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Connecting.Ideas4Research: Exploring Options for Increasing Responsiveness and Responsibility in Science, Technology and Innovation

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Abstract. This paper provides an overview of the project *Connecting.Ideas4Research* (CI4R) that has given its name to session "A5" of the conference track "A – Open Science: Rethinking the science and society relationship." The project is divided into two major thematic strands: (1) "Digital Ethics and Responsible Research and Innovation (RRI)" and (2) "Crowdsourcing in Research". In a first step, this paper describes the project's overall aims and its approach. In a second step, for each of both subproject strands considerations concerning the framing of central notions and categories are presented and corresponding reference frameworks are sketched and discussed. The paper closes with some remarks on the relationship between the two subproject strands.

1 Overview on the Project *Connecting.Ideas4Research*

Universities are and all other research organizations are confronted with increasingly complex demands from their societal environment—such as digitalisation, the emergence of new disciplines, exploitation orientation or transdisciplinarity—which point to opportunities but also to the need for change. The project *Connecting.Ideas4Research* (CI4R)[1] tries to reflect how people which are affected by research and innovation (R&I) can be integrated in the research process – e.g., by direct integration into a research project. The focus of CI4R was sharpened by the needs of the involved partners, universities and research organisations who are both: research performers as well as affected by R&I and research policies. These organisations are confronted with highly demanding international projects, increasingly complex and wide-ranging digital technology, and increased involvement of individuals, organisations, stakeholders, etc. in the research process itself. Moreover, researchers are being increasingly attributed with responsibility for the impact of research results and the consideration of needs of society in their research.

[1] The project ConnectingIdeas4Research is part of WTZ Süd (Knowledge Transfer Centre South: https://www.wtz-sued.at/en/). The project is conducted by CAMPUS 02 Graz, Graz University of Music and Performing Arts, Medical University of Graz, Montanuniversität Leoben, University of Klagenfurt, University of Applied Sciences FH JOANNEUM Graz (lead), and Carinthia University of Applied Sciences. The WTZ Süd is financed by aws, by means of the National Foundation of Research, Technology and Development (Austrian Funds).

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In the project CI4R we approach these topics from two perspectives and in two separate subproject strands: (1) Digital Ethics & Responsible Research and Innovation (RRI); (2) Crowdsourcing in Research. The *Digital Ethics & RRI subproject* undertakes the examination of ethical implications of digitalisation for research practice (and research organisation). The *Crowdsourcing subproject* focuses on the integration of specific professional groups or other directly affected groups like patients in the process of identifying relevant research questions as well as in the generation of new ideas for solutions for practical problems.

The CI4R project is designed as a knowledge transfer project between the partners as well as other involved higher education institutions, (research) organizations and stakeholders. This major characteristic given, the project organizes knowledge flows concerning the project topics and to enable mutual learning—between the participating partners as well as by learning from external expertise. Also, by opening its project events and activities to external audiences, the project aims at practicing knowledge transfer and networking along the whole project life cycle, not only at the end of the project. The results represent the learnings of all partners as well as the preparation and promotion of findings for implementation. Rather than trying to address its topics exhaustively in all details, the project takes a pragmatic approach to its subjects: The topics that are addressed in the project are derived from concrete issues and interests at the participating organisations rather than by theoretically driven considerations.

1.1 Digital Ethics and RRI

In the last years, not only in academia but also in more popular or policy related debates ethical issues related to digitalization are increasingly being discussed. In the face of polarization, hate and fake news in social media, of the power and practices of big (quasi-)monopolized platform tech companies, or of the rise of automated decision making and machine learning algorithms, it is obvious that there is a need to discuss how we want to live with digital technologies, to which intentions they should be applied, and how these technologies should be designed (cf. exemplarily Werthner et al. 2019, Nida-Rümelin/Weidenfeld 2018, Spiekermann 2019, Zuboff 2019). While the scope of topics addressed in these debates goes far beyond the notion of digital ethics that can be applied in the context of this project, these debates underline the claim that universities and universities of applied sciences – as important actors in innovation systems – must be responsive to such public debates and concerns.

