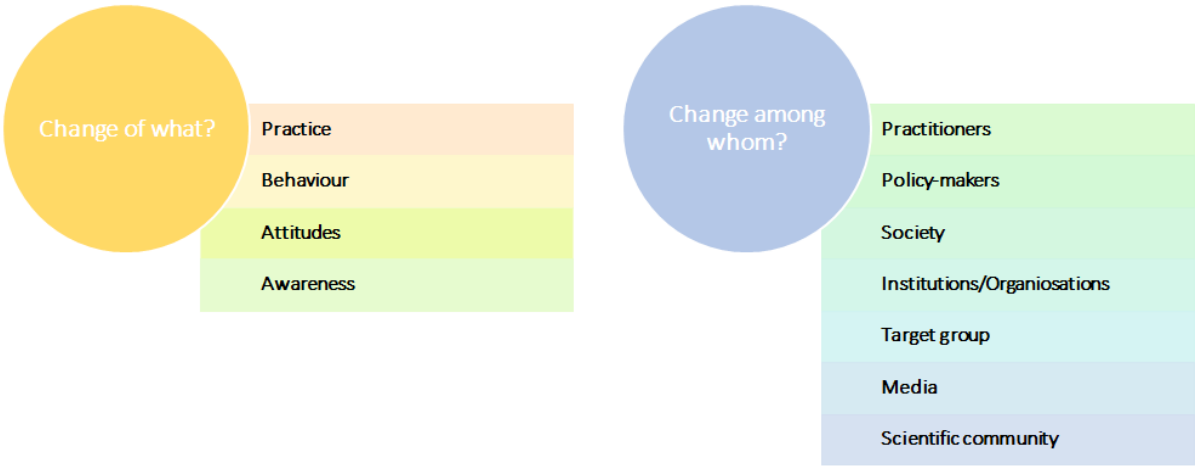
Table 9: Distribution of intended change

Target audience	Changing … understanding		awareness		attitude		behaviour		other	
	abs	%	abs	%	abs	%	abs	%	abs	%
the general population (n=170)	79	46.47%	50	29.41%	10	5.88%	15	8.82%	16	9.41%
businesses (n=100)	29	29.00%	29	29.00%	12	12.00%	18	18.00%	12	12.00%
specific social groups (n=73)	22	30.14%	19	26.03%	12	16.44%	15	20.55%	5	6.85%
welfare- and education-providing institutions (n=93)	35	37.63%	24	25.81%	10	10.75%	17	18.28%	7	7.53%
NGOs, advocacy or other civil society groups (n=53)	13	24.53%	20	37.74%	5	9.43%	12	22.64%	3	5.66%
policy-making, public administration, governmental agencies (n=117)	33	28.21%	33	28.21%	15	12.82%	31	26.50%	5	4.27%
academia (n=312)	219	70.19%	32	10.26%	21	6.73%	28	8.97%	12	3.85%

In Table 9 academia is also included as an intended target group of the surveyed PIs, which is the case for almost 90 % of all funded SNSF projects. Here, improving understanding is by far the most expressed intended change category. In other words, science is predominantly related to science, which is indispensable for the progress of scientific knowledge. At the same time, however, it is not only related to itself, but also intends to have change effects on non-academic groups.

In the interviews with the PIs, the intended dimensions of change were further explored. As shown in Figure 16, mostly the same change dimension already raised by the survey were mentioned, but a "change in practices" category was explicitly added.

Figure 16: Interview findings differentiated between change categories and target groups



1. **Change in practices:** One aspect of intended change is the change in practices, which is the central object of a social innovation. Practices can be seen as something that is performed regularly or habitually, such as actions that are perceived as standard in a given field. Several of the interviewed PIs aimed at changing practices. Some interviewees reported that the objective of their research was to change the way medical treatment is executed or how and in which situations doctors prescribe drugs. Others emphasised that their aim was to change political decision-making or the training for practitioners. While in many cases change in practices was an explicit goal of several projects, it was also emphasised that such action-oriented change in practices often takes place only incrementally over a longer period. Furthermore, a change in practice is often related to and follows a change in, for example, attitudes and behaviour. Hence, achieving a transformation of practices can be a complex and long process.

2. **Change in behaviour:** Very similar to a change in practices is a change in behaviour. The difference is that while practices refer to *"the customary, habitual, or expected procedure or way of doing something"*[25], behaviour is defined as *"the way in which one acts or conducts oneself, especially towards others"*[26]. While the definitions differ, a clear demarcation between the two is not easily identifiable, especially since behavioural change often results in practice changes when done frequently. Both change dimensions are action-oriented and can be regarded as elements for contributions to social innovation. One interviewee said that one of his goals was to achieve a reflexive process for practitioners, which should ultimately change their behaviour in certain situations. However, he also stressed that once this behavioural change is incorporated, this could also result in a change of practices. This example highlights the interconnectedness of behaviour and practice, but also shows that even a changed behaviour does not necessarily lead to regularly changed practices, at least not immediately, especially if, for instance the framework conditions oppose a more generic roll-out of new practices.

[25] https://www.merriam-webster.com/dictionary/practice
[26] https://www.merriam-webster.com/dictionary/behavior

3. **Change in attitudes:** Several PIs did not have the intention to initiate a change in practices or behaviour. Rather, their goal was to change the attitudes of a given sub-population or wider society. For instance, one interviewee who studied the effects of migration on housing and segregation argued that one important aspect that prohibits societal change is the attitude of policy-makers as well as the public. Accordingly, different stakeholders perceive recent migration flows negatively and as a potential for conflict, while this was not necessarily the case with past migration flows. Hence, most often a change in attitudes and perceptions is essential when trying to kick-off a change in behaviour or practices. Accordingly, when trying to accomplish a broader impact, it is also crucial to keep people who might not be obvious stakeholders (e.g., society as a whole) in mind. One interviewee, who investigated medical treatment with antidepressants, stated:

"Another, further social component is the population's broad perception of psychotropic drugs. They are viewed critically in broad sections of the population, and I think part of this criticism also comes from the fact that they (i.e. the prescription of drugs) *are not discontinued. A social component that is important for me is that this concern, this perception is addressed, and that it is perceived and taken up." Interviewee 7*

4. **Change in awareness:** Another aspect that can be suspect to change is awareness. One-third of the interviewees said that one of their aims was to raise awareness regarding their research problem. This awareness-raising was either targeted at a specific group (e.g., decision-makers, institutions, businesses/industries) or directed at society at large. Again, the differentiation between a change in awareness and a change in attitude is often hard to make. One interviewee, for example, mentioned that in order to raise awareness amongst society, it is necessary to change the attitude of the media when reporting about an issue at stake. Accordingly, the interviewee stated that when working on a highly polarised problem, the press tends to have a hardened opinion towards this problem. This, however, influences both the attitude of society toward this problem as well as hinders the possibility to raise awareness about certain aspects of the issue. A change in awareness can act as ignition to a change in practices and hence can enhance or limit the opportunities for social innovation. Another interviewee summarised the link between a change in awareness and practices in the following way:

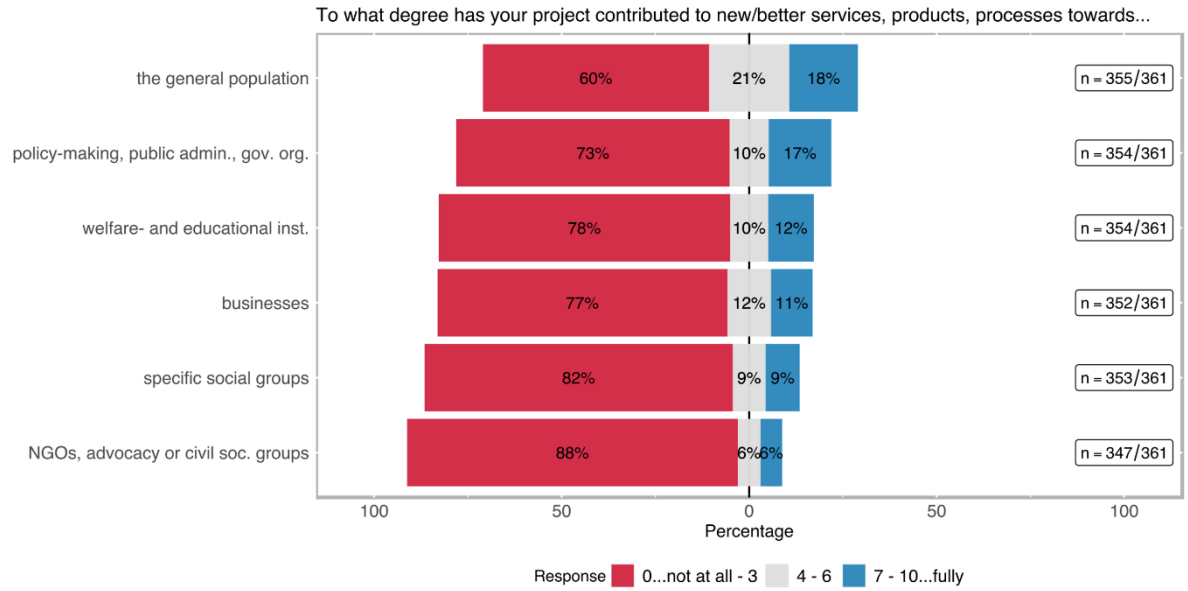
"I wouldn't say / it's still far from over, it's really hard to say what will really work and what won't, but that will probably be even more intense in the next few years because there are new areas. But what I can say is I believe that this continuous discussion between researchers, between doctoral students, other researchers and authorities and residents, so to speak, the awareness of the problem of how these processes are to be designed at all and the interest in adapting formats, new formats trying out, looking for new forms of dialogue, that we at least make our contribution from the research side." Interviewee 9

4.3 Targeted outcomes and solutions

The generation of solutions, both tangible and non-tangible, to certain social groups or the population, or in more general words the generation of outcome defined as a use of project results by the targeted groups, is a central dimension of the definition of any innovation, including social innovation (see Table 1). However, we need to be realistic: research contributions to any innovation, regardless of whether we speak about techno-economic innovations or social innovations, are usually at a preliminary stage and one input among others to successful innovations. Both the scholarly contribution to social innovations (SI) and the scholarly contribution to techno-economical innovations precede the actual applications, which are usually outside the domain of academic research. Therefore, we refer in this study to the generation of potential solutions and contributions to outcome generation through the funded SNSF projects.

Moreover, we need to be aware that not every (technical, economic or social) innovation is necessarily based on scientific input, but it is undisputed that our society and economy are increasingly permeated by technology and knowledge and that scientific progress is increasingly needed to tackle the wicked challenges our societies and our planet is confronted with.

Figure 17: Direct contribution to target group(s)



As expected, the survey results revealed that the usual level of contribution of research projects funded by SNSF to new or better services, products, processes or ways of doing things beyond academia is rather low.[27] Although the majority of respondents marked 3 or lower on a 0-10 scale for these specific result categories (see Figure 17), around 40 % of the respondents (n= 355) noted that their projects at least somewhat contributed to new or better products, services, processes or ways of doing things for the general population (4 or higher on a 0-10 scale). Among those, 18 % stated that the level of contributions to new or better services, products, processes or ways of doing things to benefited the general population was high (7 or higher on a 0-10 scale).

17 % (n= 354) of the surveyed PIs responded that their SNSF-funded projects had a high degree of benefit for policy-makers, public administration or governmental agencies in form of new or improved services, products, processes or ways of doing things. 12 % indicated a high level of benefit for welfare and educational institutions; 11 % to businesses and 9 % to specific social groups. NGOs, advocacy or civil society groups were the least addressed by new or improved services products, processes or ways of doing things through the SNSF-funded projects (see Figure 17).

As shown in Table 10, the question *"to what degree has your project contributed to new or better services, products, processes or ways of doing things … towards academia"* was also raised. As expected, almost ¾ of the survey respondents (n= 357) mentioned a high degree (7

[27] The exact question in the survey was "To what degree has your project directly contributed to new or better services, products, processes or ways of doing things that were targeted towards …. (i) the general population, (ii) businesses, (iii) specific social groups (e.g. women/men/non-binary; youth/elderly; migrants; or minorities/indigenous people); (iv) welfare- and education providing institutions (such as schools, kindergartens, hospitals, or care centres); NGOs, advocacy or other civil society groups; policy-making, public administration, governmental agencies; academia).

or more on a 0-10 scale) of benefitting academia by new or improved services products, processes or ways of doing things. We interpret this as the (high) direct contribution, which SNSF-funded projects have made to the progress of science through newly generated knowledge. Only 13 % of the respondents have classified their contribution as low in this respect.

Table 10: Direct contribution to target group(s)

	the general population (n=355)		businesses (n=352)		specific social groups[28] (n=353)		welfare- and education-providing institutions [29] (n=354)		NGOs, advocacy or other civil society groups (n=347)		policy-making, public administration, governmental agencies (n=354)		academia (n=357)	
response	**abs**	**%**	**abs**	**%**	**abs**	**%**	**abs**	**%**	**abs**	**%**	**abs**	**%**	**abs**	**%**
0	116	32.68	177	50.28	223	63.17	200	56.50	241	69.45	185	52.26	29	8.12
1	26	7.32	32	9.09	30	8.50	32	9.04	27	7.78	26	7.34	3	0.84
2	39	10.99	36	10.23	24	6.80	21	5.93	22	6.34	25	7.06	8	2.24
3	33	9.30	27	7.67	13	3.68	22	6.21	16	4.61	22	6.21	8	2.24
4	15	4.23	13	3.69	8	2.27	13	3.67	7	2.02	11	3.11	10	2.80
5	40	11.27	24	6.82	13	3.68	12	3.39	10	2.88	20	5.65	27	7.56
6	21	5.92	4	1.14	10	2.83	11	3.11	4	1.15	6	1.69	16	4.48
7	21	5.92	9	2.56	11	3.12	14	3.95	9	2.59	22	6.21	46	12.89
8	22	6.20	11	3.13	10	2.83	14	3.95	3	0.86	19	5.37	59	16.53
9	5	1.41	6	1.70	4	1.13	6	1.69	3	0.86	5	1.41	41	11.48
10	17	4.79	13	3.69	7	1.98	9	2.54	5	1.44	13	3.67	110	30.81

We tested if the action-oriented intention to improve the human condition/welfare as expressed by some PIs (see section 4.1) directly correlates with a higher level of output contributions to non-academic audiences. As previously discussed, SI is per definition built upon its focus on new social practices or actions in a social context that address issues/needs better than already established approaches or practices (Howaldt, 2019). Although we do not want to exclude ex-ante that purely academic research motivations can also trigger social innovations or contribute to them (probably via several bifurcations), we expect that

- H_4: the higher the motivation to *improve human condition/welfare* by the PI is, the higher the chances of direct contribution of the project results are to new or better services, products, processes, or ways of doing things when targeting
    - the general population,

[28] e. g. women/men/non-binary, youth/elderly; migrants; or minorities/indigenous people
[29] such as schools, kindergartens, hospitals, or care centres

- specific social groups (e.g., women/men/non-binary, youth/elderly; migrants; or minorities/indigenous people), or
- NGOs, advocacy, or other civil society groups.

Figure 18: Relation between the motivation to improve the human condition/welfare and the direct contribution of the project results towards...

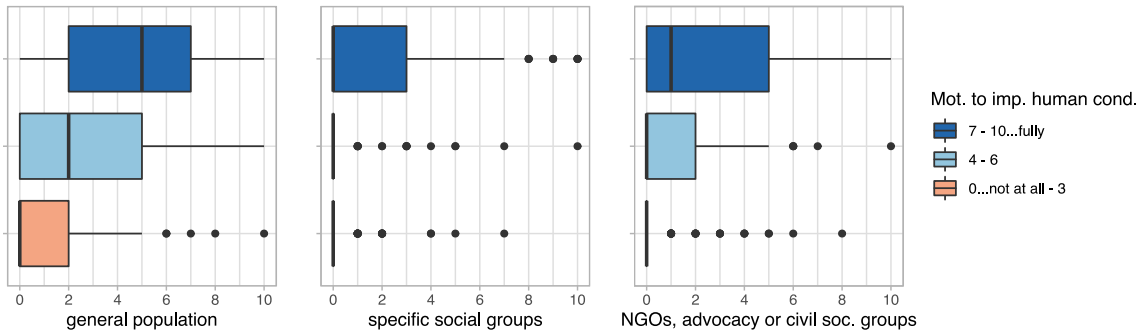


Figure 18 suggests that a high *motivation of a researcher to improve the human condition/welfare* may relate to direct contributions of project results to the target groups of research projects funded by SNSF. A deeper analysis of this variable shows statistically significant correlations with each of the outcome variables (p-values < 0.05, see Table 17 in ANNEX-II for details). The strongest correlation is a moderate positive correlation with the *direct contribution to new or better services, products, processes, or ways of doing things* that were targeted towards the **general population** (rho ≈0.5) [$H_{4.1}$].[30] Direct contributions for *specific social groups* and *NGOs, civil society organisations* are correlating relatively weaker (rho is 0.34 and 0.31, respectively) in comparison [$H_{4.2,}$ $H_{4.3}$]. As anticipated, the motivation to generate an impact in improving the human condition/wellbeing has a significant relationship with the direct project results for specific social groups.

As shown in Figure 17, 17 % of the surveyed PIs of SNSF-funded projects (n= 354) responded a high degree of contribution of their projects to new or better services, products, processes or ways of doing things to benefit policy-makers, public administration and governmental organisations. Another 10 % indicated a medium degree of contribution to benefit policy-makers, public administration and governmental organisations. To further explore the actual uptake of results by policy-makers, public administration and/or governmental agencies two additional questions were raised, which mainly aimed to measure how far the project results have been adopted by such public authorities and what the nature of impact of this uptake was.

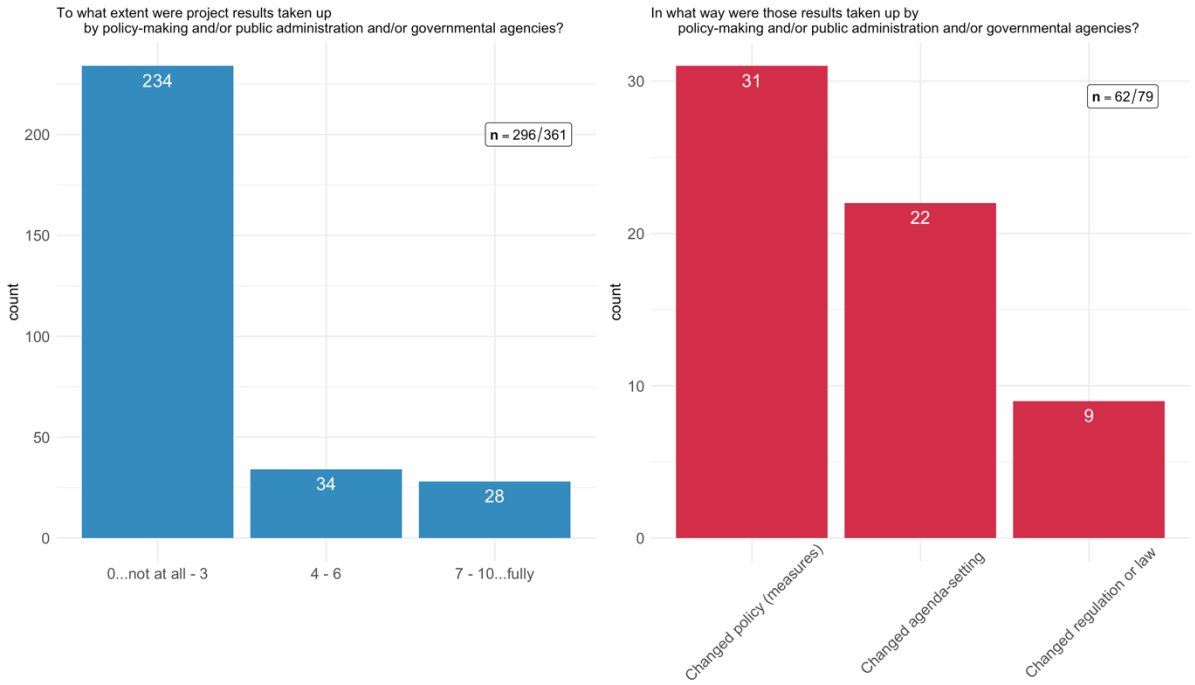
An overwhelming majority of the respondents reported that there was little to no uptake of the project results by policy-makers, public administration, or governmental agencies (see Figure 19). 21 % of the respondents rated the uptake of the project results by public authorities as moderate to high.