In academic discourse ethical consideration of information and communication technologies (ICTs) and digitalisation has received growing attention in the last years, and a lot of research projects and literature has been produced focusing on ethically relevant impact of ICTs in society, economy or the environment (cf. Reijers et al. 2018,

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Mittelstadt 2019, Bogner 2013). Evolving from information ethics[2] the general perspective of digital ethics is quite broad: Based on the observation that in information societies it has become impossible to assume separated online or offline spheres of life, digital ethics in principle means no less than to address the (morally relevant) "impact of ICT on society and the environment" (Capurro 2009, also cf. Capurro 2017, pp. 187 ff.)—or to be more general: "What kind of mature information societies do we want to build? What is our *human project* for the digital age? (Floridi 2018, p. 2). Floridi also points to the entanglement of digital ethics with digital regulation and digital governance: These fields should be seen complementary to each other, and their distinctive normative approaches should be recognised. Ethics of the digital should be understood as the study of moral problems relating to data and information, to algorithms as well as to problems of corresponding practices and infrastructures, in order to identify morally good orientation or solutions. In this sense, digital ethics produces knowledge for the moral underpinning and shaping of digital governance (ibid., pp. 2ff.).

Beside this ethics boom in the last years the Responsible Research and Innovation (RRI) approach came up and has widely been adopted (von Schomberg 2011, cf. Stahl et al. 2014). Representing one of the central "keys" of RRI, ethics takes a prominent role in this influential concept. Additionally, ethical argumentation has been widely used in technology policies in the last years and ethical advisory is in many cases being requested by policy makers (cf. Bogner 2013). Regardless its popularity for scholars in innovation research or science and technology studies or for policy makers, it has to be acknowledged that the RRI approach is adopted by scientists overall with some more reservation. Also, regarding implementations in different fields of research as well as in different kinds of R&I conducting organisations there is a wide range of interpretations of the meaning of doing science with and/or for society (Carrier/Gartzlaff 2020).

This overview illustrates the need to narrow the scope of the digital ethics subproject and the notion of "digital ethics" that shall be applied. Given the project's main character as a cooperative knowledge transfer project, this narrowing also has to reflect the specific situations at the participating universities, their profiles and interests. These considerations have led to a rather pragmatic perspective and understanding of digital ethics for our project:

The focus in the digital ethics and RRI project stream is to explore ethical challenges for research practice (and research organisation) in the context of digitalisation.

[2] And its neighbouring disciplines like computer ethics, media ethics, data ethics, ethics of technology, and likewise.

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Corresponding major interest of our activities can be expressed by the following questions:

- In which ways are we (as universities / universities of applied sciences) confronted with digitalisation related ethical challenges in our research and innovation activities?
- And how can we put ourselves in a position to be able to deal with such challenges adequately?

1.2 Crowdsourcing in Research

The core idea of the substream on crowdsourcing in research is to analyse the process of generating innovative research topics and questions in collaboration with practitioners. This is done in a participative approach with a variety of methods and disciplines. To this end, four exemplary and interdisciplinary use-cases from the fields of medicine, physiotherapy, music pedagogy and architecture were set up. All of these four use cases are collaborating with a specific "community of practice"[3] from their field (="crowd"). The use cases address specific professional groups from their field as well as other relevant groups (e.g., patients, users) that are directly affected by research content and results, but that typically not have the opportunity to co-design research projects.

The groups addressed differ from use case to use case; and different methods have been used to get in contact and work with the specific target groups. In addition, the "crowds" addressed by the four use cases are very different (by size, motivation, shared understanding, level of academic training, access to research and infrastructure, etc.). Some of them are very homogeneous, while other groups are not easily identified as a "community of practice" in the first place.

The focus of in the Crowdsourcing for research project stream is to experiment and learn in practice and identify challenges in an interdisciplinary diverse setting with practitioners and their "Community of practice".

This diverse setting of the projects made it necessary to find a practical working definition of "Crowdsourcing" as a method for research that suits the interdisciplinary and multi-methodological character of this knowledge transfer project. Therefore, in this paper the reference framework of "Crowdsourcing" that underlines the project will be shortly presented and discussed.

[3] The definition of "community of practice" follows largely the definition by Wenger-Trayner (2015) "Communities of practice are groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly." This term was coined in the early 1990s in several publications by Etienne Wenger, William Snyder, Jean Lave and others.

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2 Digital Ethics and RRI

According to the project's narrowed notion and approach to digital ethics at universities and universities of applied sciences, as described in chapter 1, we want to present some considerations concerning reference points for the development of suitable perspectives on digital ethics and RRI at our organisations.