The nature of the policy uptake indicates what kind of a change the uptake by policymakers, public administration and/or governmental agencies caused. Nine PIs claimed that the results of their SNSF-funded projects changed/influenced laws and regulations, 22 respondents noted that the results changed specific agenda-settings and 31 reported about changed policies (i. e.

[30] We suspect that the relatively high significant association between motivation to improve the human condition/welfare and the general population has to do with the contribution of medical research in addition to SSH.

changes in policy measures) (see Figure 19). This means that 17 % of the SNSF-funded projects had an impact on policy, public administration and/or governmental agencies, mostly in the way how policies or policy measures are designed and implemented.

Figure 19: Uptake of project results and kind of uptake by policy-makers

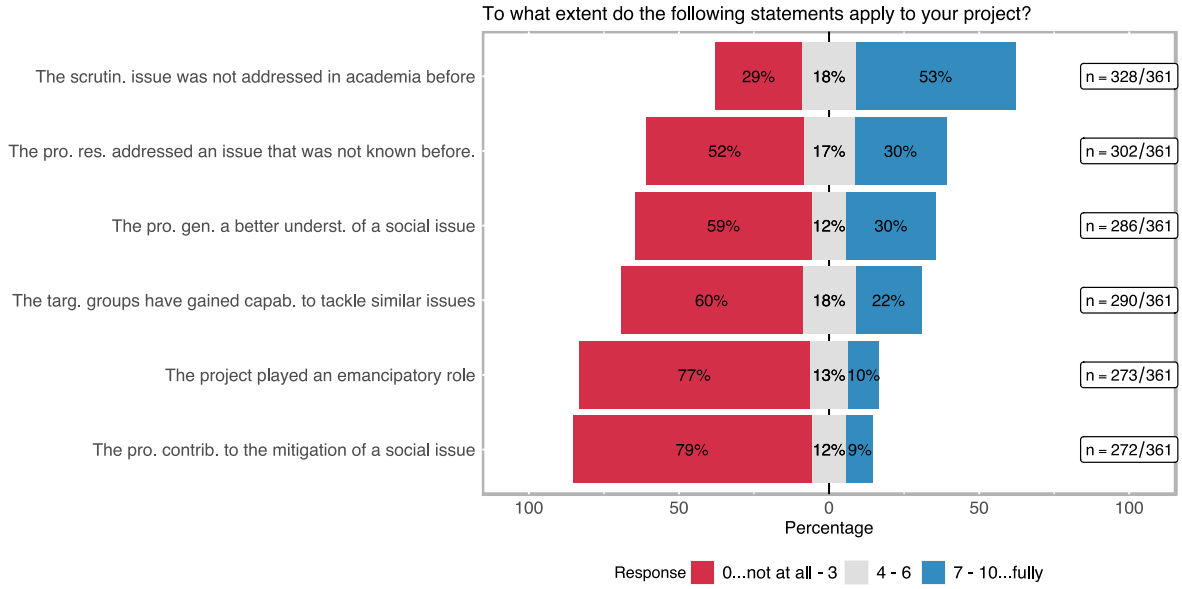


The last question in the outcome orientation section of the survey focused on impact statements and how the changes effected by the scrutinised SNSF-funded projects corresponded to these statements. The statements were chosen to address SI-relevant aspects either directly or indirectly.

The academic rationale was prevailing among the survey respondents (see Figure 20); 53 % of the respondents (n= 328) rated the statement *the scrutinised issue was not (widely) addressed in academia before* with 7 or higher on a scale from 0 to 10. This result is followed by a similar statement postulating that *the project results addressed an issue that was not (widely) known before* in general. 30 % of the respondents (n= 302) rated this statement with 7 or higher. The statement that *the project generated a deeper/better understanding of a social issue* was similarly rated by the respondents (n= 296). These three response categories primarily indicate effects with regard to the progress of science.

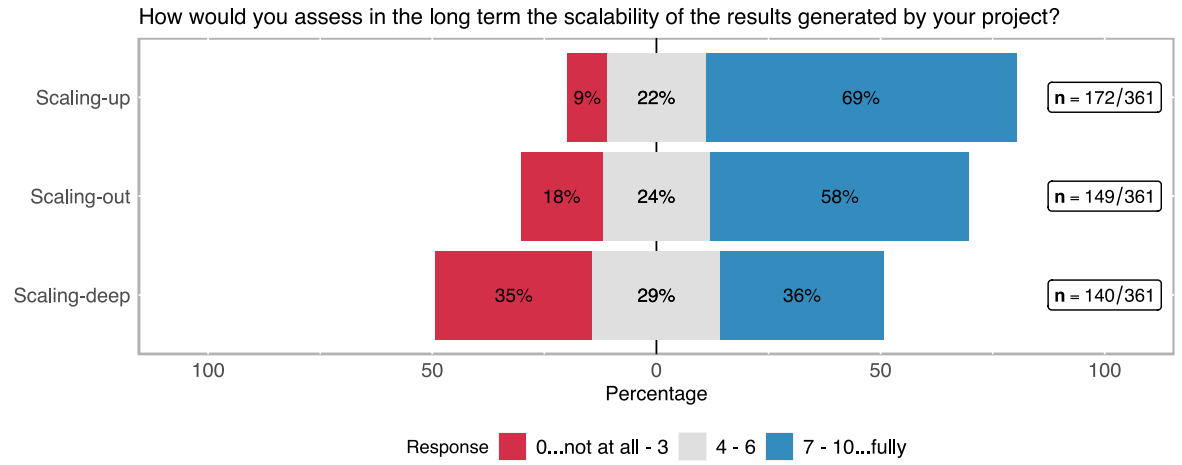
However, it is striking that as many as 22 % of the responding PIs (n= 290) indicated that their *targeted groups have gained capabilities to tackle similar existing or upcoming issues*. Moreover, 10 % and 9 %, respectively, of the SNSF-funded projects (n= 273 resp. 272) contributed highly to an *emancipatory impact/role for the target groups* or the *mitigation of a social issue* (see Figure 20). The latter three items indicate an orientation toward (social) innovation.

Figure 20: Impact statements – change affected through the funded research project



In terms of the potential scalability of the results of the SNSF-funded projects. 69 % of the respondents to the survey noted that the results generated throughout the project potentially have a high capability to be scaled up (see Figure 21), i. e. to achieve a higher impact if further developed and used. The potential for scaling-out to different geographic areas was highly rated as well. This is hardly surprising, because most scientific research is not regionally limited but strives for universal knowledge, insights and applicability. Interestingly, 36 % of the respondents also think that their project results can potentially scale-deep in the sense of changing cultural and social values (Westley and Antadze, 2010).

Figure 21: Types of scalability



It is sometimes hypothesised, that wider impacts and better scalable solutions are developed, if stronger forms of participatory involvement of non-academic target groups in projects is

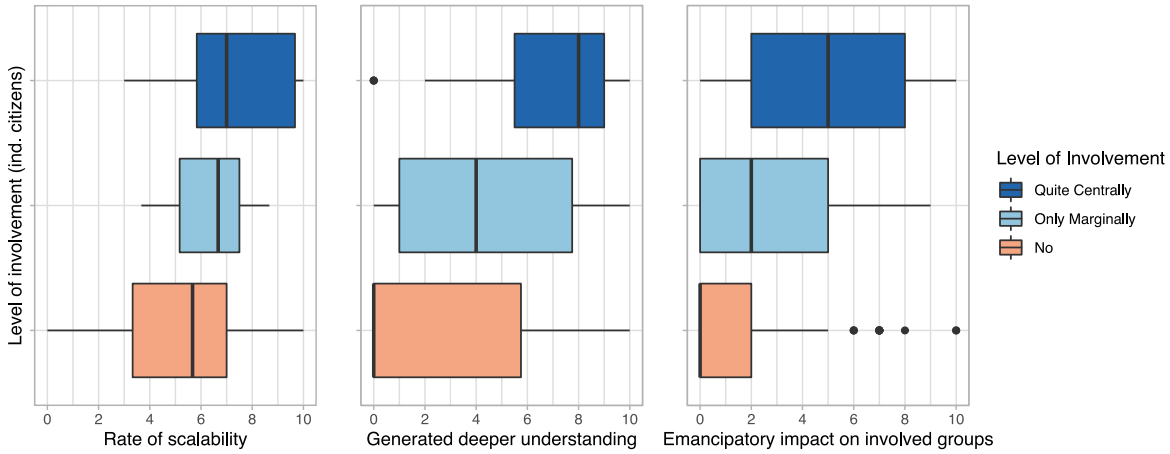
undertaken[31]. We tested if a more central involvement of citizens in research processes would enable the creation of more widely applicable results and increased impacts for the involved individuals. In this sense,

- H_5: the *more central the involvement of individual citizens* in research processes is,
    - the higher is the probability of the *scalability* of the results[32],
    - the more often a *deeper/better understanding of a specific social issue* is being generated, and
    - the higher the *emancipatory impact* of the research on participating groups is.

Figure 22 shows that there might be a vague relationship between the level of involvement of citizens in research processes and the generated results in terms of *scalability*, a *deeper/better understanding of a specific social issue* and the *emancipatory impact* on the involved groups. Indeed, as the statistical analysis shows (see Table 18 in ANNEX-II), g*enerating a better/deeper understanding of a social issue* as well as *emancipatory* impact on the involved societal groups seem to be correlating relatively high with the level of involvement of citizens in research processes (rho > 0.45, p-value < 0.05 each). In addition, scalability seems to be rated slightly higher in research projects where citizens were involved centrally (rho ≈ 0.35, p-value < 0.05).

Hence, we can say that higher levels of *transdisciplinary involvement of citizens* have a statistically significant relationship with the *scalability of results*, a *deeper/better understanding of the studied issue*, and the *emancipatory impact* on the participating societal actors.

Figure 22: Relation between citizens' level of involvement and selected outcome variables



[31] For a brief discussion about the scale of the research and scalability of the research results in the context of citizen participation, see P. 56 in Svidroňová et al., *Co-Creation and Citizen Involvement in Social Innovation: A Comparative Case Study across 7 EU-Countries*.

[32] The concept of scalability has been operationalised under 3 different categories in the survey (deep -, out -, and up scalability). However, after a dimension reduction process in the analysis (explanatory and confirmatory factor analysis), it has been decided to compile the sub-variables of scalability into one single scalability variable because of the similarity of their explained variances. Either because of the similarity of concepts or because of the lack of the knowledge on different forms of scalability the responses under different categories were highly similar (or because of common method bias).

Further outcomes of SNSF-funded research projects

The interviews with the PIs generally confirmed the survey results, but highlighted additional aspects related to the generation of outcomes beyond academia, which are briefly presented in this section.

1. **Opening up a discourse between academia and stakeholders:** Almost all interviewees who identified transdisciplinary aspects in their projects highlighted the opportunity for dialogue and exchange. It was argued that most often, academic research happens in a vacuum while solutions in practice differ from what has been suggested by academics. Hence, bringing together people from academia with non-academic stakeholders (e.g., practitioners, policy-makers, civil society) enabled both sides to communicate their knowledge and expertise and to work jointly on solutions. Exchange helps researchers and stakeholders to better understand each other while also creating common knowledge which could advance research endeavours as well as solutions on the ground. In several cases, this transdisciplinary exchange has led to further collaborations and jointly developed research plans.

2. **Empowering target groups:** One aspect that was highlighted by many people who worked with the projects' target group was the empowerment of this specific group. A few interviewees emphasised that projects that talk about or research a certain group often fail to account for this particular groups' perspectives, knowledge and vulnerabilities. Solutions, either academic or practical, are often readily present to target groups with no to little room for co-development. One interviewee stressed that the prototype produced within the scope of his project was significantly altered due to the many insights of the target group. At the same time, the target group comprising vulnerable individuals, received a chance to be heard, to raise concerns and influence outcomes that directly affect them. Correspondingly, several interviewees argued that real and positive impact is only achievable when the groups affected are heard and included in the research process. However, it was highlighted that not only solutions or products can be improved by including target groups in research processes. Researchers also highlighted the mutual benefit of including target groups in the research process. On the one hand, solutions and products are improved, thereby benefitting the target groups using them. On the other hand, the system of academia, i.e. the way knowledge is created, can benefit from an exchange with target groups, as their opinions and experiences inform the results gained in the scientific process.

3. **Better products and services:** One particular aspect of a change process is the improvement of the usability of a product or service. More specifically, several interviewees from vastly different fields argued that without the support and feedback from non-academic stakeholders, the final results would not have been as promising.

4. **Learning and changing perspectives:** Interactions with non-academic stakeholders opens up new perspectives and interests. Correspondingly, several interviewees emphasised that working together with practitioners enabled them to increase their knowledge about certain issues that were not on their radar before. One interviewee who worked with practitioners from clinics stressed that these exchanges enabled him to think *"outside the box"* which ultimately led to an increased interest in transdisciplinary work. Another interviewee emphasised that the interactions with non-academic stakeholders fostered an "(…) innovation-push which came through learning from partners". (Interviewee 10)

5. **Advancing academic research through transdisciplinary exchange:** Interactions with non-academic stakeholders can improve the way research is understood and done. In one case, the transdisciplinary exchange with citizens has resulted in the development of new research directions. One interviewee underlined that through the exchanges with professionals and practitioners, her research idea emerged and developed.

"Here we have a conception of scientific work, and this is another element which is extremely important for me. It's almost political. We're not breaking with common sense. We are not in this vision of science as an epistemological break where there will be researchers and the ordinary world. When I go into the field to understand how professionals work, I'm not going to arrive with a normative vision. (…). I'm not going to arrive with a ready-made conception of how they should work or what their value should be. The only thing I don't question is my pragmatic approach. But on the other hand, for example, my working hypotheses will emerge from my encounter with the field, from the questions that professionals ask themselves." Interviewee 1

While PIs emphasised in general the importance of the knowledge of non-academic actors, one interviewee emphasised that PhD students also get the chance to put their research into practical context and eventually make it more relevant to the non-academic world. This can be rewarding, especially for early-stage researchers who struggle to get settled in academia.

6. **Advancing academic research through interdisciplinary exchange:** According to our interviewed PIs, bringing together different theories and methods from diverse fields has several advantages compared to staying within disciplinary boundaries. Many interviewees stressed that the outcomes of the project would not have been achieved if the project had been conducted within one research field. One interviewee reported that within his field, it is not common to work with people outside the field who, for example, consider the impacts of bacteria on humans. By bringing together insights from distinct fields, results that were gained from working with cattle could be then analysed with a focus on potential human impact. However, one interviewed PI highlighted that crossing disciplinary boundaries does not necessarily mean having a shared problem that researchers from different disciplines want to solve. Rather it also encompasses learning from others without working on the same project.

"[...] It is less about social science studies being carried out by artists or something like that, but that one is through parallelising the works, i.e. the humanities scholars, natural scientists, artists doing their work in the same room in parallel, so that sparks fly there like that. I call that aggravated neighbourhood. So it's not about that, it's another concept of transdisciplinarity in theory, there's a problem that you can't solve on your own, that's why the disciplines come together. Everyone tries to solve the problem together. That's not how I do it. There is no common problem. There is a common place and this creates mutual accelerations, so to speak." Interviewee 8

7. **Achieving impact through the connection of fundamental and applied science:** Some of the interviewed PIs reported that while their research was fundamental, they tried to achieve greater impact by working together with applied scientists. Several PIs emphasised that although there is room for societal impact also in fundamental research, a lot more can be achieved when adding an applied perspective to research. This fosters translational science and results can be implemented and realised faster and more efficient outside academia.

Communication and Dissemination of results

The survey results (see Table 11) showed that PIs used a wide range of dissemination channels. Next to the publications in scientific journals (96 %), which is the dominant dissemination channel, the surveyed PIs also often mentioned publications in conference proceedings (85 %), and institutional or project websites (79 %) for dissemination and communication purposes. This is followed at a distance by another group of dissemination channels that include monographies and book contributions (46 %), traditional media (43 %), journals and magazines targeting practitioners (42 %), general events for a non-academic public (40 %), social media (37 %), online platforms (34 %), provision of consultancy (33 %), and targeted events for practitioners (32 %). Only policy briefs were employed by just 10 % of the responding PIs.

Table 11: Dissemination channels

Dissemination channel	no		yes	
	abs	%	abs	%
Peer reviewed journal publication (n=358)	14	3.91%	344	96.09%
Monography, contribution to a book (n=342)	186	54.39%	156	45.61%
Conference proceeding (n=356)	52	14.61%	304	85.39%
Policy brief(s) (n=333)	301	90.39%	32	9.61%
Traditional media (TV/radio/print/etc.) (n=346)	196	56.65%	150	43.35%
Professional journals/magazines targeting practitioners (n=343)	198	57.73%	145	42.27%
Own institutional or project website/blog (n=354)	74	20.90%	280	79.10%
Social media (n=347)	219	63.11%	128	36.89%
Online platforms (other than social media and project website/blog; e. g. data or code sharing, citizen science platforms) (n=343)	228	66.47%	115	33.53%
(You providing) consultancy (paid or unpaid) (n=342)	226	66.08%	116	33.92%
Targeted events for (non-academic) practitioners (n=343)	233	67.93%	110	32.07%
General events for a non-academic public (other than practitioners) (n=343)	207	60.35%	136	39.65%

Dissemination can be a driver of change and we assume that motivational aspects and the intended purpose of the research seem to guide dissemination activities. Interviewees who identified a relevance for practice and transdisciplinary aspects early on in their research projects argued that workshops, training programmes and conferences that are open to non-academics are crucial for fulfilling impact outside of academia.

One aspect that was emphasised by almost all interviewees who undertook dissemination activities was the aspect of science communication to the public. They consider it as important to not only communicate research findings to specific stakeholders (e.g. practitioners) but also to wider society. Depending on the field and discipline, different project teams initiated different strategies to reach out to the public. For example, one interviewee gave talks in museums, while others talked to the media.

"Well, we have always tried very hard to convey and make our information available in a form that / both in terms of the way it is presented, but also in terms of accessibility. For example, we have [results] publicly accessible and we also have, you can see that, we have a website where we also show it, where we actually make everything accessible, with just a few exceptions, that's an important thing for us. It is also a prerequisite that something like a transfer takes place and that ultimately other actors do something like social innovation with it." Interviewee 19

Generally, interviewees mentioned ten different dissemination channels. Some only used one, while others combined different channels:

1. **Publication in academic publication formats:** Almost all interviewed PIs confirmed that they published their results in academic journals or as a book targeted at the scientific community. The pressure to publish was stressed by many interview partners. Accordingly, academia requires researchers to actively publish (or perish), that was surprisingly often referred to as "quick and dirty", which takes time away from other dissemination activities.

2. **Publication in non-academic publication formats:** Besides publishing articles in academic journals, some interviewees also published their results in non-academic publication formats. One interviewee, for example, said that he published his project findings in specific magazines for practitioners. Another highlighted university magazines, which required the team to reflect about how to make the topic interesting and accessible for students.

3. **Policy briefs:** A few interviewees said that they wrote policy briefs, some of which were commissioned by a political authority while others were not. One interviewee especially stressed that a policy brief could only be effective when then discussed with the responsible people. Therefore, writing such a report without a dialogue afterwards can prove less promising when trying to engage with decision-makers.

4. **Open-access material:** Four interviewees mentioned that they published their data sets with the aim to help other researchers to improve their work. Open-access databases can be important for further analyses, but they can also serve as a communication tool. One interviewee stressed that he not only makes his data freely available, but also uploads all project outputs (reports, articles etc.) on a website in order to make all findings publicly accessible.

5. **Lectures and teaching:** Lectures and teaching were also seen as an essential channel for communicating project outcomes. Most of the interviewed PIs who employed lectures as a source for dissemination did so in a university context, but some highlighted the importance of further training of practitioners too. Accordingly, one interviewee stressed that in his case it was essential to feed the project results directly into the training of practitioners, which is why he turned to experts rather than students for teaching. Another interviewee claimed that in order to reach people not only in Switzerland but also abroad, a Massive Open Online Course can help overcome distance in dissemination.

6. **Interviews and discussions:** Five interviewees mentioned that they gave interviews either for magazines or during discussion rounds. Others noted that they took part in round tables, which were mostly aimed at the general public. Those interviewees who participated in such activities highlighted that this gave them the chance to put their research more into context. One interviewee expressed that conferences are very useful for dissemination, although often very focused on topical details. Round tables and discussions, which are open to the public, are more characterised by openness and less scientific language.

7. **Conferences and presentations:** Two of the most used dissemination channels were conferences and presentations. Although conferences were mostly targeted at an academic audience, some interviewees mentioned that they presented their findings at conferences to either the public or practitioners. Similarly, others mentioned that they were invited to give presentations at other meetings. Many interviewees emphasised the informal parts of such events for widening one's network for future collaborations.

8. **Media:** Around one-fourth of the interviewed PIs said that they talked to the media. Some of them stressed that journalists were very interested in their research and that they received numerous requests for interviews. Contrarily, others claimed that it was quite hard to raise journalists' interest, because their research phenomenon was less of a "hot topic". Nonetheless, all of them noted that the media can be an important source for dissemination as it is able to reach an audience, which researchers mostly cannot reach.

9. **Websites:** Sometimes, research projects were represented and summarised on specific websites. Those interviewees who mentioned open-access databases also referred to their projects' websites as they provide opportunity for downloading there. In a few cases interviewees mentioned their website without showing open-access material.

10. **Excursions:** Two interviewees reported that they went on excursions where they visited practice partners and experts from other countries. This enabled them to put their findings into perspective and get feedback from people who work in different contexts. According to one interviewee, this allowed the research team not only to talk about their findings but also to acquire deeper knowledge about the structures and practices outside their research field.

Exploitation and follow-up activities

A) Exploitation

Based on the feedback of the interviewed PIs, exploitation activities can be roughly divided into activities aiming at commercialisation and activities aiming to contribute to education and knowledge transfer.

1. Commercialisation

- **Company/Start up:** Three of the interviewed PIs from the natural and technical sciences tried or still try to exploit their projects by founding a company or a start-up to translate their research into a product ready for the market. They mentioned that the founding process requires a lot of funding (from the public or private investors) and a lot of commitment from partners with different expertise and skills. Many partners from the original projects were involved in the companies or start-ups. At the time of the interviews, these companies were in different phases; one company was at a point briefly before bringing their first product onto the market; one company was in the set-up phase; one company was dropped after two years of existence. Some other PIs also

considered founding a company to exploit their research results, but then decided to continue academic research instead.

- **Patenting:** Patenting is seen as an important tool for technological transfer and to find industry partners for further development, in particular in the fields of pharmaceuticals/chemistry and technology. Projects in these fields can result in several patents, which, however, do not necessarily result in a product.
- **Further tests in practice context:** For some interviewees, one goal of exploitation was to recruit a practice partner (e.g., a company, political administration) to further uptake and test their research in an applied context to better estimate the potential of their approach for impact in the real world. They see this as a logical next step for their research, allowing them to both further their scientific investigations and challenge them in the practice context.

2. Education and knowledge transfer

- **Consulting:** One of the interviewed PIs involved consulting companies as part of the exploitation activities, applying the knowledge gained from research. Importantly, in this project, the company was already involved in the proposal and implementation phase of the project.
- **Online Courses/ MOOC and further training:** Some of the projects' results could be further exploited in the form of online courses, training (e.g., for teachers), developing curriculum modules and workshops. These formats were used as a form of knowledge transfer into the practice field.
- **Developing guidelines:** In addition to consulting, provision of courses or training, developing practical guidelines and principles for organisations and institutions was another form of exploitation.
- **Creating a database/publishing materials:** In one research project, a database was established to systematise and prepare material used in the project for a wider audience; data could then be used by students or other researchers.

B) Follow-up activities

Usually, SNSF projects are not starting from scratch, but build up an accumulated knowledge including learnings from previous SNSF-funded projects. Conversely, the results of current projects are often the inputs for future projects. The researchers are often very familiar with practice partners working in the same field. They have built partnerships and collaborated with both academic and practice partners. Because of the PIs' general activities in their respective field of research, it was not always possible to distinguish between distinct single projects with regards to their exploitation and follow-ups during the interviews.

1. Follow up projects:

- **Pure research projects:** Based on research findings, methods or products developed in the SNSF-funded projects, some follow-up projects dealt with expanding the previously achieved results, applying methods in new contexts, overcoming previous limitations, or investigating questions that remained open. Often, these were conducted with some of the same previous academic project partners or with former PhD students who are now in new positions. Follow-up projects, however, also emerged with new partners from other academic institutions. In some instances, the PIs themselves were not involved in the follow-up project, which was then led and advanced by a former PhD

student or Post Doc. In one case, ideas for a follow-up project resulted from exploitation and communication activities, whereby the researchers were confronted with feedback from practice, which provided new perspectives and impulses on the topic. In another case, the impulse to continue with a follow-up project came from the patients that were involved in the previous study. Many smaller follow-up projects were financed with internal university funds, which also often served the purpose of examining the results for the readiness of exploitation and perhaps commercialisation. Most often, the funding for purely applied follow-up projects stemmed from internal funding or other funding schemes, but almost never from SNSF.

- **Practice/applied projects:** Often applied follow-up projects were funded by Innosuisse. Accordingly, many interviewees reported that they submitted proposals to Innosuisse to enable the transfer of projects results that were gained during the SNSF project. In a few cases, follow-up projects were taken up by industry partners, in which tools and applications were further developed.

- **Research projects with access/involvement of practice partners:** Some of the follow-up projects dealt with a similar topic as the previous SNSF project, but were able to gain access to new stakeholders and practice partners. This promised new avenues and opportunities of achieving impact beyond academia. There was also a follow-up project that combined research and practice by transferring the results from the SNSF-funded project to other applied contexts including the development of guidelines for the responsible institutions. One PI participated in an art exhibition where he contributed an installation based on his SNSF-funded research project. Efforts were also made to involve industry partners or private foundations in funding to enable follow-up projects.

2. Further collaborations with project partners: More than half of the interviewed PIs who were involved in collaborations with companies during the project implementation phase continued after the official end of the project. In other cases, further collaborations with national and international academic partners with the aim of submitting proposals for new projects, publishing papers, setting up labs, and working together on projects on different topics, were reported.

In some fields (e.g. education, medicine), the academic partners are already connected through their institution such as medical researchers and doctors who are both working at the same university hospital, or researchers in education science who do their research at the same institution that trains future teachers. Such institutional connections enable exchange and collaboration and facilitate ongoing communication.

3. Staying in touch: Many interviewed PIs are still in contact with their previous project partners and contacts from practice, despite the project's end. Some PIs also work at institutions that regularly interact with other practice institutions and foster student and employee mobility, often with the prospect of continuing the collaboration with the help of a new project.

However, the interviewed PIs do not stay in contact with all of their practice partners. If they found an interested and engaged practice partner during the project, they try to stay in touch and to exchange ideas and knowledge in the future. They value the contacts made during the SNSF project as a way of expanding their network and drawing on it when a new potential project or other opportunities for collaboration arise. Oftentimes, the contact between academic and practice partners had already existed before the project started, because the researchers

have been active in the same field for years and have built expertise. Then these contacts are usually ongoing after the SNSF project has ended.

4. Other long-term benefits of the project: Another benefit in terms of sustainability is that researchers can increase their recognition within the scientific community, but also among relevant stakeholder communities from practice and industry.

5) LIMITATIONS AND BARRIERS ON THE ROAD TO IMPACT

The interviewed PIs identified several barriers when it comes to the exploitation and utilisation of their project results:

1. **Commercialisation:** Some researchers experienced difficulties in achieving the commercialisation of a product. Accordingly, product development often requires certification and additional administrative steps (e.g. for pharmaceuticals), which is often not perceived as worthwhile. One PI mentioned that the commercialisation of project outcomes is basically a different job, while others stressed limited time for such activities. Additionally, oftentimes product development and making it ready for market entry requires a lot of money, predominantly from investors, and collecting money from investors requires a company if this is done by oneself.

"If you want to achieve an impact, if you want this to become a real product, you need to make a company, you need to get eventual capital, otherwise it is not going to work." Interviewee 5

   In some cases, where commercialisation was a goal of the interviewed PIs, they found it difficult to find industry partners with whom they could commercialise the product. Some interviewees referred to different intrinsic logics, e.g. that industry partners often do not want to work together with academic partners because their research, materials and codes are often open access, which is detrimental for the companies' goals.

   Some PIs also mentioned that findings generated from fundamental research are often perceived as too risky by industry as they are not tested in the "real world".

2. **Time:** After the end of a project, researchers tend to do other research projects or to teach and present project findings at academic conferences. Many interviewees claimed that they have no time for exploitation and utilisation activities once the project is finished.

   Quite a lot of interviewees stressed the high pressure to publish, which consumes a lot of time and energy. Several interviewees emphasised the situation of young researchers in academia who struggle to find long-term or permanent employment and face fierce competitive pressure. Hence, neither senior nor young researchers often have the time to spend more time than necessary on implementing outcomes if such activities go beyond the scope of their project.

3. **Funding:** Project funding is typically limited to three to four years, and a project is considered finished when the results can be presented (e.g. in a final report, a scientific paper or at a conference) and not when the results are exploited in an applied context. This means that mostly exploitation and utilisation work has no funding dedicated to it, which limits the work researchers can do in this area. Funding could be in the form of a follow-up study or a dedicated exploitation project. Existing funding schemes are not considered as exhaustive in this regard, as, for example, Innosuisse requires existing support of the industry and the involvement of business partners. Though part of exploitation work would be to identify and recruit these partners, this effort is usually not funded and not always supported (e.g. by Technology and Knowledge Transfer Offices).

4. **Administration and organisation:** Three PIs expressed that administration and organisation posed a challenge to their exploitation and utilisation activities. Different

issues were anecdotally mentioned, such as delays caused by the need to resubmit to the ethics committee because of small changes within the project, or the change of administrative support staff of their universities, which resulted in fluctuating support for their project and their ideas, or delays of receiving funding due to specific legal provisions.

Also mentioned were difficulties to access sensitive data, the sharing of data and issues of accountability and responsibility. Accordingly, one interviewee emphasised that any effort for improving a situation can be undermined when regulations do not allow access or sharing of data that would be necessary to better understand a problem and - as a result - to communicate more in-depth results rather than general findings. Another interviewee mentioned complex funding regulations in some practice fields (e.g. health care and hospitals). He argued that such complicated systems make it difficult for researchers to understand the entangled web of rules and regulations.

5. **Raising awareness and communicating the project and its relevance:**

- **Among the general population/ the public:** Some research topics are associated with already existing opinions or stereotypes in the general public, which makes it difficult to communicate their importance and relevance and to raise awareness.

"I mean, the general impression is that it is a little bit difficult from general population to understand how severe is the problem. Actually, […] is mostly interpreted by the general population as something to do with wellness, not with medicine, and so this was difficult for us to let them understand that we are talking about a disease." Interviewee 14

In addition, some PIs were challenged to abstract and simplify the manifold facets of a research project and its results to better communicate the public relevance and scientific achievements. Some PIs confessed to find it difficult to communicate concrete conclusions or to suggest concrete actions for applied or practice contexts, which makes actual exploitation of the project results difficult.

One interviewee argued that sometimes researchers who work with target groups outside of their home country, do not report back the results to relevant stakeholders to the country the research was conducted in:

"And that is what I found, perhaps in a deep sense this is also a problem of the scientific community, especially in these development contexts, that one, so to speak, with one's own motivation. That one wants to earn one's own salary and have a good life in Switzerland, in Austria - one goes to the slums, because there you can collect good primary substances and with that you run back home, tell great stories and the impact on the ground is actually non-existent or even extractive, or, in other words, that you take people's time away, or also with the hope that something would improve and effectively nothing ever flows back." Interviewee 16

Several interviewees emphasised the role of the expectations in disseminating results. One interviewee, for instance, stressed that one single project can only achieve limited impact in general. Another interviewee highlighted the importance of networks when it comes to dissemination. Appropriately, knowing the actors when communicating the results can be crucial for successful dissemination. Yet, the interviewee also stressed that even when you have invested time and energy to get to know relevant actors, the impact you can accomplish is limited.

"Well, if you want to achieve something, you have to spend a long time getting to know the actors in the field, you have to understand what they are concerned about, you have to build up trust, you have to spoon in new ideas and after a lot of effort, sometimes after years, in the best case you have a context - now with my last project, which I have just completed - where you can work together joyfully and perhaps achieve something, but even then you have to be modest in the end." Interviewee 16

- **Among policy makers and responsible institutions:** Communicating and introducing or at least suggesting change based on research findings can be difficult if policy makers or the responsible institutions are not willing to go for such change, especially if it is too costly, or if the conclusions based on the research findings would not lead to immediate impacts. Accordingly, one PI stressed that decision-makers lose interest if results take too long to be implemented and if change is not immediately noticeable.

"They would use our results immediately like that, it is always the same - if nothing happens, no one cares." Interviewee 12

Another interviewee stressed that his topic (the prevention of an epidemic caused by a certain strand of bacteria) was not seen as urgent enough by policy-makers to implement actions as the last outbreak of the related illness lies decades behind.

One interviewee highlighted the pressure that politicians experience when dealing with topics such as migration, where enormously different interests within the political arena exist, which makes it difficult for academics to firstly bring all crucial stakeholders together and secondly, bring all stakeholders to agree on the topic. Similarly, several interviewees highlighted that the multi-level governance of Switzerland makes it difficult to achieve policy change.

Moreover, interviewees stressed that political will is often connected to particular people in the office, but when these people leave, topics that were previously interesting can become irrelevant to successors. Generally, several interview partners underlined the often-limited interest from policy-makers for certain topics.

6. **Limited networking and exchange:** To achieve scaling and utilisation of project results, national as well as international networking, exchange and collaboration is important– specifically between researchers but also with practice partners, including industry. Some interviewees perceived quite limited exchange and collaboration with governments and the civil society within the German-speaking countries, which challenges scaling and exploitation of their project results. They argued that it would be in particular helpful if more structural or institutionalised exchanges, for instance in the form of scientific centres which foster interactions between different disciplines, universities, or countries would exist.

7. **Limited support or coaching:** Though most of the interviewed PIs stressed that they received support from their organisation in pursuing exploitation and utilisation activities, three PIs voiced that the limited support or coaching from their organisation posed a challenge to this. While they were not explicitly hindered, they did not receive support and were seen as outsiders with their research. Others simply lack institutional backup, which would support them in the next steps of applied work and the generation of impact in practice fields. They are left alone with applied and translational work, and have to do it on their own.

8. **Limited opportunities to continue projects:** Many interviewed PIs stated that it is difficult to exploit and utilise their projects without formal opportunities for the continuation of a project. Many ideas, questions, and conclusions only emerge towards the end of a project, and there is hardly an opportunity to follow up or deepen these ideas and avoid wasting expertise and know-how. The PIs suggested that funding agencies like the SNSF should actively encourage project continuation as part of a grant

or as part of a new track so that these potential new insights can be followed-up and exploited. This kind of funding could focus on a follow-up study, on finding out whether results were taken up, or could just focus on dissemination and science communication to inform the public and relevant stakeholders, for instance, by preparing results for different audiences and travelling to different institutions, bodies, and organisations. In particular, PhD students would benefit from such a funding scheme endorsed by a funding agency like the SNSF, as they basically lose their job with the end of the project. Such a funding scheme would be helpful for exploiting their research work. It would also support those researchers who are forced to always be involved in a project in order to get paid.

9. **Difficulties in engaging relevant stakeholders:** When trying to communicate results and make them usable, some PIs experienced that their target group or stakeholders, e.g., policy makers, simply were not interested or developed other priorities in the meantime. Policy makers did not come to presentations they were invited to, and hence, in-depth discussions of the topic could not take place. In addition, stakeholders from practice often have difficulties with interpreting and translating scientific results for their practice; they rather want suggestions for concrete actions, or generalised statements, and need the information to be translated with regard for relevance for their own work

10. **Difficulties in achieving social impact:** Some PIs mentioned structural difficulties within academic practices in achieving social impact with their project. They refer to a lacking continuity of projects, of research teams, or in the composition of institutional bodies, which leads to changing interests and priorities and prevents one topic from being really implemented or turned into an applied context. They stressed that achieving social impact would require a more structured and sustainable way of exploitation and utilisation of a project. In addition, the novelty of project ideas is highly valued in academia and especially in research funding, which means that a new project should not be a follow-up or applied project of a previous one but should deal with a new and innovative topic (see also Reale at al., 2014). However, it would be exactly this continuous engagement with a topic that would be beneficial to achieve long-term impact.

    Some PIs mentioned that especially fundamental research has too little application orientation to go for exploitation. Interviewees stressed that the road to impact is extremely long and can be tedious at times since the academic system is not geared towards generating immediate results. SNSF grants usually do not call for application orientation or efforts for transfer and translation. Moreover, efforts for exploitation or knowledge transfer are usually not rewarded in an academic career. Publishing in scientific journals remains the main currency of researchers.

11. **Limited knowledge if results are taken up:** Many PIs responded that they cannot assess whether their exploitation and utilisation activities were successful because they do not know the extent to which project results were taken up by practice partners. or were further spread. Finding out to which extent results were taken up by practice would require a follow-up inquiry, which is out of the scope of an SNSF-funded research project. In addition, several PIs do not see themselves in the responsibility of ensuring an uptake of their project results. They rather see this as a task of policy makers, practitioners, and representatives of institutions who have the responsibility of making use of the results and of investing in their realisation.

6) EXCURSUS: THE VIEW FROM PRACTICE PARTNERS

To better understand which effects the projects have had outside of academia, we also interviewed nine practice partners of PIs involved in SNSF-funded projects. These practice partners are working in public administration, civil society organisations, or welfare- or education-providing institutions. Some of them have (had) explicitly the role of providing a linkage between research and practice at their institution. Their usual tasks at their institutions can be summarised as project managers, supervisors of project implementation at their institution, consulting partners, or experts.

Motivation and social purpose

The motivation of the surveyed practice partners or their institutions to participate in the SNSF-funded projects was justified by the problem orientation or the research questions addressed by the research project. These were questions or challenges that the practice partners also experienced in their own work. They hoped that the research could not only address this problem but also contribute to a solution and that they would gain benefits through participating.

Specifically, their motivations for engagement in an SNSF-funded project were …

1. … interest in the topic and the **wish to gain knowledge** about the projects' results as basis for evidence-based decision-making. They expected that the project can provide stimulating discussion and new insights. Research projects often bring together people with different expertise and knowledge, whether it is in the project team or by organising events or conferences. One practice partner expressed that a stimulating exchange with different partners was important to discuss new findings.

2. … interest in the topic and the **wish to apply** the results in their field of practice. The interviewed practice partners hoped that the project results would be transferable and could be applied as solutions for perceived problems. They expected the researchers to support them in the transfer of knowledge to implement the results.

With the results and knowledge transfer from the research projects, the interviewed practice partners also hoped that the project …

1. … will fill a research gap and provide data relevant to their field of work;

2. … raises awareness about certain issues and challenges that they experience in their practical work;

3. … identifies and promotes activities to address problematic issues in their field of work;

4. … provides some independence from industry: One practice partner explained that by participating in the research project he was able to learn and develop new strategies for his field of practice, whereas working with a commercial company would have created dependencies that could have influenced the project results or at least the communication of the results.

Social purposes that were identified related to

- improving clinical practice
- initiating change among the participating institutions (e.g., public administration, welfare- and education-providing institutions)

- raising awareness of problematic issues from other areas of practice
- improving care and care situation in hospitals.