At first glance, new ethical challenges of universities' research activities in the context of digitalisation can be seen on two levels:

First of all, the results of scientific research and innovation activities might prove to be an issue. In the last years, the enormous *impact* of the digital technologies in almost all spheres of our lives has become visible. Especially potentially negative impacts point to the problem of responsibility and accountability in research and innovation.[4] While negative effects are to be avoided, certainly chances shall be used, and positive impact must be realised. Already this rough juxtaposition between negative and positive impact points to the fact that societal expectations on science, technology and innovation (STI) are in many cases quite variable: The valuation of potential effects will highly depend on one's value orientations and interest (and also on individual concern or involvement in decision making).[5] Secondly, besides such an *output* (or *outcome*) *oriented view* the R&D *processes* themselves prove to have normative implications: E.g., digitalised R&D practice is increasingly based on big mounds of data (and produces big mounds of data). Therefore, suitable arrangements for an appropriate handling of such big data sets have to be established. This applies to the handling of personal data, but also the access to the research data, possibilities to re-use data and data provenance.

Re-framing the distinction between output and process orientation can stress that the focus of digital ethics in the context of scientific research and R&I is not limited to ICT development and engineering disciplines: Regarding *objects of research*, technologies of digitalisation may be subject to ethical consideration as well as their embedding in societal practices, their adoption by users or emerging demands for regulation. Ethical implications will be easier to attribute with increasing application readiness of technology, and specific areas and goals of applications, as well as organisational forms, emerging economic models, societal adaptations to (or drivers

[4] Albeit, it has to be acknowledged that the field of ICTs and digitalisation rather than in universities the main drivers of technology development will be found in commercial environments.

[5] For the differentiation of effects as intended/unintended, expected/non-expected, desirable/non-desirable (and corresponding implications) see Gloede 2007.

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of) applications or regulative frameworks can be investigated from an ethical[6] At the same time, digitalisation alters the *methods* with which scientific knowledge and new technology is being produced. Digitalisation and data driven changes in research methods are not restricted to technoscientific disciplines but do also affect social sciences and humanities, as it is reflected in notions like digital humanities.

These considerations show that in the context of digitalisation universities face challenges that apply to different dimensions of their R&I activities. Also, it becomes clear that such ethical challenges in principle may occur in all disciplines or fields of R&I and are not limited to computing departments and related engineering disciplines.

2.1 Research Ethics and Ethics in R&I

As described at the beginning, in our project we are not aiming at giving answers to ethical questions in the context of digitalisation and research. We rather aim at identifying options to prepare our organisations to become able to (better) address such issues in future STI activities. With reference to the different dimensions sketched above a closer look at understandings of research ethics and ethical consideration of impact of STI can help to identify and assess suitable approaches for our leading questions.

Reijers et al. (2018) distinguish in their literature review two research paradigms and corresponding ethical approaches: “traditional” research (and “traditional” research ethics) on the one hand, and research and innovation (and ethics in R&I) on the other hand. Insofar R&I is being characterised by its guiding interest in application (and thereby in intervention into its societal, economical, or natural environment), ethics in R&I needs to take an outcome or impact-oriented perspective. In contrast, the focus of traditional research ethics is primarily seen in proper research conduct: Traditional research ethics are perceived as a “professional ethics of researchers, including for instance considerations of scientific integrity and treatment of human subjects in experiments” (ibid, p. 1438). As digitalization related activities at universities and universities of applied sciences certainly cannot be limited to one of these two paradigms, both branches of ethical consideration are relevant in our context and may provide productive connections and insights.[7]

[6] Digital ethics, understood as applied ethics investigating the moral problems in regard to digital technologies and corresponding practices and regulation (see chapter 1), can largely be assigned to this dimension.

[7] It is obvious that the distinction proposed by Reijers et al. roughly reproduces the distinction between basic research on the hand and application oriented research and technology development on the other hand. Of course, this distinction has to be seen as opposing two ideal types. For a similar approach to ethical assessment in R&I see Brey et al. 2015.