Impact on changed practices

According to the interviewed practice partners, the SNSF-funded project generated only limited change in the partners' everyday practice. One practice partner mentioned that he talked to his manager after the project to reflect on the change the project had and could have had. He claimed that while his team had high expectations, the project did not create change within the organisation. However, there was impact and change on the level of understanding and awareness-raising.

1. **Understanding and feedback:** For most practice partners, it was nevertheless a positive experience to get feedback and insights from researchers, who have different perspectives on their field of work. Positive feedback supported and strengthened the practice partners' confidence in their work.

   Another aspect that was expressed by two practice partners, was the increased knowledge through expanded research activities. Accordingly, the exchange with researchers allowed the accumulation of knowledge, which resulted in more interest in issues at stake for the practice partners. One interviewed practice partner said that his organisation and, more general, his field, benefited from the project as several doctoral students wrote their dissertations on issues the organisation is dealing with.

"Indirect further effects are of course that we have these researchers who did their dissertation there, because that creates know-how, that's actually / that was an important goal on the part of the [organisation], that's why we're now launching a similar project again, because we simply need research on the subject, we need people who acquire competences, and that's also been successful in parts." Practice Partner 1

2. **Raising awareness among different stakeholders:** Generally, several interviewed practice partners appreciated that the collaboration with academic partners also enabled the exchange with other actors. Two practice partners reported that they organised conferences together with their academic partners in order to facilitate exchange between practitioners and scientists. While this exchange was perceived as meaningful, both interviewees said that it did not result in changed practices.

"Little, little. We took note of that, and of the results. We had / there was another exchange. We organised a conference between practice, administration and science, where we also discussed with people from the school practice what they think of the findings, but I would not attest to a lasting effect here." Practice Partner 1

   Half of the practice partners stated that the project had had a positive impact on raising awareness of their organisation's goals. Correspondingly, one interviewee said that the cooperation with academic partners advanced the organisation's goal by raising awareness amongst policy-makers and the broader public. Similarly, another practice partner said that she experienced a slight change in the narrative surrounding her organisation, both in the political as well as public discourse.

How can change and impact be facilitated?

As shown in Figure 23, interviewees from practice identified seven ways to enhance impact from project collaborations with academia.

Figure 23: Ways to improve impact generation between academia and practice

1. **Transfer from academic to practical knowledge:** Seven practice partners mentioned the limited use of academic knowledge for the "practical world". One interviewee, for example, stressed that the *"distance between practice and research is huge".* Many projects were simply not designed to fit knowledge accumulation outside academia. Hence, findings could not effectively be translated from academia to practice.

"And of course, we asked the question a few times, how do you transfer this knowledge into practice […] because the project is very descriptive, and rightly so, but the question is, how do you then get a kind of practical transfer from these very descriptive results without too much structuring" Practice Partner 2

In order to facilitate this transfer, projects require an explicit design to enhance collective knowledge creation already at the early stages of a project and/or clear dissemination strategies to facilitate this transfer. Another way to ensure the transfer of knowledge is to refer to support from intermediaries or knowledge brokers.

2. **Long-lasting collaborations:** Three interviewed practice partners reported that there was no contact with academic partners beyond the project end. However, all of them noted that further exchange could have promoted impact as long-term change cannot be achieved within a few months or one year. To enhance impact through long-lasting collaborations between academic and practice partners, specific programmes or funding schemes would be beneficial. However, they should be designed flexibly, allowing both parties to bring in their knowledge and resources.

3. **More dissemination and networks with other stakeholders:** A few practice partners reported that they would have wished for more dissemination of the project results and raising awareness of the role of practice partners. It was also highlighted that although there were some dissemination activities, they did not go far enough and failed to implement change. Moreover, missing networking was identified as a barrier to change. One interviewee, for instance, said that he would appreciate a digital platform that makes research results available and connects researchers and practice partners.

4. **Increase relevance for practice:** A few practice partners also mentioned that academic research is often focused on theory development rather than addressing issues that concern practice partners. Accordingly, the relevance for their own work was limited. In order to increase the relevance of academic knowledge for practice, the practice partners pleaded to be involved in a project at an early stage in order to contribute their perspectives.

5. **Develop mutual goals and questions:** Similarly, it was stressed that there were no common goals within the collaboration framework of the project, which lowered the motivation of practice partners as well as their scope for action. One interviewee said that he had the feeling that the transdisciplinary approach rather benefited the researchers (e.g. because it was necessary to generate funding) but did not sufficiently include the interests of the practice partners. Partnerships between academic and practice partners need to better address the needs and goals of all partners.

"We sometimes have interests, but the exact research question or the central interest of the research sometimes doesn't fit, and if it could only be slightly adapted it would sometimes be more useful for us, like that. That's the way it is, that's a theoretical assumption, but we sometimes see in projects where it's possible to get involved a bit earlier, that you can also give them add-ons that can then be used and are more useful to us." Practice Partner 4

6. **Intentional transdisciplinary design:** In addition, the level of involvement of practice partners could be increased within the projects. Correspondingly, an explicit framework that allows for mutual decision-making and mutual research activities could enhance the impact of collaborations. Contrarily, fixed and stringent ideas and presumptions should be avoided. Moreover, one interviewee partner said that research activities should be better tailored to the organisational context rather than designed beforehand.

7. **Foster bottom-up processes:** Two practice partners mentioned that the impact of the project was limited because the systems they operate in did not allow bottom-up processes. Accordingly, decisions were made on the top end of the "hierarchy", which neglected the knowledge and experiences that were generated by people operating on the lower end of the hierarchy.

"Yes, it's difficult to say from the bottom up, because change is very difficult there. Of course, it would have to be rinsed from the bottom up, so there would really have to be problems in practice, which would have to be passed on upwards, which would ultimately have to be changed politically." Practice Partner 4

Interactions with academic partners and challenges in these interactions

1. **Proposal phase:** Three interviewees reported that they interacted with academic partners during the proposal phase. However, these interactions played out very differently in all three cases.

   In one case, the exchange during the proposal phase was limited to some informal exchanges and some preliminary networking in order to ensure collaborations during later stages of the project.

   One interviewee reported that he experienced his role rather as a consulting one. Accordingly, he met twice with the research team to give some insights and provide some ideas for the proposal. He said that the communication was rather restricted and did not have vast effects on the proposal development itself.

Another practice partner involved in the proposal phase was able to contribute significantly to the writing of the proposal. Correspondingly, the practice partner said that he met several times with the research team where they *"put backgrounds together and developed the project together".*

In general, however, we can conclude that in-depth exchanges with practice partners were rather loose during the proposal phase, which in some cases also limited the scope of further interactions. In order to increase the impact of cooperative interactions, exchanges should ideally start at an early project phase as this facilitates mutual trust-building and knowledge transfer and reduces the transaction costs. Questions that could be answered during this phase could be:

- Why and how is this issue relevant in practice?
- How can practice partners be involved in the later stages of the project?
- How could results be used in practice?

2. **Implementation phase:** Almost all practitioners reported exchanges with their academic partners during the implementation phase. Three modes of interaction could be identified:

    - **Discussions:** Four interviewed practice partners said that they engaged in regular discussions about the project's status with their academic partners. While they were not directly involved in the gathering data or the implementation of the project, they gave continuous feedback and the researchers updated them about the projects' progress. While one interview partner said that the interactions were sometimes bumpy due to misunderstandings or conflicts, most others said the discussions went very smoothly:

"[…] it was always very uncomplicated and quick, so I could really send an email if I had questions, or if it was more complex, I could call and either it could be solved immediately, or an appointment was made for a meeting, and, yes, that was all that was necessary, so it was well supervised, you had your contact persons, and in the end, it was a bit of a self-runner." Practice Partner 3

    - **Exchange about results:** Other practice partners said that their exchange with academic partners was limited to the exchange about project results. Additionally, practitioners stressed that this partly resulted in limited usability of the results for practice since the generation of results was *"a one-way street rather than mutual effort".* While this was sometimes the case because researchers did not reserve time for deeper exchanges, one interviewee stressed that he had limited financial means i to participate in more meetings:

"I think I have to say that the exchange in the whole project, that is, between the whole project and me, individually, decreased a lot at the point where I simply no longer had a role, I had no finances." Practice Partner 6

    - **Productive collaboration:** Two practice partners highlighted that they were intensively involved in the implementation phase. One of them reported that he supported the researchers in developing a questionnaire and subsequently with the collection and interpretation of data. The other practitioner helped the project team with the recruitment of participants and also supported the team with the analysis of recorded information. Both interview partners stressed that the extensive collaboration enabled them to bring in their perspectives as well as to use the gained knowledge in practice.

3. **Exploitation phase:** Half of the interviewees reported exchanges during the exploitation phase. These were either:

    - **Informal meetings:** Two practitioners said that they frequently met with the researchers during the exploitation phase. These meetings were mostly informal and included discussions regarding the usability of the results. These informal meetings also fostered the personal relationships between the researchers and the practitioners, which increases the probability of future collaborations.

    - **Presentations:** In some cases, the researchers presented the project and its results at meetings with the organisations where either the practice partners or additional people from the respective organisation were present. While this was highly appreciated by the practitioners as well as their managers, it often did not go further in terms of future contact and cooperation.

"We see the motivation and the efforts of the producers, I would say now, to make their research tangible, so they offer to come by, to present, also put it in context, for example. We see that. That's how it went in this case, and yes, but the contact remains relatively loose." Practice Partner 7

    - **Conferences:** Three interviewed practice partners said that they either participated in or co-organised a conference with their academic partners. One interviewee emphasised extensive interactions during the dissemination phase. Correspondingly, he organised conferences as well as other formal events together with the academic partners, which enhanced the outreach to other stakeholders and widened the impact of the project.

"We went to this exchange conference and we said "yes, come on, no, let's take that with us, let's play with it in practice, let's try to make it concrete and make it tangible in our context"." Practice Partner 8

Some interviewed practice partners stressed that their involvement in the project declined over the different project stages. Accordingly, one interviewee mentioned that he was included in the writing of the proposal as well as the collection of data, however, he felt that communication was losing substance during the exploitation phase. While he attributed this to the lack of time and funding, he acknowledged that the potential outcome could have been bigger if he had been able to contribute to the exploitation phase.

Benefits for practice partners

1. **Increasing knowledge:** While the impact on the practitioners' work has overall been limited, many of them highlighted the positive individual effects they gained from the collaboration. Accordingly, four practice partners confirmed that they gained remarkable insights through the exchange with academic partners, as it allowed them to change perspectives and gain insights into research. One interviewee said that his work is so stressful that he does not have enough time to read every research article that might be interesting for him. However, by specifically working together with researchers who focus on his field, he had the chance to get insights into current publications and innovative work that is being done. Another interviewee underlined that he is still in regular contact with his academic partners, who update her on new research findings that might be essential for her work.

2. **Building skills:** In addition to building up knowledge, practitioners also benefited from increasing specific skills relevant to their work. Correspondingly, two practice partners mentioned that they had the chance to work on their skills during the collaboration by having access to new data and new methods. Hence, these interviewees said that the

academic partners provided them with resources they could use to improve their skills and practices.

3. **Enlarging network:** One benefit that was mentioned by all practice partners is the aspect of an increased network. Researchers did not only collaborate with the practice partners alone but included them in their wider network. Thus, practitioners had the chance to interact with additional actors that are also relevant to their work. One researcher said that after the project ended, he felt that power relations changed from being very hierarchically to being more equally distributed. Accordingly, before the project, she experienced misunderstandings and a lack of interest from other stakeholders. This, however, changed when she had the chance to communicate with others and got the chance to point out the challenges in her organisation.

4. **Contributing to change/impact:** Although the impact of the project on changing practices was limited according to most interviewees mostly because of structural limitations, the opportunity to – at least potentially - contribute to a change of practices was seen as beneficial for practitioners. They argued that despite the failure to achieve immediate change, practice partners had the feeling of being able to add to processes that can eventually lead to long-term change. This has two main benefits. First, one interviewee claimed that through being included in such a process, she felt empowered and heard since she had the feeling to be working with others on an equal footing. Secondly, one practitioner mentioned that he felt motivated to contribute to creating impact as he realised what was possible in collaboration with others.

Sustainability and exploitation

1. **Follow-up project with academic partner:** One interviewed practice partner reported about a follow-up project with the academic partner. The practice partner mentioned that due to the trust that was built during the first collaboration, both parties agreed to continue working on relevant issues. Accordingly, the academic partner was already planning to start another project and the practitioner was hence asked whether he wanted to be involved again.

2. **Follow-up project without academic partner:** One interviewee said that he could use the collaborative project as a starting point to work on a follow-up project with other partners. Accordingly, the project raised his interest in a new method, which was only sparsely touched upon within the project. He wanted to further develop this method with other stakeholders and also with his academic partner who unfortunately had no time to contribute to the follow-up project.

3. **Continuing contact with academic partner:** Three practice partners mentioned that they are still in touch with their academic partners. While one stressed that this contact is only very loose, the two others said that they still have meetings with their academic partners where they update each other on their work. Both of these interviewees said that they could imagine future collaborations again, but the situation has not yet arisen.

4. **Bottom-up dissemination:** Two interviewed practice partners said that they were able to disseminate the project results to upper levels within their organisations. Although both of them claimed that they could not achieve a broader structural impact, they had the feeling of being acknowledged by the management level. Furthermore, both of them argued that the positive experiences from the projects increased the willingness of the managers to further support employees to participate in such projects.

5. **Discussions:** Three practice partners said that they were or are still in the discussion either with colleagues from their own organisation or with external experts. While these discussions do not happen on a regular basis, they provide fruitful ground for future

project ideas. One interviewee said that he was explicitly approached by another expert in his field because this expert heard from him because of the research project. Hence, participating in research projects also allows practitioners to widen their network apart from the academic partner.

7) CONCLUSIONS: POLICY IMPLICATIONS FOR VALUATING THE SOCIAL IMPACT OF SNSF-FUNDED RESEARCH

7.1 Wrap-up of findings and conclusions

1) Social innovation is a concept that the majority of the SNSF's clientele, i.e. the funded principal investigators (PIs), are not familiar with. Still, 22 % have at least a rudimentary idea of it, another 16 % even claim to know it quite well.

2) The conceptual understanding of social innovation is significantly higher in the SSH than in the other two scientific dimensions. The differences between the life sciences and the natural and engineering sciences in terms of the conceptual understanding of social innovation are statistically not relevant.

3) Of those who have at least an average understanding of social innovation (5 or higher on a 0-10 scale), almost half indicated that the contribution of their projects to social innovation was high to very high. Taken together, this is as much as 14 % of our total sample. While this may not seem high at first glance, it is a quite robust indication for a social impact dimension that focuses on the change of practices that should not be ignored.

4) From the subsample of PIs from SSH (n= 67), who have at least some basic familiarity with the concept of social innovation (4 or higher on a 0-10 scale), 52% self-assessed their project's contribution to social innovation as high to very high. The respective share among the life science (n= 18) is 44 % and 30 % among the natural and engineering sciences (n= 27). The data clearly show that social innovation is primarily a social impact category of the SSH, but also that it is not limited to this scientific domain.

5) We can further conclude that experience in transdisciplinary research, which is according to literature an important approach for research that aims to contribute to social impacts in general and social innovations in particular, is quite widespread among the funded PIs. 48 % responded that they have a high to very high transdisciplinary research experience and another 26 % fed back a moderate experience.

6) While natural and engineering sciences have the least propensity for transdisciplinary research among the three major scientific domains of SNSF, 52 % of the respondents from SSH and 44 % of the respondents from the life sciences reported a high to very high transdisciplinary research experience.

7) 62% of SNSF-funded projects include non-academic groups at least somewhat in their research designs. Individual citizens, policy makers and officers from public administration or governmental agencies, representatives from welfare and education providing institutions and from companies are most often included. 6 % of the scrutinised SNSF-funded projects included also representatives from NGOs. This inclusive orientation of a majority of SNSF-funded projects speaks for a high awareness on impact generation.

8) At the same time, it must be noted that the involvement of non-academic groups in the projects was predominantly of a consultative or contributory nature. Collaborative or even co-creation engagement approaches were significantly less frequent but still present. These two higher-order categories of engagement are usually deemed indicative of participatory processes aimed at changing and improving practices. However, we could also show that projects deliberately designed to create benefits for non-academic actors correlate only moderately with the nature of involvement.

9) The most important advantages of including non-academic actors during the proposal phase related to the development of the project idea, the refinement of the proposal, the access to "insider knowledge" from a field of practice, and the establishment of contacts,

which were perceived as important for project execution. During the implementation phase, the contribution of non-academic actors in data collection, in adaptation of the research design, in provision of resources, and in provision of field access were perceived as most advantageous by the PIs. During the projects exploitation phase finally, the feedback of non-academic actors on achieved project results, discussions and dialogue with them, sometimes even co-authoring, and their contributions to dissemination were seen by the interviewed PIs as main advantages of their involvement.

10) Challenges of conducting transdisciplinary research, as reported back by the interviewed PIs, refer to several issues. These include regulatory issues, difficulties in reaching stakeholders, communication problems, different understandings of a research problem and mentalities between the target groups and the researchers, different cultures and procedures in relation to decision-making, different considerations of how to use the results, difficulties in dealing with and communicating critical issues, and different interests, priorities and perspectives of researchers and practice partners, including occasional resistance and rejection of the project by practice partners.

11) The most important skills identified to overcome these challenges include using non-judgemental communication, constantly trying to remain concrete instead of communicating in a fuzzy way, trying to make a complex topic accessible and understandable, remaining adaptable based on previous relevant practice experience, staying in conversation with practice partners, working together on knowledge transfer, acting in a committed way, acting as a mediator between conflicting practice partners and/or involving a broker in a mediating role.

12) As regards interdisciplinary cooperation, i.e. the involvement of two or more different subjects or areas of knowledge, we can conclude that interdisciplinary research cooperation happens quite regularly. In 41 % of the SNSF-funded projects researchers from other disciplines are quite centrally included. Another 37 % include them marginally. 22 % of the scrutinised projects do not include researchers from other disciplines.

13) As regards intention and agency, which are central elements of the applied definition of social innovation, the motivation to improve human condition/welfare, was mentioned by 45 % of all survey respondents as high to very high. This motivation to contribute to a change to the better complements the more genuine motivation of better understanding a natural, technical, economic or social issue and the more problem-oriented motivation of addressing a natural, technical, economic or social problem. While high values for the motivations to better understand something or to address a problem were expected, the motivation to do something good for the human condition was at this scale surprisingly high. It shows that SNSF projects, although predominantly committed to do fundamental research and to contribute primarily to the progress of sciences, are not one-dimensionally motivated by scientific intentions only, but have the motivational potential to more directly contribute to innovation and change, including social innovation, through their research.

14) We can further conclude that the *motivation to improve the human condition* correlates significantly with the capacity of transdisciplinary research experience, while the *motivation to address a (non-academic) problem* did not yield a statistically significant correlation with this capacity.

15) Moreover, we could show that a quarter of all surveyed PIs deliberately designed their projects to a major extent in a way to generate an immediate and intended benefit for either the general population or specific non-academic target groups. We can conclude that at least a moderate intention to create benefits outside of academia is present in most of the SNSF-funded project. Only 37 % of the scrutinised SNSF-funded projects, mostly from the natural and engineering sciences, did not confirm this intention. Interestingly, the level of intention to generate an immediate benefit for either the general population

or a specific non-academic target group did hardly differ between the different SNSF instruments of project funding.

16) A third of the impulses from the non-academic world to initiate a SNSF project relate to specific health or medical problems. 26 % refer to a social problem, 19 % to a specific technical problem, 15 % to a specific ecological or natural problem. Economic problems were least often mentioned as impulses for SNSF-funded projects.

17) The intended social purpose of the PIs is achieved through several pathways. Mostly, PIs aim to better understand a research phenomenon, followed by the aim to prevent certain situations or circumstances (often related to illnesses), and to improve a certain practice or situation. The latter in turn refers to social innovations.

18) Many surveyed PI aimed to increase understanding and/or to raise awareness about a certain issue among the general population or certain project related target groups. A third of all PIs, who targeted a specific social group, even aimed with their project results to contribute to changes in attitude or behaviour, i.e. action-oriented change categories. Still, however, science is predominantly related to science, which is indispensable for scientific progress. Almost 90 % of the surveyed PIs funded by SNSF aim to contribute to changes in academia, mainly by improving understanding.

19) Three quarters of the responding PIs argued that they created through their SNSF-funded projects a direct benefit for academia respectively the progress of science. As could be expected, the level of direct contribution of research projects funded by SNSF to new or better services, products, processes or ways of doing things beyond academia was considerably lower. Still, however, 18 % of the survey respondents stated that the level of contributions from their SNSF-funded projects to new or better services, products, processes or ways of doing things was high or very high. Most of these respondents argued with a benefit for policy-makers, public administration or governmental agencies. Some indicated also high levels of benefit for welfare and educational institutions or for businesses or other specific social groups. We could also show that a high *motivation of a researcher to improve human condition/welfare* correlates positively with direct project contributions *to new or better services, products, processes, or ways of doing things.*

20) 17 % of the surveyed PIs confirmed a moderate to high uptake of project results by policy-makers, public administration, or governmental agencies, mostly in the way how policies or policy measures are designed and implemented.

21) Scientific impact statements were those most frequently endorsed by PIs. Strikingly high, however, a fifth of the PIs indicated that their targeted groups have gained capabilities to tackle similar existing or upcoming issues and around 10 % of the PIs claimed that their SNSF-funded projects contributed highly to an emancipatory impact/role for the target groups or the mitigation of a social issue. These claims indicate an orientation toward social innovation. We can thus conclude that SNSF projects do not only demonstrate very different impacts, but certainly also impacts that characterise them as contributions to social innovations. A large majority of surveyed PIs also believed that their projects results can be scaled-up[33] and scaled-out[34]. We could also show that higher levels of transdisciplinary involvement of citizens have statistically positive significant correlations with the scalability of results, a deeper/better understanding of the studied issue, and the emancipatory impact on the participating societal actors.

22) As expected, publishing in scientific journals is the dominant dissemination channel applied in the SNSF-funded projects. In addition, however, other formats of dissemination, both

[33] Scaling-up means that a higher impact can be achieved if further developed and/or used. According to Davis (2014), organisations attempt to affect a wider system change by tackling the institutional causes of a problem.
[34] Scaling-out means that the results can be replicated – although probably in adapted form - also in other geographical areas.

traditional and non-traditional, including lecturing, participation in interviews and discussions, or even excursions, are used. Open access (also of data) is increasingly common in the SNSF-funded projects.

23) Exploitation activities can be roughly divided into activities aiming at commercialisation and activities aiming to contribute to education and knowledge transfer. They include for instance attempts for start-ups, patenting, further tests in practice contexts but also consulting, provision of online courses, guideline development and establishment of (monitoring) databases.

24) Usually, SNSF projects are not starting from scratch, but build up on an accumulated stock of knowledge, including learnings from previous SNSF-funded projects. Conversely, the results of current projects are often the inputs for future projects. The follow-ups can have quite different formats, including pure research projects or applied research projects (with and without involvement of practice partners), other collaborations with previous project partners, or simply to stay in touch.

25) There are, however, also serious limitations that hinder the dissemination and exploitation as well as other follow-ups of SNSF-funded research projects. These include the trouble of identifying commercialisation partners, time and funding constraints, burden of bureaucracy, difficulties in communicating the relevance of the project results, limited networking and exchange opportunities, limited support for exploitation and coaching, limited opportunities to continue projects, difficulties in engaging relevant stakeholders, limited knowledge if results are taken-up and in general difficulties in achieving social impact.

Now, what does this all mean for SNSF's contribution to the development of social impact in general and for contributions to social innovations in particular?

Based on the findings of this study, we can conclude that there are numerous links in SNSF-funded projects to both the generation of social impact and the development of social innovation. We can trace these links through the motivations of PIs to do research, the research objectives and designs of the funded projects, the diverse transdisciplinary practices employed, and the intentional pursuit of PIs concerning the creation of effects beyond scientific impact, some of which are quite clearly aimed at improving the human condition and social welfare.

As mentioned in Chapter 2, we followed a downstream approach, starting from research towards possible contributions to (social) innovations. Especially, the interviews were very conclusive on one point: direct linkages from research, especially from basic research, to innovation are rare. This conclusion applies both to technical-economic innovations and social innovations. If there are linkages, then they are often mediated and, above all, time-delayed.

The motivations, activities and challenges discussed in the previous chapters show that there is sufficient leeway to increase the (social) impact of research projects. The interviewed PIs provided us with several suggestions. Some were very general and simply asked for more money to increase the effectiveness of research. A few were concerned that the impact orientation in research policy is becoming too powerful and risks losing sight of the essential purpose of research, which is to improve our knowledge of the world - from subatomic particles to the boundaries of the universe, from single-celled organisms to complex social formations.

7.2 Recommendations

Our findings from the analysed data and the feedback from the interviews lead us to the following recommendations, which can lead to approaches to improve impact generation without overstretching the burden of scientific research. We have distilled these into five core recommendations.

1) Maintenance of freedom and flexibility
2) A broader Third Mission understanding
3) Wider promotion of BRIDGE-Discovery and project-specific support
4) Support for transdisciplinary research
5) Improve science communication

Recommendation 1 in a nutshell: Maintenance of freedom and flexibility

Under the first recommendation, appreciation for the freedom and openness in research promoted by the SNSF is placed at the centre. At the same time, this is linked to the demand to continue to act flexibly, to allow projects their own development trajectories, even if they deviate at least partially from the original plan (e.g. due to recognised exploitation potentials), and not to make bureaucratic requirements more difficult. In addition, the diversity of research which includes inter- and transdisciplinary approaches should be appreciated and, accordingly, there should be a refraining from placing certain impact dimensions equally over all projects. Also improving the review process to capture the breadth of scientific research approaches, rather than narrowing them, is an ongoing challenge for any research funding agency pursuing a bottom-up, research-open approach.

The first recommendation is based on the conviction that the freedom that the SNSF gives to funded PIs to implement their research ideas is an important advantage, also for generating impact. Many of the PIs are intrinsically motivated to contribute somehow to social and economic progress, especially by generating new knowledge that can be used, among other things, to make problems more workable, but also to draw attention to important or critical issues. Some even want to contribute directly to changes in practice. PIs funded by the SNSF do not live in an ivory tower. When they see opportunities for improvement, be they technical or socio-practical, they do not a priori exclude them from their consciousness. Some fear, however, that a top-down approach of defining standards or indicators to measure and evaluate the impact of projects, would produce an opposite restricting effect, especially because social impact is a multifaceted concept, and there are various different ways of generating impact and being innovative.

In this context, the maintenance of flexibility is an important asset, especially for tracing and pursuing indirect and immediate application possibilities. The SNSF is well advised not only to allow inter- and transdisciplinary cooperation, but also to actively support it by allowing changes of direction in the course of the project without inflating the bureaucracy that may be required. Not surprisingly, PIs wish for more flexibility and support in mastering administrative processes, which can be difficult, for instance in clinical research projects or other projects researching living subjects where specific ethics protocols need to be fulfilled. In such cases, administration is increasingly perceived as overburdening, diminishing the freedom and flexibility of researchers.

Many interviewees confirmed, that inter- and transdisciplinary projects require flexibility to foster the involvement of both other disciplines and non-scientists. This calls, on the one hand, for the creation of spaces for non-scientists to approach a research project in their own way

without forcing the academic definition of what research is on them, and on the other hand, to give space for different approaches and rationales in the research design.

It is unclear whether this call for flexibility should be accompanied by a change of proposal evaluation criteria in relation to the management plan or project implementation plan. From time to time it became clear in the interviews that researchers tend to adapt their proposals not to what they think is innovative, relevant and reasonable, but to what they think the reviewers will understand and approve based on pre-defined review categories. Many researchers, especially younger ones, live off third-party funded projects and do not want to take any additional risk. But it is also acknowledged that the review of a transdisciplinary and interdisciplinary project proposal is not trivial, as it requires very broad knowledge and far-fetching understanding of different fields and applied contexts. Improving the review process to capture the breadth of scientific research approaches, rather than narrowing them, is an ongoing challenge for any research funding agency pursuing a bottom-up, research-open approach.

Not quite unexpectedly, concerns were also voiced in this context from the SSH that methodologies and research traditions predominantly common in the natural sciences are forced onto the field of SSH, which – so it was argued - restricts their research and their approaches. A few PIs from SSH felt that their proposals and projects are evaluated based on criteria that do not apply to their fields and that their projects need to adapt to standards that do not fit their specific research. We cannot judge whether this criticism is justified or not in the case of the SNSF, but we believe that the high autonomy of the scientific domains should be a good corrective in this respect.

Recommendation 2 in a nutshell: A broader Third Mission understanding

This second recommendation addresses the SNSF in its capacity as a central player and opinion leader in the Swiss research system, specifically in terms of supporting an expanded understanding of the Third Mission of universities in order to create better opportunities to engage with civil society, public service providers, policy makers, federal and cantonal authorities and agencies. This should also be accompanied by an appreciation of and incentives for actors who strive for social impact in research and teaching. So far, this has not been an issue for the university's internal promotion system. Objectifying the scope and size of this engagement is an additional challenge.

Several interviewees noted that the universities' self-understanding of their so-called Third Mission should be expanded. First and foremost, this recommendation is thus addressed to the employers of most PIs and not to the SNSF, but the SNSF is considered and addressed as a central opinion leader in the Swiss research system that may be able to work towards a broader understanding of impact.

Many interviewed PIs experienced support from their institutions in pursuing transdisciplinary and translational projects, both in terms of a supportive culture and concrete support offers like coaching. However, they also argued that the universities' priorities are not focused on creating social impact or contributing to social innovations but rather on increasing outreach, dissemination, and popularity. Achieving real outcomes are not perceived as the foremost goals. If researchers want to implement their results to contribute to social change, they are expected to do that on top of their usual activities and not instead of those; this attitude limits resources in terms of time and money.

One way of refocusing these priorities and promoting applied and translational research is by teaching, in which students can be made aware of all the possible outlets and applications of science.

Another possibility would be to operationalise the Third Mission in a broader understanding that goes beyond the transfer of knowledge and technology to companies (Renault et al. 2017; Brudenius, 2017; Benneworth, 2015; Cuna and Beneworth, 2013). A more social and community-oriented Third Mission understanding would also require to create spaces for exchange and cooperation with society, beyond Sunday speeches. This includes the creation of opportunities to engage with civil society, NGOs, public service providers like schools and public administration, not least in order to better recognise their problems and possibly make them usable for (joint) project ideas.

Unfortunately, these civil society or non-profit actors are rarely in a position to pay adequately for research. In contrast to profit-oriented companies, they hardly have the means to commission research services. On the other hand, they can facilitate field access, assist in data collection, contribute to deeper understanding and corresponding knowledge gains, just to name a few of the points that have already been mentioned in several paragraphs in this report.

Some universities are already engaged in processes to better manage this connectivity towards to non-commercial non-scientific groups. An often-cited example is the Centre for Social Innovation at the Stanford Graduate School of Business. Experimental projects and structures to expand the Third Mission, in particular to facilitate contributions from research for the development of social innovations also exist in Europe (Roessler and Brinkmann, 2020; Tuunainen et al., 2019; Russegger, 2019; Caro-Gonzales 2019).

An important point here is also the appreciation for efforts to create social impacts. Incentive systems at universities are primarily aimed at scientific achievements, as indicated by the publication of scientific articles with a high impact factor. Patents are increasingly discussed as being of equal value, as is the scope of third-party funded projects, but research commitment to the development of social innovations is not a category that is conducive to institutional promotion. Objectifying the scope and size of this engagement is an additional challenge.

Recommendation 3 in a nutshell: More open promotion of BRIDGE-Discovery and project-driven support

The third recommendation calls for specific support to bridge the "valley of death" between an SNSF-funded research project and the potential application of its results in fields of practice. Our recommendation is, firstly, to change the framing of BRIDGE-Discovery to make it explicitly open for all SNSF-funded researchers aiming to work on innovations, including social innovations. Secondly, a low-threshold project-specific add-on funding for six to twelve months of extra project time and resources devoted to dissemination, communication and exploitation of results for SNSF-funded projects, which fulfil certain criteria, could be tested that explicitly supports piloting of new social practices in a field of practice.

Although BRIDGE-Discovery explicitly targets applicants who want to realise an innovation with a strong societal or economic impact, the program's web presence suggests a techno-economic understanding of innovation. It also portrays to the outside world a high-threshold programme characterised by a high level of funding and a long project duration. From the interviews, however, we perceived above all a desire for a low-threshold, quickly accessible programme that supports specifically non-economic impacts and social innovations. Thus, we recommend firstly an intensified promotion of BRIDGE-Discovery that takes social innovation more prominent into account. Secondly, we recommend a new low-threshold fast-track funding instrument for social innovations that specifically bridges the Valley of Death between research results and application in practice fields. The activity to be funded has to be a research endeavour, however at higher levels of the Societal Readiness Concept[35] developed by the

[35] https://innovationsfonden.dk/sites/default/files/2019-03/societal_readiness_levels_-_srl.pdf; accessed on 27 June 2022.

Innovation Fund Denmark (SRL6 and higher; see also Figure 10) with a clear focus on developing a pilot application and pilot-testing as well as demonstrating new social practices in a field of practice. These can be experimental but fulfil the required core functionalities.

Several of the interviewed PIs mentioned that the three-to-four-year framework of project work can hamper a project's contribution to (social) innovation, as it restricts time for dissemination, time for follow up with practice partners, and investigation of new questions or ideas that developed during the project. Some PIs emphasised a basic systemic issue regarding the way of how new proposals are evaluated; they claimed that there is too much focus on the novelty of the topic and approach, the compilation of a new project team, and doing something different than before. They further argue that an academic career requires researchers to swiftly jump from one project to the next in order to be funded, which leaves little time for project dissemination and exploitation, not at least due to the fact that new proposals need to be developed already during the lifetime of the ongoing project. However, implementing change and achieving impact is a long-term process that requires stability and continuity, because practices for achieving (social) innovation need long-term knowledge generation and capacity building as well as continuous efforts for communication, dissemination, and relationship building among stakeholders and practitioners.

> *"This whole funding and application policy is actually somewhat at odds with the ability of research, to research social innovations, to accompany them, and actually to accompany them in such a way that the other actors then also notice how important the research is by seeing the continuity and seeing the knowledge build and not seeing - now a graduate student comes along and now another graduate student comes along and so on." Interviewee 9*

> *"You have funding for three years, and then within three years you start the same project again? So this is not original! That's not new!' Whether it's articles or research projects, I've had this kind of remark very often." Interviewee 15*

As an alternative to BRIDGE-Discovery, some interviewees suggested a provisional add-on funding at project level. They argued that already in the proposal phase a concept of project exploitation could be required for those proposals, who want to receive add-on funding for exploitation work. In addition, calls for proposals could encourage longitudinal research designs, in which the same people are followed and investigated over a longer period of time to better capture changes. Alternatively, a similarly spawned idea put forth was that at the end of a project, the SNSF could grant another six months of extra project time devoted to dissemination, communication and exploitation of results. This, however, should be based on certain criteria. Those projects should receive support, which show that their results have a strong application potential and can name a practice partner for piloting.

> *"Our daily routine is that when the SNSF money runs out, we have to land the next one and have relatively little time to continue working on the project, although there is no point in stopping there. There are other logics at play here. If only the SNSF were to add a buffer so that the results could be distributed even more widely." Interviewee 22*

> *"But that you would then have another six months, perhaps, to really speak to various organisations, bodies, institutions, and perhaps also to prepare the results in a slightly different way, in addition to articles or monographs, so that you could also better bring them to the people, that is simply not possible within a project." Interviewee 23*

Recommendation 4 in a nutshell: Support for transdisciplinary research

Transdisciplinary projects are characterised by high efforts in integrating non-academic actors and process management. As the study showed, these processes are time-consuming and repeatedly shaped by communication requirements and operational as well as regulatory challenges. This increases the transaction costs of such projects, which is why it could be considered in a pilot to increase the overheads for such projects on a flat-rate basis.

Alternatively, a separate discrete support instrument for certain forms of transdisciplinary research could also be considered, such as for citizen-science projects.

Transdisciplinary projects are characterised on the one hand by higher transaction costs (higher search effort, higher information effort, higher communication effort, higher coordination effort, higher adaptation effort to particular fields of practice, etc.) and on the other hand by higher efforts in process management and controlling.

Support can be provided through a flat-rate surcharge on the direct costs (e.g. 15 %). However, separate discrete support instruments for certain forms of transdisciplinary research can also be considered. The Austrian Science Fund (FWF) for example provides funding for citizen science expansion projects. All scientists leading a funded FWF project are eligible to apply. The extension projects are intended to address citizens of different ages, genders and social backgrounds as well as people with highly specialised knowledge or expertise (knowledge communities). Young target groups are expressly welcome. The aim of this initiative is to promote research activities that enable the participation of citizens, whereby - without compromising excellent research - citizens contribute their skills, expertise, curiosity and willingness to participate, thus enabling an expansion of research results and findings contributing to a substantial, additional scientific gain in knowledge.

Overall, many of the interviewed PIs expressed interest in systematically connecting research and practice by promoting and engaging in transdisciplinary projects. Many, however, expressed the concern that this remains on the shoulders of the individual researchers who then have to do that on top of their usual academic work.

> *"If one of the ultimate goals of the SNF is to change society through science, I believe some centralisation is needed there - if we leave researchers by the task of doing that by themselves, that is fine, but they need some guidance, some audit, at least, during, not ex-post, like we are doing now, but during the project development." Interviewee 17*

Several interviewed PIs regard the promotion of transdisciplinary work as vital to achieve social impact and, as such, to contribute to social innovation. Some requested the creation of opportunities for connecting and strengthening the dialogue and transfer between researchers and relevant stakeholders from practice (see also our second recommendation). Others argued that diversity is key in order to bring together people with different skills and profiles. Several PIs claimed, sometimes indirectly, that SNSF could use its reputation to actively promote funded projects among policy makers and practitioners and accelerate networking, in particular with experts from the universities of applied sciences (see also recommendation 5).

Some of the interviewed PIs called for an early-stage involvement of stakeholders already in the proposal phase to facilitate the achievement of outcomes and contributions to social innovation. Focus should be on jointly identifying problems and developing research questions so that the findings can be more readily implemented in practice and achieve higher impact. This could also be addressed by particularly supporting young researchers with a practice background or recruiting practitioners or people from the industry for coaching researchers.

Due to competition standards, we cannot imagine ex-ante support in the proposal phase by the SNSF, but we assume that the prospect of top-up funding for transdisciplinary projects is a sufficient incentive to dare to involve non-academic partners in proposal development.

> *"The interaction with the actors on the ground and the kind of expertise they bring up and thinking about how we should organise ourselves so that we can overcome certain barriers together, that's what I find exciting." Interviewee 16*

> *"But if you want to have an impact, you have to create a cooperation with these policymakers. You have to invite them to university, you have to make sure they understand what you are doing, […] and have a more proactive approach." Interviewee 17*

Recommendation 5 in a nutshell: Improve science communication

Although there are already SNSF activities related to science communication, such as AGORA, we consider it beneficial, to increase the promotion of the existing instruments and to enhance support for this purpose. Ideally, a specific unit at SNSF should advise interested PIs of SNSF-funded projects or their collaborators on how to present project results in a media-friendly way without being misunderstood. The unit should also provide a network of journalists and policy-makers or public service providers that can be activated in relation to individual topics.

It became evident through the interviews that PIs are used to communicating with other researchers about their projects and findings but often find it difficult to transfer the findings into a format, which appeals the interest of the public. In particular, researchers feared that their transfer work could result in inadequate generalisations or misunderstandings of their findings. The extent to which this is a bogus argument for not getting involved in the first place cannot be judged here. We also got the impression from the interviews that some PIs are not aware of the existing measures to support science communication through SNSF. Thus, we recommend further efforts as regards the provision of advice and consultancy support from science communication experts to interested PIs. These communication experts should help researchers in translating their insights and findings into an accurate but digestible version for communication in non-scientific areas and for the public.