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Reijers et al. also point to problems of conflicting values in the normative assessment of impacts of R&I. Value conflicts may be grounded in different ethical claims that apply to a subject—e.g., privacy and security in the field of security technologies. But check lists or principled approaches to research ethics often do not give orientation for weighting or prioritizing in value conflicts (ibid., p. 1457). Additionally, ambiguity in the normative assessment of impacts may occur from very general or abstract value orientations: Referring to very fundamental values, like human rights, has the potential of being highly agreeable; on the other hand, especially in cases of conflict such fundamental value references can show a significant interpretive flexibility and are not necessarily able to ensure shared problem views or even solutions.[8]

Concerning the impacts of R&I, ethics assessments are well established on different levels like research organisations, national funding organisations, project funding by the EC[9]. Another way of addressing impacts of R&I projects (and R&I policies) may be accompanying Ethical, Legal, Social Aspects (ELSA) and Ethical, Legal, Social Impact (ELSI) usefulness, both approaches have in common that the ethics related activities keep in a way detached from the actual research practice: In case of ethics assessments by or for institutional review boards this applies as ethics assessments typically are done ex-ante. And in case of accompanying research limitations may arise because commonly such studies are conducted by separated sub-teams that do not directly contribute to the R&I activities and look on its objects from outside (Stahl et al. 2019).

2.2 Implications for the Project

For our CI4R project, we try to reflect these considerations in the project's specific working formats. In a first series of roundtable discussions, we analysed current topics and issues in our organisations with respect to ethics, research and digitalization: Promoting and Communicating RRI; Ethical Aspects of Video Recordings of Teaching Situations; Application of Machine Learning Methods in Health-Related Research; Ethics Assessment Schemes for Digitalization Related Research; Design, Technology and Ethics of Online Exams. The chosen topics can be attributed to specific aspects of the distinctions discussed above, as they address different problem dimensions, types of actors or fields for action.

Based on the evaluation of the round table discussions, in a small series of more implementation-oriented workshops we want to identify options and starting points for

[8] To point to the gap between reference to very basal value orientations and demands for practical orientation for action is of course not very new, see for example Pimple 2002.

[9] E.g., as ethics self-assessments done by researchers in the course of funding proposals; and/or as decisions or consultancy by ethics boards or committees.

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practical measures in our organisations. Such measures may address, on an *individual level*, researchers and research groups and their competences, skills and awareness for ethical issues in their research (concerning both, outcome dimension and process dimension). On the *level of organisations* they may show a need for the extension of support structures for researchers and they can emphasise options for the embedding of digitalization related ethics in the organisational culture. And on the *level of regional cooperation* it shall be discussed, if and how an (institutionalised) cooperation for the ethical assessment of research related to digitalization can be suitable and feasible.

2.3 The Case of ICTs

Even though we have stated that digital ethics (understood as ethical consideration in digitalisation related R&I) is not limited to computer sciences, data sciences or ICT development, a closer look at suggestions for implementation of ethics in these fields can be rewarding.

In the last years we have faced high dynamics in the application of new digital technologies, of corresponding business models and usage practices. “Artificial intelligence” (AI)—regardless if it makes sense at all to use this term when talking about machine learning algorithms – stresses some socio-technical aspects of the latest developments that it might be justified to ascribe new qualities to current digitalisation. Rather than pure computing capacity and performance of modern devices it is networking, automatisation, and increasing autonomy of ICT systems that point to significantly new socio-technological conditions. In particular, informational and material contexts of human agency become increasingly overlain and modified by information technology, thereby questioning and blurring established perceptions of artificiality and naturalness of environments (cf. Greif et al. 2011). In this sense, the ubiquity and pervasiveness of digitalisation applies to almost all spheres of human agency – and is widely accepted. Additionally, decision making in information societies is increasingly assisted by or completely delegated to machines. Recent ethical discussion about digitalisation has reflected this and has focused on algorithms for machine learning, automated decision making or methods for big data analysis. Consequently, “ethics of algorithms” is evolving as a significant field of research (cf. Mittelstadt et al. 2016). Such approaches are particularly interesting for our project because they may be able to tackle some of the problems of ethics assessments or accompanying ELSA/ELSI research (as indicated above) by integrating ethical consideration into the core of technology development.

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2.4 Integration of Ethical Consideration into R&I Activities

Approaches to ethics in R&I located inside or at the core of proper R&I practices can be framed as "intra methods".[10] The overall aim of such intra approach can be seen in "enabling, organising and ensuring ethical technology design … by integrating ethicists in R&I practises, identifying ethical issues in design, embedding values in design and organising ethical design in the R&I process" (Reijers et al. 2018, p. 1451). For example, in the field of ICTs proposals for such intra methods are discussed in the ICTs as "Value Sensitive Design"[11]. about 15 years now. Following the insight that ICT systems "are intentionally or unintentionally informed by moral values of their makers" (van den Hoven 2007, p. 67), procedures for the integration of ethical expertise have been proposed and tested in various projects and contexts in the last years (cf. Simon/Wong/Rieder 2020, Reijers et al. 2018, Brey et al. 2015, van den Hoven 2007).

Regarding machine learning algorithms, the concepts and tools for value sensitive design and related concepts still need to be further developed and spread more widely (Morley et al. 2020). Calls for the integration of values sensitive design, like ethical consideration into IT design, are of course not new; the current debate and adoption of such approaches in the context of RRI may offer a chance to promote these methods and to benefit from each other. Whilst having different and specific starting points RRI and the intra methods in ICT design can be performed complementary and thereby enriching each other (Simon 2016). Intra methods may work against the detachment of ethical consideration from research practice and a pro forma performance of ethics assessment without significant consequences for research practice ("tip box mentality", cf. Stahl et al. 2019). They may also supplement shortcomings of the variety of existing guidelines and professional codes of conduct. Such guidelines and codes may give clues concerning properties of "ethical ICT systems", but in many cases they fail to provide insights regarding the question how ethical goals can be achieved in practice. In other words, to include and promote intra methods in RRI might contribute to a shift "from what to how" by "translat[ing] principles into practices" (Morley et al. 2020, see also Mittelstadt 2019).

We will see to which extend such approaches will be established in future and which effects they can generate. If these methodological innovations in ICT design succeed to contribute to systems that, for example, have less biases and avoid discrimination of certain user groups, these methodological innovations might open additional links to adjacent debates: E.g., claims for value sensitive approaches can be substantiated

[10] In distinction to ex-ante and ex-post methods.

[11] Originally introduced by Friedman et al. (2006) the term evolved into to an umbrella term, covering also similar approaches and concepts like values in design, or disclosive computer ethics (cf. Simon 2016).

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not only with moral argumentation but also with the prospect of better products in terms of quality (and acceptance). In addition, the integration of value sensitive methodologies into teaching might be a leverage to spread such approaches beyond specific (academic) circles.

3 Crowdsourcing: Harmonization and Reference Framework

Crowdsourcing is an actively discussed topic[12] and promises remarkable advantages over classic research approaches at first glance: Researchers can get additional resources (that are always hard fought for) and inputs to complete their research tasks. Furthermore, crowdsourcing promises to be a possible way to integrate the needs of society in research, or at least to integrate the public into the research cycle in some way.[13]

But Crowdsourcing also might touch some ethical issues. Tasks are outsourced to other (largely disadvantaged) groups outside of academia motivated by monetary incentives. In practice, both Crowdsourcing as a way to do transdisciplinary and participatory research as well as a tool for outsourcing are often combined in projects.

Methods of Crowdsourcing are used in a wide range of applications. The wide range of application areas in- and outside of academia and the very different approaches to crowdsourcing, results in a large variety of definitions for crowdsourcing itself.[14] In our interdisciplinary project CI4R with its four different use cases we are also addressing, engaging and experimenting with different ways of approaching different methods of crowdsourcing.

To provide a basic approach for all four use cases, all disciplines, various methods and all partners involved (see section 1), a common ground for a definition of Crowdsourcing had to be developed. Therefore, in this short paper three perspectives on definitions of Crowdsourcing will be discussed—all three related to the specific characteristics and topics of the CI4R project.

[12] See for example Gordon (2021), showing a significantly increase of research content tagged with crowdsourcing (or variations), since the first coinage of the term crowdsourcing by Howe (2006).

[13] Crowdsourcing in Research is often seen as a method of democratic engagement and participation. In addition, Crowdsourcing as tool for integrating a variety of perspectives and inputs from a crowd is also a matter of Responsible Research and Innovation (RRI). Related policies might increase the acceptance of research, democratize funding of research projects as well as provide efficient research, See Fossum et al. (2019).

[14] For other definitions and approaches not mentioned in this short paper see for example: Hosseini (2016), Lichten (2018), English (2018).