Many of the interviewed PIs regarded the "marketing" of results that target the society and policy makers as helpful, but they also stressed that "marketing" their own research is very tiring - albeit necessary - especially as researchers do not have the time to do "marketing" on top of their research. They called for structural support in gaining access to experts in science communication provided either by SNSF or by their universities.

One researcher expressed that she would like the SNSF to work together with journalists who are rigorous and trustworthy and who will cooperate with researchers to write about their findings. In this context, it is important that vulnerable or excluded groups are not misrepresented or exploited for the purpose of a catchy article. It was also emphasised to develop long-term relationship with journalists to build trust. However, such a relationship of trust is more likely to be built from a centralised location than decentralised and atomised through the various projects and project actors.

> *"If that was a freelance journalist, for example, then, if I were to plan something like that again, then I had good experiences with her and then I would perhaps approach her specifically and say - could you imagine, perhaps under the conditions, to do so and so. And then the person would perhaps see where they could cooperate with which newspaper, for example. Then that would be the concrete support, I think, that you could work together with such an experienced person." Interviewee 18*

Some PIs also expressed interest in getting support for communicating results on social media platforms because there, they argued, researchers can better control their messages.

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9) ANNEX-I: TOWARDS A MODEL OF ASSESSING RESEARCH CONTRIBUTIONS TO SOCIAL INNOVATIONS

A side goal of the study was to model the operationalised social innovation characteristics (see Figure 2) into a quantitative index to approximate the *degree* of social innovation (SI) in each project.[36] Since the questionnaire included questions beyond the scope of the four main SI dimensions, including questions related to demographic data of the Principal Investigators (PIs), varying hypotheses and further aspects, a statistical *dimension reduction* process was applied to transform the spectrum of the questionnaire into a manageable set of features

WHY DIMENSIONALITY REDUCTION?

Dimensionality reduction methods are meant to turn large datasets into computable formats with as minimal information loss as possible. This is achieved by the analysis of the association between variables. In the conventional dimensionality reduction methods, the dataset is either represented through a smaller-dimensional matrix or as in the case of our study similar variables are combined into so-called latent variables (or factors). In the *factor analysis* used as dimensionality reduction method*,* the assumption is that the latent variables or factors are representing to some extent a common aspect in a specific subset of variables. How many factors a dataset contains and which variables a factor should be associated with are usually matters of appliance of a specific theory, computation, and statistical testing.

Before applying any kind of dimensionality reduction method, the dataset was purified from unrelated variables including the ones measuring other aspects than the substance under scrutiny. Furthermore, some of the relevant variables might not have enough variance or too few observations to be a part of any kind of modelling approach despite their relevance. We have taken the following steps to achieve a workable dataset for the factor analysis process:

1. Questions related to metadata about the respondents (i.e. demographic data like academic age) were removed from the dataset.
2. The *observations* in the study were the projects, therefore any question measuring the characteristics of the researchers like their *familiarity with SI* or *experience with transdisciplinarity* has been removed.
3. One of the questions was designed to capture respondents' self-assessment of the SI contribution rating of their specific project. The purpose of this question was to compare the responses with the SI-index generated after the factor analysis process. Therefore, this *control variable* was excluded from the dataset.
4. Although purely academic motivation/ achievements and interdisciplinary cooperation were important variables in the analytical part of this study, they are not indicators in SI measurement.
5. A statistical method, Principal Feature Analysis[37] (PFA) has been used to find the least *important* variables (Yijuan et al., 2007). PFA is aiming to identify a subset of variables in a dataset without losing any vital information. PFA is utilising clustering approaches on the covariance/correlation matrices. The algorithmic approach by utilising k-means clustering was applied with slight adjustments by following the

36 We acknowledge the valuable statistical contributions and expert knowledge of our colleague Stefanie Konzett-Smoliner, who helped us to develop the model.
37 Not to be mistaken with Principal Component Analysis (PCA), while PCA finds a representation of the features in lower dimensions, PFA is estimating the importance of each feature for the researcher to decide which features could be eliminated.

guidelines in *Yijuan et al. (2007)*'s publication. The algorithmic process was 10.000 times iterated to assess the reliability/accuracy of the results. According to the results of the PFA approach, the following question groups were removed from the dataset:

a. Dissemination-related variables & open science-related variables.

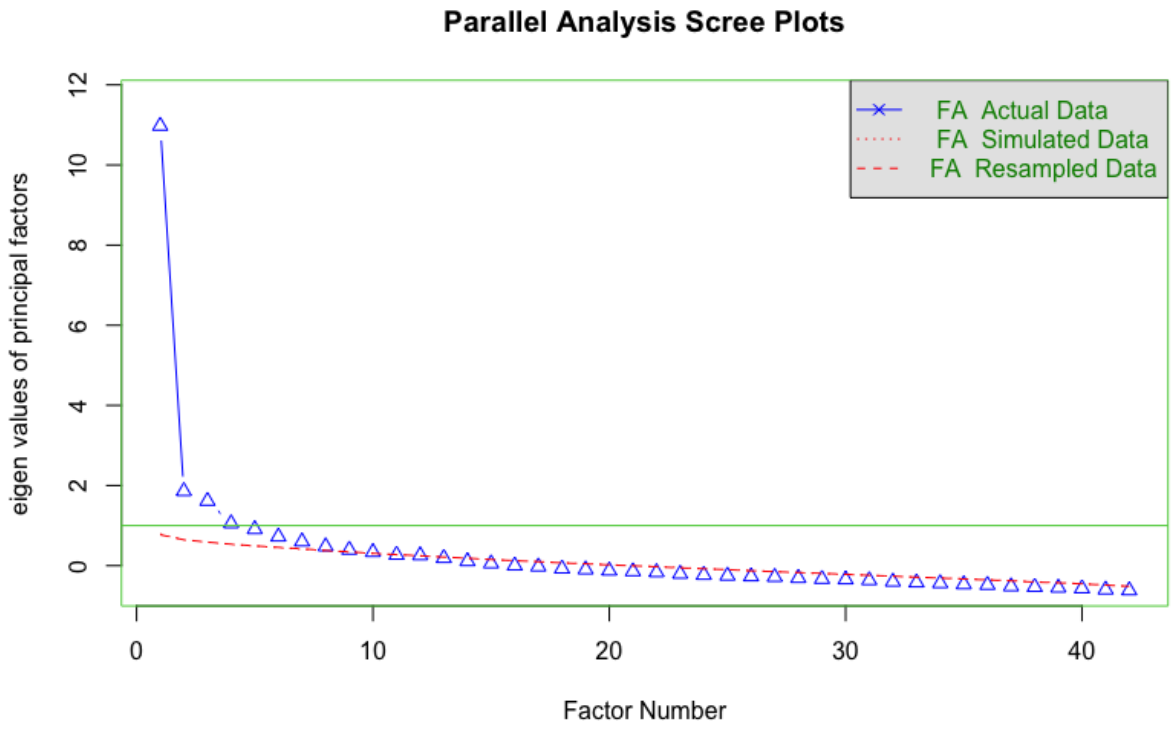
b. Policy adoption and policy-related questions: although important for the theory, questions like how much the results were adopted by the policymakers/ policymaking processes were not significant enough to include in the modelling processes.

c. Business-related items were excluded in order to safeguard the focus on social innovation.

EXPLORATORY FACTOR ANALYSIS

A common obstacle in the factor analysis model-building process is the potential bias in the study. If the variance among the responses was caused by the instruments/methodology instead of the intended aspects of measurement, there might be Common Method Bias (CMB) in the study. An effective method to test the CMB is Harman's single factor test. This approach is basically testing, how much variance a single factor (latent variable) would explain if all the variables in the dataset are included in it. If a single factor is able to explain an absurd proportion like over 50 %, the dataset is jeopardised by CMB. To ensure statistical robustness of results, all of the items included in the dataset were explored via Harman's single factor test to evaluate Common Method Bias. The explanatory factor analysis (EFA) process with a single factor returned the total explained variance as 0.26 suggesting there was no significant indication of common method bias in the study (Podsakoff et al., 2003). Furthermore, Bartlett's Test and as a measure of sampling adequacy Kaiser-Meyer-Olkin (KMO) tests were applied to the dataset. Both results were significant (p-values < 0.01) with a KMO value of 0.87. These results provide support for the decision to apply factor analysis.

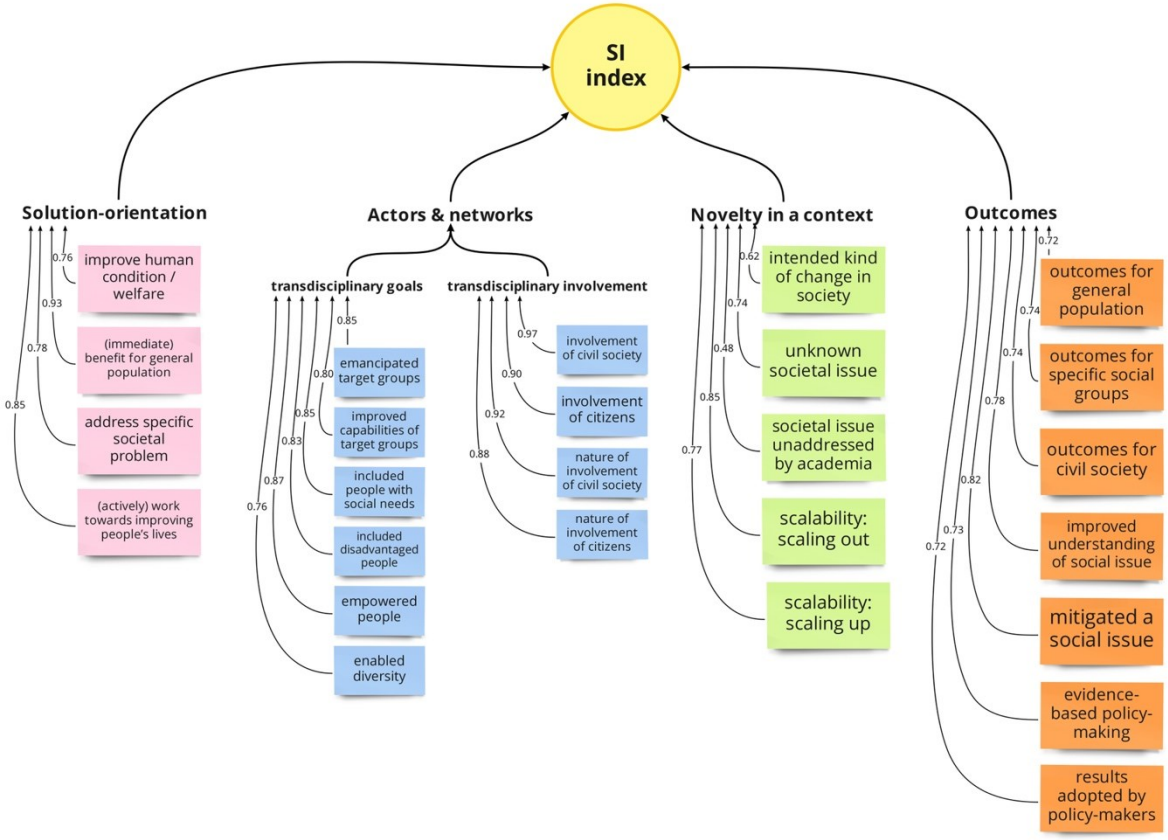
Figure 24: Scree plot regarding the eigenvalues of principal components



Two main approaches exist in the factor analysis methodology, Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). EFA approach is prioritising algorithmic extraction of the factors through the sole associations between the variables without any previous assumption derived from a theory. CFA, on the other hand, requires an already defined factor model to test the *fitting* of the variables and factors with each other. Our study is built on an existing theory, therefore, the main approach used in the study is CFA. However, to test, firstly, how fitting a specific number of factors to the dataset is, and secondly, if unforeseen relations between the variables exist, several EFA rounds with varying parameter definitions were applied. Based on the SI-pillars (see Figure 2) the expected number of factors was 4. After generating a scree plot, the analysis of eigenvalue computations yielded 4 components with eigenvalues higher than 1 and a 5 and one component with an eigenvalue just under 1 (see Figure 25). Experimenting with different EFA parameters has shown that two EFA models each including 4 and 5 factors respectively with *varimax* rotation and *maximum likelihood* factoring method yielded the best results. The five-factor approach performed generally better and returned a total explained variance of just over 50 %. The first factor accounted to only 10 % of the variance further ensuring the absence of common method bias.

CONFIRMATORY FACTOR ANALYSIS

Figure 25: Path diagram of the CFA model



After deciding the possible number of factors through eigenvalue analysis and EFA experiments, we built a CFA model with five factors as the main model and several other models with varying

numbers of factors for comparison. The model has followed a variable grouping scheme very close to the initial theory. The only major difference between the pre-defined SI-Pillars (see Figure 2) and the CFA model structure was splitting the Actors & Networks" pillar 2 into different factors (See *transdisciplinary goals* and *transdisciplinary involvement* in Figure 26). The idea behind the separation of the Actors & Networks pillar was to isolate the different types of goals intended for involvement of societal groups in the study from the degree and nature of the transdisciplinary involvement. Goals like *"emancipation"* or *"building capacities*" etc. for the involved societal groups have an (additional) individual effect in the model than the variables measuring the solely different types and *depth* of transdisciplinary involvement.

The theoretical justification of the variables and factors are as follows:

- Solution-orientation was the first SI-pillar in the theoretical framework that contained intentions, objectives, social purpose, improvement of living conditions, social inclusion, and needs. This pillar has been operationalised by several variables in the study, all aligned with the theory. Having an intent to improve the human condition, benefiting the general population, addressing societal problems and working towards improving people's lives are very well aligned questions with the purpose of this specific pillar. As Figure 28 displays the factor loadings are also reflecting this alignment[38] with relatively high values.

- Transdisciplinary goals include the intentions/achievements regarding the social group included in the participatory research process and/or the inclusion of disadvantaged groups in the study.

- Transdisciplinary involvement is aiming to measure the degree and nature of involvement of societal actors. Although the initial pillar initially aimed to include additional types of stakeholders, the categories under this factor have been reduced to citizens and involvement of the broader civil society either because of insufficient responses or insufficient feature importance of the other categories.

- The Novelty pillar tried to encapsulate the intention/plan to introduce something new through the project results. Projects designed to cause a change in society, to address a specific social issue as well as aim for a scalable solution have been evaluated to be novelty-oriented works.

- Although outcomes can be interpreted in different ways, the factor includes only the concrete outcomes of the projects. These are the direct impacts caused by the project results. Although it is not a necessity to generate immediate impact for SI, innovative outcomes are one of the important factors in social innovation.

The confirmatory factor analysis (CFA) Model has been fitted via *the Lavaan* library using R. Since all the features in the dataset were ordinal scaled, *Lavaan*'s factor analysis option for the *ordered* (ordinal) variables has been applied to the CFA model. Accordingly, *a weighted least square mean and variance adjusted estimator* (WLSMV) has been selected as an estimator (suggested estimator for ordinal variables) which uses *diagonally weighted least squares* (DWLS) to estimate the model parameters.

After the comparison of the models with an Anova test, the confirmatory factor analysis model was tested by using a 5-fold cross-validation process with an 80 % to 20 % train-test split. In comparison with other possible factor analysis models (which included more factors/ variables), the final model has produced the best scores. The fit scores of the 5-factor model generally indicated a good fit. However, several initial variables had to be removed from the model because of their unsatisfactory factor loadings to ensure a good fit. The fit statistics robust χ^2

[38] Factor loadings are the values that indicate how much variance from a specific variable is explained by the overarching factor (caution, explained variance is the square of the given value). For example, ~86% of the variance (0,93 ^ 2) of the variable *benefit for general population* is explained by the factor *Solution-orientation*.

(Chi-squared) score's (~926) division (see Table 12) by the degrees of freedom (289) returns are approximately 3,2; although there is a fair amount of debate about this ratio, values under 4 are usually confirmed as acceptable values[39]. Comparative Fit Index (CFI = 0,933) and Tucker-Lewis Index (TLI = 0,925) are higher than the common threshold of 0,9, indicating a good fit. Root Mean Square Error of Approximation (RMSEA) is around 0,07 which is still under the commonly accepted threshold of 0,08 but not in the most optimal range (under 0,6 or 0,55).

Table 12: Summary of the Confirmatory Factor Analysis (CFA)

Confirmatory Factor Analysis (CFA) – Summary				
Estimator	DWLS			
Optimisation method	NLMINB			
Number of model parameters	188			
Number of observations	361			
Model Test User Model:			**Latent Variables:**	
	Standard	**Robust**		**Std.all**
Test Statistic	871.439	926.712	**solution-orientation** =~	
Degrees of freedom	289	289	improve human condition	0.756
P-value (Chi-square)	0	0	benefit for general population	0.932
Scaling correction factor		1.104	address specific societal problem	0.779
Shift parameter		137.274	work towards improving people's lives	0.851
simple second-order correction (WLSMV)			**transdisciplinary involvement** =~	
			involvement of civil society	0.973
Model Test Baseline Model:			involvement of citizens	0.896
Test statistic	31166.661	9827.725	nature of involvement of civil society	0.925
Degrees of freedom	325	325	nature of involvement of citizens	0.876
P-value	0	0	**transdisciplinary purposes** =~	
Scaling correction factor		3.246	emancipated target groups	0.847
			improved capabilities of target groups	0.805
User Model versus Baseline Model:			included people with social needs	0.849
Comparative Fit Index (CFI)	0.981	0.933	included disadvantaged people	0.826
Tucker-Lewis Index (TLI)	0.979	0.925	empowered people	0.866
Robust Comparative Fit Index (CFI)		#N/A	enabled diversity	0.762
Robust Tucker-Lewis Index (TLI)		#N/A	**novelty** =~	
			scalability: scaling out	0.853
Root Mean Square Error of Approximation:			scalability: scaling up	0.768
RMSEA	0.075	0.078	unknown societal issue	0.736
90 Percent confidence interval - lower	0.069	0.073	societal issue unaddressed by academia	0.481
90 Percent confidence interval - upper	0.081	0.084	intended kind of change in society	0.621
P-value RMSEA <= 0.05	0	0	**outcomes** =~	
			evidence-based policy-making	0.732
Robust RMSEA		#N/A	outcomes for general population	0.717
90 Percent confidence interval - lower		#N/A	outcomes for specific social groups	0.739

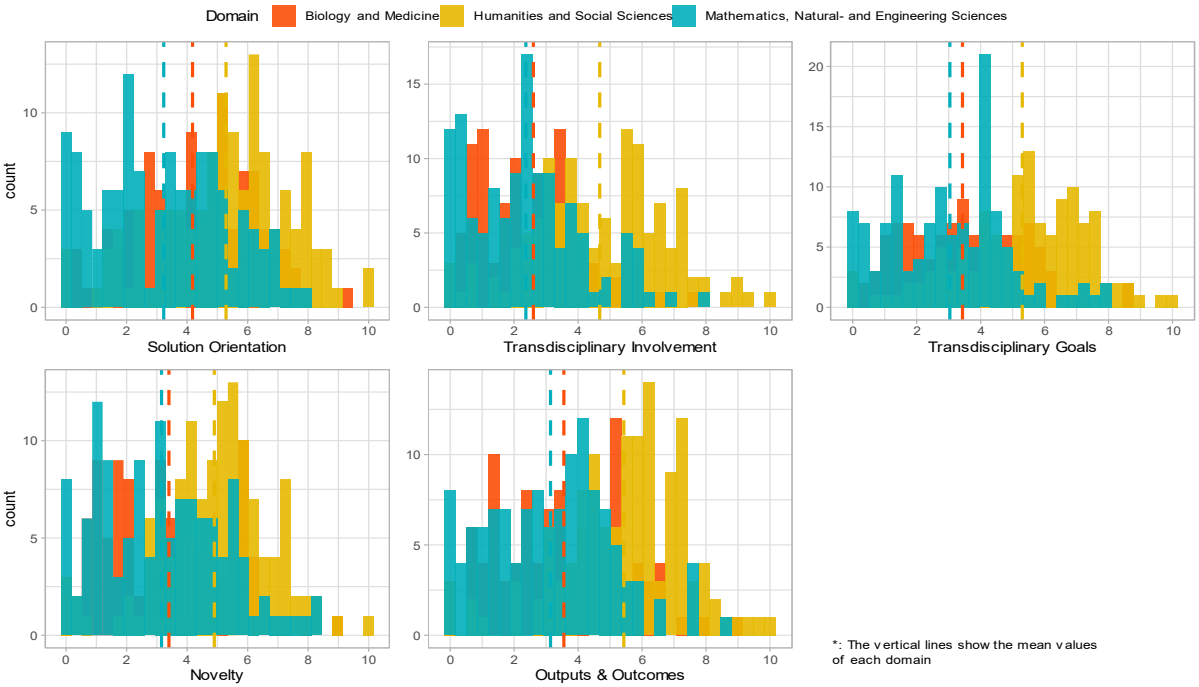
[39] It is generally preferred to have a non-significant χ^2 but as the sample size gets larger, there are usually only significant values.