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First, the project stream of "Crowdsourcing in research" is dealing with a professional community and their needs from R&I, but also questioned how they are affected by it. Taking a RRI perspective we can identify benefits using this approach similar to benefits of Citizen Science (CS). As Resnik et al. (2015) state, CS increases or provides valuable resources for the research as well as it contributes to a better understanding of scientific research of the participating "Citizens". In addition, a widely stated beneficial output of CS methods is to "democratize the research process" (Resnik et al 2015, p. 477), providing the possibilities for CS participants to engage in the design of R&I topics, processes, output, etc.

The project CI4R also works with professionals from a specific field. Their motivation, in contrast to CS participants, might be highly affected by their professional interest. Therefore, the first perspective presented here will be dedicated on the (presumed) dialectic characteristics between Crowdsourcing in Citizen Science and Crowdsourcing in a professional setting like "Clickworking" or paid Microtasks. This perspective on Crowdsourcing is supplemented by a definition based on the use of Crowdsourcing in the research cycle, regardless of the research framework. In a second perspective, crowdsourcing is defined as a broad methodical set that amends traditional research methods and processes. A definition strong intertwined with research process, not covering non-academic use of Crowdsourcing. Therefore, a third perspective, a 4-Field approach to "Simple Crowdsourcing" was developed that harmonizes different definitions of crowdsourcing and serves as a basis and reference framework for the project itself. While this approach serves the project and knowledge transfer as a reference framework, it is applicable for many fields in- and outside academia.

3.1 Definition "Participation and Democratization": Citizen Science and Clickworkers

First, in citizen science, definitions of crowdsourcing are often based on the classification introduced by Muki Haklay[15]. Haklay sees Crowdsourcing as a "Level 1" approach, where participating citizens are simply defined as "sensors" for data in a project. This is an easily applicable definition for crowdsourcing in research, but also very limited in some sense.

In practice this "sensor" approach of crowdsourcing is common, especially in projects for environmental observations and monitoring[16] that create large amounts of data. In this context, the tasks for the individual members of the crowd are very easy and

[15] First published Haklay (2013).

[16] See for example recently the Working paper of the European Commission (2020).

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comprehensible, which makes it a perfect tool for citizen science projects.[17] In that way, a very large and heterogeneous "crowd" can be addressed and participate in the project.

On the downside, due to the limitation to very simple tasks and the understanding of the "crowd" only as "sensors", the generated input is predefined and simple. In a critical view, crowdsourcing in this perspective is mainly outsourcing of data collection. But at least it is based on voluntary action, in general for a good cause, and helps to integrate public into research.

Another form of outsourcing in scientific projects are paid micro tasks and data collection (and to some extent design and development tasks). With the catchword "Clickworkers", a method has been established that leads to ethically questionable constructs as well as doubts about their scientific quality. For example, platforms like "Mechanical Turks" (Amazon) or other "Clickworkers" platforms[18] provide a tool to find fast and cheap support in projects, like small tasks to solve, data harmonisation, making descriptions of online objects, etc. These platforms provide an excellent approach for scientists to get data[19]. But there are several negative effects, regarding the underpayment of participants[20], reproducibility of the collected inputs from the participants[21] as well as other possible downfalls of the methods.[22]

In our project, we do not rely on paid participation in the form of "Clickworking". Instead, self-motivation and voluntariness play a major role. However, to avoid misunderstandings in the communication and especially when working with professional groups, it is important to clearly distinguish between paid work and the Crowdsourcing approach chosen for our project. In this context, we can refer to the basics of measures for Citizen Science project[23] when it comes to a responsible and appreciative approach in such projects.

However, we would also like to question the narrow definition of Crowdsourcing in Citizen Science projects as a pure network of human sensors. Not only does this

[17] See for example the large community of https://www.zooniverse.org/ providing "people-powered research" and hosts especially a lot of projects that uses citizens involvement for data clarification and tagging of objects and images.

[18] See for example Peer et al (2017).

[19] See for example the use of Crowdsourcing in Behavioral Sciences Chan et al (2016); Chandler et al (2016).

[20] Koaro et al (2018), showed "that workers earned a median hourly wage of only ~$2/h, and only 4% earned more than $7.25/h" in Crowdsourcing projects down with Amazon Mechanical Turk Platform.

[21] See Shapiro et al (2013).