90 Percent confidence interval - upper		#N/A		outcomes for civil society	0.737
				results adopted by policy-makers	0.715
Standardised Root Mean Square Residual:				mitigated a social issue	0.818
SRMR	0.091	0.091		improved understanding of social issue	0.78
Weighted Root Mean Square Residual:					
WRMR	1.352	1.352			
Parameter Estimates:					
Standard errors	Robust.sem				
Information	Expected				
Information saturated (h1) model	Unstructured				

IMPLICATIONS OF THE CFA MODEL FOR THE SCIENTIFIC DOMAINS

Finally, the survey dataset fitted into the factor analysis model to predict the estimated observations under each factor. Factors were scaled to reflect the standard scale from 0 to 10 in most of the survey questions. Figure 27 displays the distribution of the scientific domains under each of the factors presented on the path diagram (Figure 26). Under *solution orientation, transdisciplinary involvement, and novelty* the domain 'Math., Natural- and Engineering Sciences' mostly occupies values under 5. Under *transdisciplinary goals* and *outputs & outcomes* the domain 'Math., Natural- and Engineering Sciences' has a high frequency in middle values. The domain 'Biology and Medicine' is consistently positioned around middle values; mean values also show similarity to the values of 'Math., Natural- and Engineering Sciences'. The domain 'Biology and Medicine' also shows a relatively high frequency of values over 5 under *outputs & outcomes*. The SSH domain has higher values under each factor; mean values of SSH are also by far higher than those of the other two domains, especially under outputs & outcomes. SSH fields are especially visible with high counts of values between 6 and 8.

Figure 26: Distribution of scientific domains in each factor of the CFA Model



PREDICTION OF THE OUTCOME FACTOR VIA OTHER FACTORS

The establishment of a prediction model was not one of the study goals. However, in order to see the effects of the other factors on the direct outcomes, we tried a different approach to model *outcomes* as a dependent variable. After several considerations, ordinal logarithmic regression (logit) models yielded satisfactory results. Table 13 presents the details of an ordinal logit model selected after the 10-fold cross-validation of various models by comparing F1-scores. All the determined coefficients in the model are statistically significant. The novelty factor is by far the most influential variable on the *outcomes*, 1 degree of increase in the Novelty factor is estimated to cause 4 degrees of increase in the *outcomes* factor. Although the effect is not negligible, solution orientation is the least impactful variable amongst the others in the model, for 1 degree of increase in solution orientation, only 1 degree of increase in output & outcomes is estimated. Transdisciplinary goals and transdisciplinary involvement, both have similar coefficients with transdisciplinary goals being slightly higher (2.6 and 2.0 respectively). Both are thus influencing the outputs & outcomes variable higher than solution orientation.

Table 13: Ordinal Logistic Regression Model

Ordinal Logit Model							
Formula							
outcomes	**~**	**solution-orientation** + **transdisciplinary involvement** + **transdisciplinary purposes** + **novelty**					
link	**threshold**	**nobs**	**logLik**	**AIC**	**niter**	**max.grad**	**cond.H**
logit	flexible	292	-876.76	2.23E+03	11(3)	1.57E-07	8.70E+06

Coefficients	Estimate	Std. Error	z value	Pr(>|z|)	
solution-orientation	1.0015	0.1314	7.624	2.46E-14	***
transdisciplinary involvement	2.0439	0.165	12.39	< 2e-16	***
transdisciplinary goals	2.8038	0.2782	10.078	< 2e-16	***
novelty	4.1039	0.2398	17.117	< 2e-16	***
Significance codes	0 '***'	0.001 '**'	0.01 '*'	0.05 '.'	0.1 ' '

GENERATION OF THE SI-INDEX

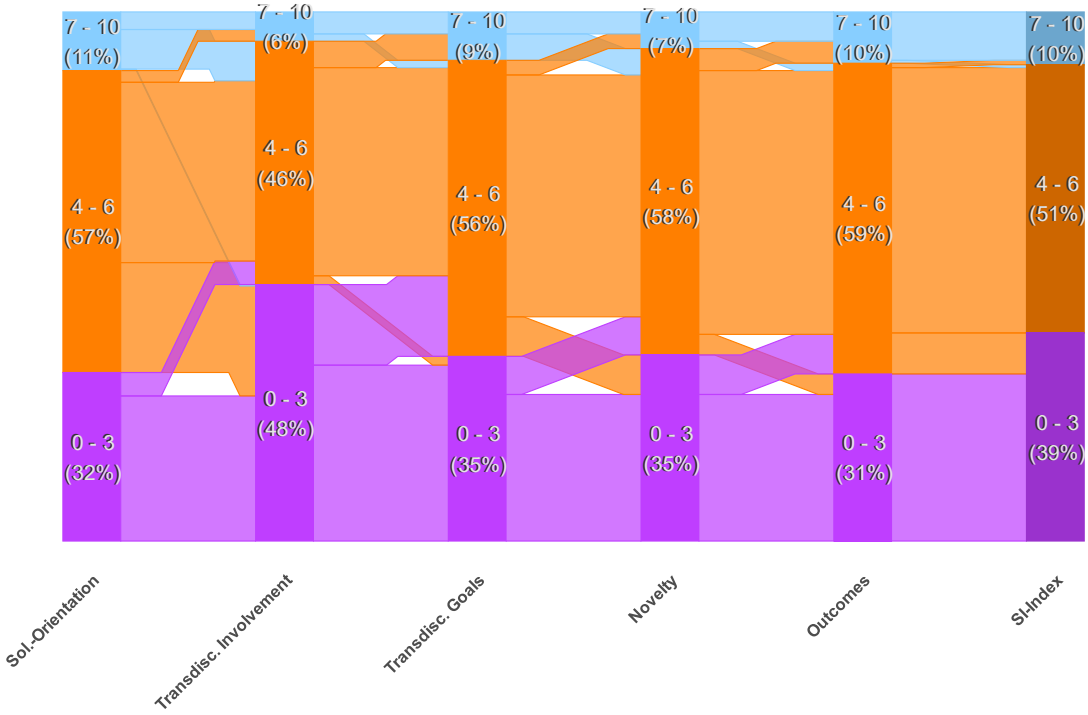
One of the purposes of the factor analysis approach was to generate an SI-Index derived from the pillars of the theoretical framework. Figure 28 is visualising the distribution of the generated SI-Index (split into 3 segments) along with the other factors for comparison. The segmented distributions of the factors seem to be similar, most often with values between 4 and 6 accounting for a proportion between 45 % and 60 % of the responses among the factors. The proportion of the values 7 and above is remarkably smaller; none of them includes a proportion greater than 11 %. The proportion of the values smaller than 3 is the greatest under the factor transdisciplinary involvement with 48 % and equal to or smaller than 35 % under other factors.

The methodology of SI-Index generation included the following rules:

- Any project that had 0 values in 2 or more pillars was classified as a 0 under SI-Index.
- Since transdisciplinary involvement and transdisciplinary goals both share the same theoretical pillar, their values have been weighted with 0.5.

Finally, after applying both rules, factor values for each project have been summed up and scaled to reflect the common 0-10 scale consistently used in the study. In total 141 projects were associated with an SI-Index value equal to or smaller than 2 (39 %), 184 projects were associated with values between 3 and 6 indicating some socially innovative aspects, and finally, 36 projects are marked as the highest ones on an SI-Index scale with values equal or over 7. The latter are 10 % of the whole analysed project population.

Figure 27: Three segment distribution of SI-Index along with the factors



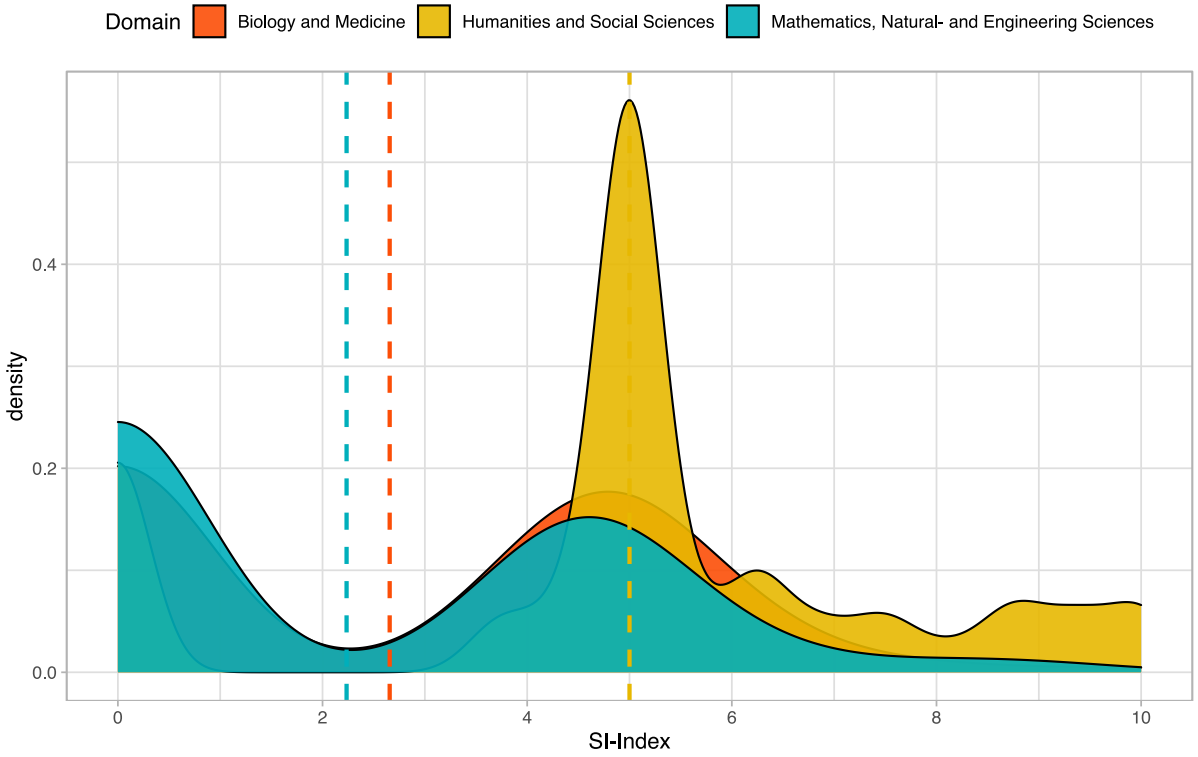
The density plot of the domain distribution (see Figure 29) under the SI-Index draws a slightly different picture than the individual factors. The density of the values from SSH fields is especially higher around 5. While the SSH domain is also more visible among the higher values, the distribution of the other domains is not much different from each other with Biology & Medicine fields being relatively higher. Accordingly, the mean value of SSH is visibly higher than the other two domains (~5). The Mean values of the domains 'Biology & Medicine and Mathematics' and 'Natural- and Engineering Sciences' are much smaller, between 2 and 3 (~2,6 and 2,2 respectively).

RELATIONSHIP BETWEEN THE SI-INDEX AND THE SELF-ASSESSED SI CONTRIBUTION

One of the survey questions asked for the respondents' self-assessment of the contribution their projects made to SI. To exclude those, who have only a low understanding of the concept of SI, the question was only addressed to those PIs, who rated their SI-Familiarity higher than 5 (on a scale between 0 and 10). These were in total 112 respondents. Two of the hypotheses of our study were related to the relationship between the self-assessment question and the measured SI rating, which we have operationalised through the prediction with factor analysis model and SI-Index:

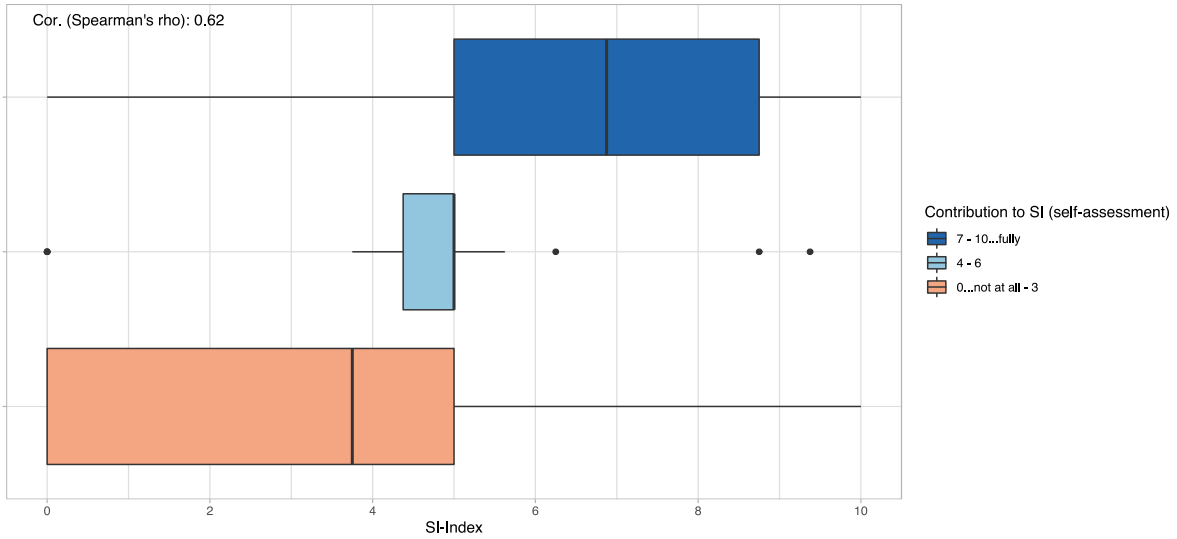
- H_{6_1}: The higher the self-assessment is the higher is the estimated contribution to social innovation.
- H_{6_2}: There is an underestimation of the project's real contribution to SI in comparison with the SI-Index.

Figure 28: Density plot of the domain distribution under SI-Index



As Figure 30 visualises, there is a positive correlation between the self-assessed SI contribution rate and the SI-Index derived from our model. The statistically significant (p-value < 0.05) moderate positive correlation (Spearman's rho = 0.62) between the two variables indicates an increment in SI-Index with higher levels of self-assessed contribution to SI. This result is sufficient to reject the null hypothesis and accept the statement in H_{6_1}.

Figure 29: Relationship between SI-Index and self-assessed rating of project's SI contribution



The first step in confirming or rejecting an underestimation is to find out if there is a statistically significant difference between the two variables. Statistical tests approve at first sight a statistically significant difference between the two variables (Kruskal-Wallis Test, p-value < 0.05[40]). However, since the number of participations and the variance in the responses was not enough, we could finally not confirm if there is an under- or overestimation as regards the difference between the two variables (Wilcoxon rank-sum test with continuity correction, p-value = 0.39).

OUTLOOK

Our modelling approach tried to establish a reproducible and scalable appliance for the operationalisation of SI. The factor analysis approach has been built upon the theoretical framework of our study and shaped further by the statistical exploration of the survey results. The definition of the latent variables in our questionnaire enables two possible further implementations of the theory and methodology in our study:

1. The latent variables and factors in our factor analysis model can be used to structure a survey on a broader scale with more participants with a precise questionnaire measuring only the components of our model. Combined with an extensive metadata collection (disciplines, domains, programmes, and other aspects of the projects), this approach could be used to build prediction models as well.

2. The components of the model can be used to assess the SI-Rating of the projects with other methodological options. For example, a combination of text analysis methods like topic modelling methods and analysis of the results/involved actors in the projects could potentially be used to assess ratings under each defined factor.

[40] As in the previous cases, since the normality of the distribution of the difference between the two variables could not be confirmed (Shapiro-Wilk Test, p-value < 0.05) non-parametric tests are used to confirm the differences.

10) ANNEX-II: STATISTICAL CALCULATIONS AND ADDITIONAL FIGURES

Table 14: Kruskal-Wallis and Pairwise Wilcoxon rank sum test results on SI-Familiarity by research domains

```
Kruskal-Wallis rank sum test:

data:  familiarWithSI.response. by domain
Kruskal-Wallis chi-squared = 45.694, df = 2, p-value = 1.196e-10

Pairwise comparisons using Wilcoxon rank sum test with continuity correction:

Biology and Medicine
Humanities and Social Sciences                 2.0e-09
Mathematics, Natural- and Engineering Sciences 1
Humanities and Social Sciences
Humanities and Social Sciences                 -
Mathematics, Natural- and Engineering Sciences 2.8e-07
-- P value adjustment method: bonferroni
```

RESULT

- H_1: K-W test with a p-value way below α shows we can reject the null hypothesis. This means, that there is a statistically significant association between the familiarity with SI and research domains. However, the only significant difference is yielded for SSH, compared to the other two domains (P-W).

Figure 30: Stakeholder groups involved in transdisciplinary research

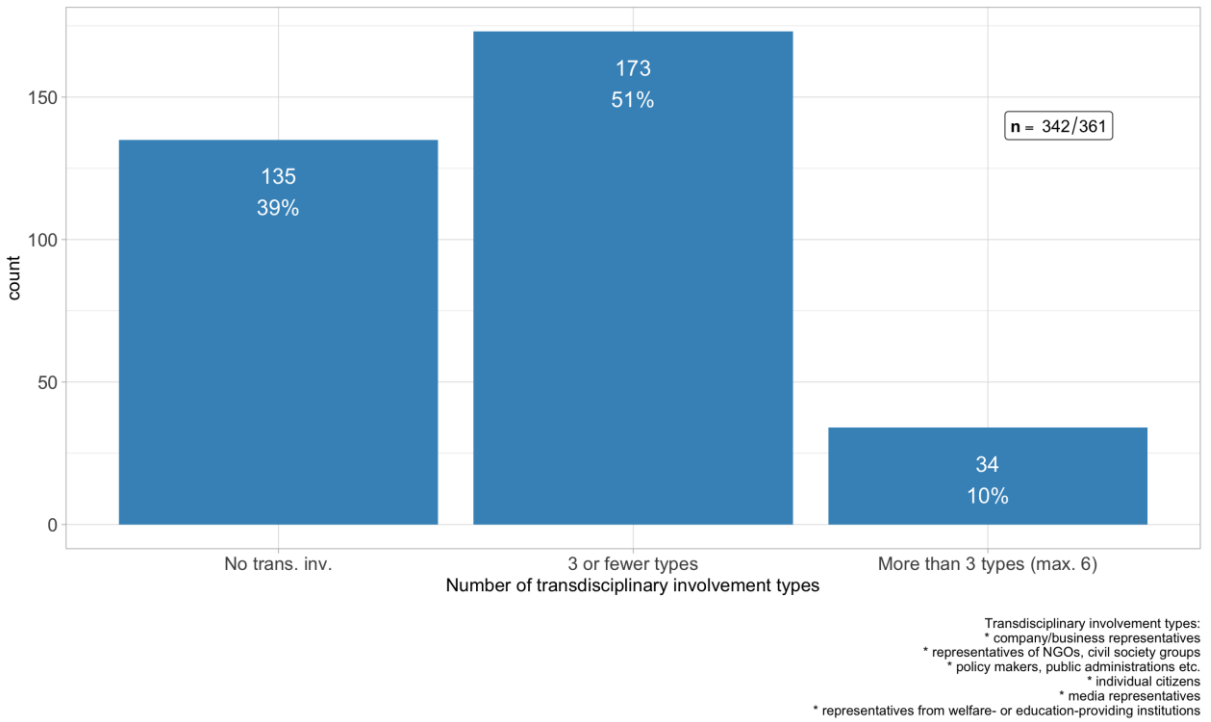


Table 15: Correlation matrix between the deliberate planning for benefits for and the nature of involvement of target groups outside academia

Correlation:

	Benefit for non-academy citizens	civ. soc. org.	welfare inst.
Benefit for non-academy citizens	1.00	0.15	0.05
civ. soc. org.	0.15	1.00	0.37
welfare inst.	0.05	0.37	1.00
	0.31	0.51	0.16

	welfare inst.
Benefit for non-academy citizens	0.31
civ. soc. org.	0.51
welfare inst.	0.16
	1.00

Sample Size:

	Benefit for non-academy citizens	civ. soc. org.	welfare inst.
Benefit for non-academy citizens	360	82	51
civ. soc. org.	82	82	34
welfare inst.	51	34	51
	74	41	23

	welfare inst.
Benefit for non-academy citizens	74
civ. soc. org.	41
welfare inst.	23
	74

P-Values

	Benefit for non-academy citizens	civ. soc. org.	welfare inst.
Benefit for non-academy citizens		0.1882	0.7077
civ. soc. org.	0.1882		0.0294
welfare inst.	0.7077	0.0294	
	0.0077	0.0007	0.4541

	welfare inst.
Benefit for non-academy citizens	0.0077
civ. soc. org.	0.0007
welfare inst.	0.4541

RESULT

- $H_{2.1}$: the *intention to benefit society* and the *nature of involvement of citizen and civil society groups (incl. NGOs)* in research processes have p-values > 0.05. This means that we cannot reject the null hypothesis for each of these, i. e. there is no statistically significant relationship between the two analysed variables.

- $H_{2.2}$: the *intention to create benefits* for stakeholders from the welfare and education sector has a statistically significant relationship ($\alpha < 0.05$) with the *nature of involvement*, although it correlates relatively weakly (rho=0.3).

Table 16: Correlation matrix between transdisciplinary experience, the motivation to address a specific problem, and the motivation to improve the human condition/welfare

	Trans._Exp.	Mot._to_add_Pr.	Mot._to_imp._HC
Trans._Exp.	1.00	0.01	0.33
Mot._to_add_Pr.	0.01	1.00	0.27
Mot._to_imp._HC	0.33	0.27	1.00

P-Values:

	Trans._Exp.	Mot._to_add_Pr.	Mot._to_imp._HC
Trans._Exp.		0.8272	0.0000
Mot._to_add_Pr.	0.8272		0.0000
Mot._to_imp._HC	0.0000	0.0000	

RESULT

- $H_{3\text{-}1}$: Since the p-value is greater than α (0.05), we cannot reject the null hypothesis, which indicates that there is no association between the motivation to solve a specific problem and transdisciplinary experience
- $H_{3\text{-}2}$: the p-value is smaller than α, we can reject the null hypothesis. There is a statistically significant relationship between the transdisciplinary experience and the motivation to improve the human condition. The correlation between the two is, however, weak positive (rho = 0.33).

Figure 31: Distribution of extent to benefit target groups outside the academic world

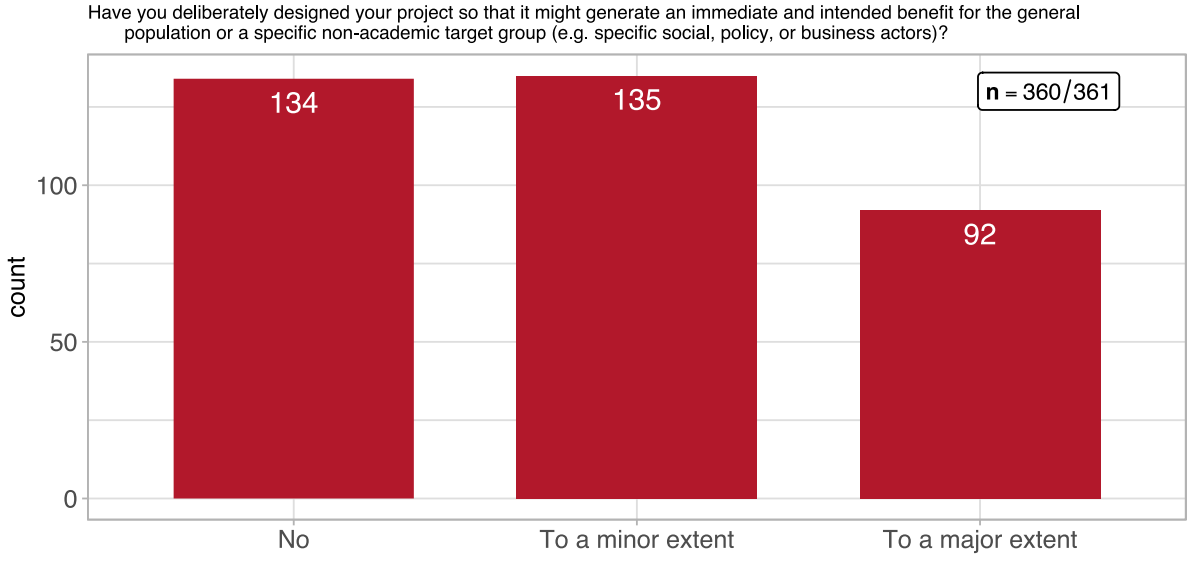


Table 17: Correlation matrix between the motivation to improve the human condition/welfare and the direct contribution of the project results to target groups

Correlation:

	Mot.to imp. human cond.	General popul.	Spec. social gr.	NGOs, civ. soc. gr.
Mot.to imp. human cond.	1.00	0.51	0.32	0.33
General popul.	0.51	1.00	0.38	0.42
Spec. social gr.	0.32	0.38	1.00	0.55
NGOs, civ. soc. gr.	0.33	0.42	0.55	1.00

Sample Size:

	Mot.to imp. human cond.	General popul.	Spec. social gr.	NGOs, civ. soc. gr.
Mot.to imp. human cond.	355	350	342	348
General popul.	350	355	344	350
Spec. social gr.	342	344	347	347
NGOs, civ. soc. gr.	348	350	347	353

P-Values:

	Mot.to imp. human cond.	General popul.	Spec. social gr.	NGOs, civ. soc. gr.
Mot.to imp. human cond.		0	0	0
General popul.	0		0	0
Spec. social gr.	0	0		0
NGOs, civ. soc. gr.	0	0	0	

RESULT

- $H_{4.1}$: the p-value < α, i. e. there is a statistically significant association between the motivation to improve the human condition and the production of better services, product, etc. for the general population (correlation is also moderately strong, rho ≈ 0.5).
- $H_{4.2}$ and $H_{4.3}$: are returning similar p-values, both smaller than α. This means that there is a statistically significant but weak correlation (0.3) between the motivation to improve the human condition and the production of better services, etc. for specific social groups, respectively NGOs, advocacy groups and civil society organisations.

Table 18: Correlation matrix between citizens' level of involvement and selected outcome variables

	Inv. of citizens	Scalability	Gen. understanding
Inv. of citizens	1.00	0.33	0.39
Scalability	0.33	1.00	0.35
Gen. understanding	0.39	0.35	1.00
Emancip. impact	0.43	0.41	0.65

	Emancip. impact
Inv. of citizens	0.43
Scalability	0.41
Gen. understanding	0.65
Emancip. impact	1.00

n

	Inv. of citizens	Scalability	Gen. understanding
Inv. of citizens	353	118	279
Scalability	118	121	114
Gen. understanding	279	114	286
Emancip. impact	267	115	266

	Emancip. impact
Inv. of citizens	267
Scalability	115
Gen. understanding	266
Emancip. impact	273

P

	Inv. of citizens	Scalability	Gen. understanding
Inv. of citizens		3e-04	0e+00
Scalability	3e-04		1e-04
Gen. understanding	0e+00	1e-04	
Emancip. impact	0e+00	0e+00	0e+00

	Emancip. impact
Inv. of citizens	0e+00
Scalability	0e+00
Gen. understanding	0e+00

Emancip. Impact

RESULT

- H_5: the level of involvement of non-academic actors seems to have a statis tically significant relationship with scalability, the generation of better understanding, and an emancipatory impact, as the p-values are smaller than 0.05 for each of these, although at a weak to moderate level of correlation.

11) ANNEX-III: FIELD DOMAINS OF INTERVIEW PARTNERS AND SURVEY QUESTIONNAIRE

I. Fields/domains of interview partners

Field/Domain	**Number of interviews**
Neuroscience	2
Psychology	3
Education and learning sciences	3
Economics	1
Other Languages and Literature	2
Social Sciences	3
Theology	2
Political Science	2
Organic Chemistry	1
Computer Science	1
Visual Arts and Art History	2
Biophysics	1
Architecture and social urban science	1
Physics	1
Information Technology	1
Medical Microbiology	1
Legal Sciences	3
Swiss History	1
Medical Technology	1
Medicine	1
Arts	1
General History	1
Neurophysiology and Brain Research	1
Bioengineering	1

Social Work	2
Molecular Biology	1
Humanities	1
Sociology	1
Ethnology	2
Astronomy, Astrophysics and Space Sciences	1
Geochemistry	1
German and English languages and literature	1

II. Survey questionnaire

Welcome!

As announced in our e-mail invitation, the purpose of this survey is to gain a first understanding of the extent *social innovation* is part of your SNSF-funded project and what contribution SNSF-funded projects make with regard to *social innovation*.

It is not necessary that you are familiar with the ambiguous terminology of *social innovation* - the survey will guide you where necessary. Depending on your answers, it may take you 10-20 minutes to complete it.

All your answers will be treated confidentially and data will only be published in aggregated form. The aim is by no means to evaluate your research project or research in general, but to gauge socially innovative aspects in SNSF-funded projects.

Section A: Demographic information

With the next few questions, we would like to learn more about you as a scientist.

A1. How would you rate your experience with transdisciplinary research?

Transdisciplinary research as regarded by the Swiss Academy of Sciences: https://naturalsciences.ch/transdisciplinarity

	0..not experienced at all	1	2	3	4	5	6	7	8	9	10..highly experienced
Please rate	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

A2. How old are you?

- 39 or younger ☐
- 40 to 49 ☐
- 50 to 59 ☐
- 60 to 69 ☐
- 70 or older ☐

A3. What is your academic age?

- 0-2 years ☐
- 3-5 years ☐
- 6-10 years ☐
- 11-15 years ☐
- > 15 years ☐

Section B: Familiarity with Social Innovation

B1. How familiar are you with the concept of "*social innovation*"?

	0..not at all	1	2	3	4	5	6	7	8	9	10..fully
Please rate	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Section C: Social Innovation in your Research Project

We have carefully sampled all projects. If there is a valid reason why you cannot confirm to continue with this particular project, we kindly ask you to let us know about any potential misalignment (Dietmar Lampert @zsi.at>) and stop filling in the questionnaire beyond this point.

Otherwise, please confirm the above question by clicking *yes* and continue with the questionnaire.

C1. Together with the SNSF, we have sampled roughly 1'000 individual projects. The one attributed to you as *responsible applicant* is the following:

Project ID: Project title: Project period: Corresponding discipline: SNSF funding instrument:

We kindly ask you to keep this project in mind, as all our subsequent questions relate to this project.

Please be so kind as to confirm that it is clear to you that, <u>from now on, all questions and your responses refer to this project exclusively</u>.

Yes ☐

No ☐

C2. To what extent do you think your SNSF-funded project contributed to *social innovation* (please see [?] below for a definition)?

We refer to the definition presented by the EU-funded SI-DRIVE-project that sees social innovation as

new combination or figuration of practices in areas of social action [...] with the goal of better coping with needs and problems than is possible by using existing practices. An innovation is therefore social to the extent that it varies social action and is socially accepted and diffused in society.

cf. Howaldt and Schwarz 2016, p.6

	0..not at all	1	2	3	4	5	6	7	8	9	10..very high extent
Please rate	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Section D: Intention and Agency

With the next questions, we would like to know more about what motivated you for your research project.

D1. When you designed your project, to what degree were you motivated to …

	0..not at all	1	2	3	4	5	6	7	8	9	10..fully
better understand a natural, technical, economic, or social phenomenon?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
directly address a natural, technical, economic, or social problem?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
improve the human condition/welfare (outside academia)?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

D2. Have you deliberately designed your project so that it might generate an immediate and intended benefit for the general population or a specific non-academic target group (e.g. specific social, policy, or business actors)?

excluding employees or co-workers

- ☐ no
- ☐ to a minor extent
- ☐ to a large extent

D3. Was there an impulse from the non-academic world that motivated you to start the project, namely ...

- ☐ a specific societal problem
- ☐ a specific economic problem
- ☐ a specific ecological/natural problem
- ☐ a specific health/medical problem
- ☐ a specific technical problem
- ☐ a different impulse, namely

a different impulse, namely

Section E: Transdisciplinary Aspects

With the next questions that deal with various aspects of transdisciplinary research, we are already at the core of the survey.

E1. In your research processes, did you actively involve one or more of the following groups(*)?

(*) excluding study subjects, suppliers of material, and employees of your own organisation

	no	only marginally	quite centrally
researchers from other disciplines	☐	☐	☐
company/business representatives (incl. farmers)	☐	☐	☐
representatives of NGOs, advocacy or other civil society groups	☐	☐	☐
policy makers, public administrations, representatives from governmental agencies	☐	☐	☐
individual citizens (e.g. as beneficiaries, customers, or concerned persons)	☐	☐	☐
media representatives (traditional media, digital media (e.g. bloggers), journalists, community-led media, etc.)	☐	☐	☐
representatives from welfare- or education-providing institutions (such as schools, kindergartens, hospitals, or care centres)	☐	☐	☐

E2. What was the nature of involvement of those groups?

	consultative (provide information via interviews, online questionnaires, etc.)	contributory (consultative + contributing through collecting data, validating data, disseminating results, etc.)	collaborative (contributory + interpreting data and/or drawing conclusions)	co-created (collaborative + participated in designing study and/or determining objectives)
researchers from other disciplines	☐	☐	☐	☐
company/business representatives (incl. farmers)	☐	☐	☐	☐
representatives of NGOs, advocacy or other civil society groups	☐	☐	☐	☐
policy makers, public administrations, representatives from governmental agencies	☐	☐	☐	☐
individual citizens (e.g. as beneficiaries, customers, or concerned persons)	☐	☐	☐	☐
media representatives (traditional media, digital media (e.g. bloggers), journalists, community-led media, etc.)	☐	☐	☐	☐
representatives from welfare- or education-providing institutions (such as schools, kindergartens, hospitals, or care centres)	☐	☐	☐	☐

E3. Please indicate whether the following statements fit your project:

Your project has ...

	false	true
... targeted a group of people with specific social needs.	☐	☐
... included socially disadvantaged or marginalised people.	☐	☐
... worked towards improving people's lives.	☐	☐
... aimed at empowering people (in general or specific groups).	☐	☐
... enabled diversity and exchange of different perspectives.	☐	☐

Section F: Regulatory Framework

With the next questions, we would like to learn more about regulatory-conceptual aspects of your research project.

F1. Did one or more of the following concepts (norms, requirements, practices) apply to your research project?

	no	yes
open access (publications)	☐	☐
open access (research data)	☐	☐
open source (code)	☐	☐
open/shared infrastructure	☐	☐
open peer review (e. g. participation of a wider community or post-publication commenting)	☐	☐

F2. Did your project consider the *sex* or *gender* dimension explicitly in your research?

☐ Yes

☐ No

F3. Did your project aim at supporting evidence-based decision-making of policy-makers?

☐ Yes

☐ No

Section G: Outcome-orientation

With the next questions, we would like to know more about the expected non-academic effects of your project, both short- and long-term.

G1. To what degree has your project directly contributed to new or better services, products, processes, or ways of doing things that were targeted towards ...

	0..not at all	1	2	3	4	5	6	7	8	9	10..to a high degree
the general population	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
businesses	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
specific social groups (e.g. women/men/non-binary, youth/elderly; migrants; or minorities/indigenous people)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
welfare- and education-providing institutions (such as schools, kindergartens, hospitals, or care centres)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
NGOs, advocacy or other civil society groups	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
policy-making, public administration, governmental agencies	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
academia	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

G2. What kind of change (short- or long-term) did your project intend to bring about in the following target groups or in the general population?

	changing understanding	changing awareness	changing attitude	changing behaviour	other
the general population	☐	☐	☐	☐	☐
businesses	☐	☐	☐	☐	☐
specific social groups	☐	☐	☐	☐	☐
welfare- and education-providing institutions	☐	☐	☐	☐	☐
NGOs, advocacy or other civil society groups	☐	☐	☐	☐	☐
policy-making, public administration, governmental agencies	☐	☐	☐	☐	☐
academia	☐	☐	☐	☐	☐

G3. What other change did you intend to bring about?

Please describe briefly per target group, if needed.

G4. From your perspective, to what extent were project results taken up by policy-making and/or public administration and/or governmental agencies?

	0..not at all	1	2	3	4	5	6	7	8	9	10..full extent	Not applicable
Please rate	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

G5. In what way were those results taken up by policy-making and/or public administration and/or governmental agencies?

- ☐ Changed policy (measures)
- ☐ Changed agenda-setting
- ☐ Changed regulation or law
- ☐ Another way, namely

Another way, namely

G6. To what extent do the following statements apply to your project?

	0..not at all	1	2	3	4	5	6	7	8	9	10..full extent	Not applicable
The targeted, non-academic groups have – either through participation or through the focus of project – likely gained capabilities to better tackle similar existing or upcoming issues.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
The project's actions played an emancipatory role for the targeted groups.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
The project generated a deeper/better understanding of a specific social issue.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
The project contributed to the mitigation of a social issue.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
The project results addressed an issue that was not (widely) known in the society before.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
The scrutinised issue was not (widely) addressed in academia before.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Section H: Dissemination and Exploitation

With the next questions, we would like to learn more about dissemination and possible reuse of your project results.

H1. Which channels were used to disseminate the project results?

	no	yes
Peer reviewed journal publication	☐	☐
Monography, contribution to a book	☐	☐
Conference proceeding	☐	☐
Policy brief(s)	☐	☐
Traditional media (TV/radio/print/etc.)	☐	☐
Professional journals/magazines targeting practitioners	☐	☐
Own institutional or project website/blog	☐	☐
Social media	☐	☐
Online platforms (other than social media and project website/blog; e. g. data or code sharing, citizen science platforms)	☐	☐
(You providing) consultancy (paid or unpaid)	☐	☐
Targeted events for (non-academic) practitioners	☐	☐
General events for a non-academic public (other than practitioners)	☐	☐

H2. How would you assess in the long term the scalability of the results generated by your project?

	0..not scalable at all	1	2	3	4	5	6	7	8	9	10..very highly scalable	I don't know	Not applicable
Scaling-up (to achieve a higher impact)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Scaling-out (to different geographic areas)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Scaling-deep (by changing cultural and social values and practices)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Section I: Closing

The following questions conclude this survey.Thank you, we highly appreciate your participation in our survey! Please make sure to press the submit button below to save your response in our database.

I1. Would you be interested in receiving a summary of the results of this survey?

- ☐ no
- ☐ yes

I2. Do you have any <u>suggestions how to address *social innovation* through SNSF-funded projects</u>? If so, please share them in this textbox:

I3. Would you like to share with us an example that illustrates project results particularly well for the general public or certain target groups? If so, please provide it here:

I4. Is there anything else you would like to tell us? E. g. a particular interesting fact about your project, a development or result that surprised you, a particular concern that you may have regarding this study, or anything else that we should know?

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