[22] See the Best Research Practices of the Use of Crowdsourcing in clinical Research by Chandler et al (2016) suggesting to pay especially attention to "Pay a Fair Wage", to "Disguise the Purpose of the Study Until the Task Is Accepted", "Reduce and Measure Attrition", "Prescreen Unobtrusively", "Prevent Duplicate Workers", "Avoid Obtrusive Attention Checks", etc. in Crowdsourcing projects.

[23] See for example Haklay et al 2020.

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definition seem very limiting, but it also negates the needs of the participants as well as their interest to deal more closely with the subject matter and not just perform a one-to-one measurement job.

3.2 Definition “Crowdsourcing is Everywhere”: The Crowd in the Research Cycle

Crowdsourcing in science might be a part of citizen science and vice versa, but it is not limited to the integration of non-researchers as sensors or collectors of data. In a meta-study, Uhlmann et al. (2019) show that “crowdsourcing” in a broad definition is used in different types and at different stages in the research cycle, from ideation and study design to writing research reports and help to replicate published and unpublished findings.

Uhlmann et al. (2019) distinguish two types of addressing the “public” in research projects: “vertical integration” and “horizontal distribution”. “Vertical integration” describes the approach that, researchers conduct their study by themselves, and the “public” is mainly addressed as a recipient of dissemination activities later in the research project. In contrast, the idea of crowdsourcing as “horizontal distribution” of ownership, resources and expertise encompasses involvement of the crowd along the entire research cycle. Accordingly, Uhlmann et al. identified crowdsourcing approaches in the full research cycle from ideation to publication, namely ideation, assembling resources, study design, data collection, data analysis, replicating findings, writing research reports, peer review, replicating published findings and deciding future directions.

From this perspective, crowdsourcing promises to provide additional resources to solve complex problems, improve results in research, increase reproducibility, provide transparency, include the needs of society in research etc. In conclusion, the “horizontal distribution” approach is very detailed and aligned directly with the process of the research cycle. The focus on the research cycle, however, might have limits when addressing development and innovation, transdisciplinary projects, public engagement, etc.

Even if this model describes very precisely and in depth the different applications of crowdsourcing within science, crowdsourcing methods are also used outside the scientific process, whether in the economic field, in technical development, or in political and social interactions. And especially the latter can be observed in transdisciplinary projects, as well as Citizen Science projects. It can also be found in combination with approaches of "classical" research in one project.

We want to be more open minded and claim for a perspective of Crowdsourcing that is not fixed to the research cycle. For this reason, we would like to present another possible definition of crowdsourcing, which comprehensively covers several areas of

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possible application. At the same time the proposed understanding provides an easier access, especially for the communication of crowdsourcing processes to groups that have little contact with academia and are not familiar with the research cycle at all.

3.3 Definition "Simple Crowdsourcing": 4-Field Approach to Harmonization for Practice

Finally, we want to highlight the approach of a definition of crowdsourcing that is now serving as reference framework for the project CI4R. The goal was to harmonize different approaches of crowdsourcing, providing a basis for all of the project's use cases. This approach[24] uses a simplified definition of crowdsourcing and identifies four fields (see Fig 1) of crowdsourcing aspects: *Microtasks*, *Macrotasks*, *Crowdfunding* and *Contest and Competition*. In practice, these four fields are not isolated from each other, but are rather often found together and mixed in research projects. They are used as well in business or organizational processes beyond academia.

While we cannot present every aspect of this model in this paper, we will give a brief overview of the most important features of the 4-fields of perspectives of Crowdsourcing. In general, this model is suitable for comparing crowdsourcing projects within and outside of academia and even for characterizing historical examples or, if applicable, specific processes within the research cycle.

[24] A similar model is described in Simperl (2015), p. 19ff based on inter alia "The Daily CrowdSource"-Umbrella (now inactive homepage); In addition, see Nakatsu et al (2014) providing a taxonomy of Crowdsourcing based on the "task complexity" similar to the two fields of Micro- and Macrotasks, with another focus; Very Comprehensive approach to a definition of Macrotask Crowdsourcing can be found in Lykourentzou (2019); For Crowdsourcing contests / competition see Segev (2020) and also Cheng (2015) for an example of breaking down macrotasks to microtasks in a crowdsourcing project; Literature on Crowdfunding is manifold – for an first impression see Moritz (2016), Böckel (2021).

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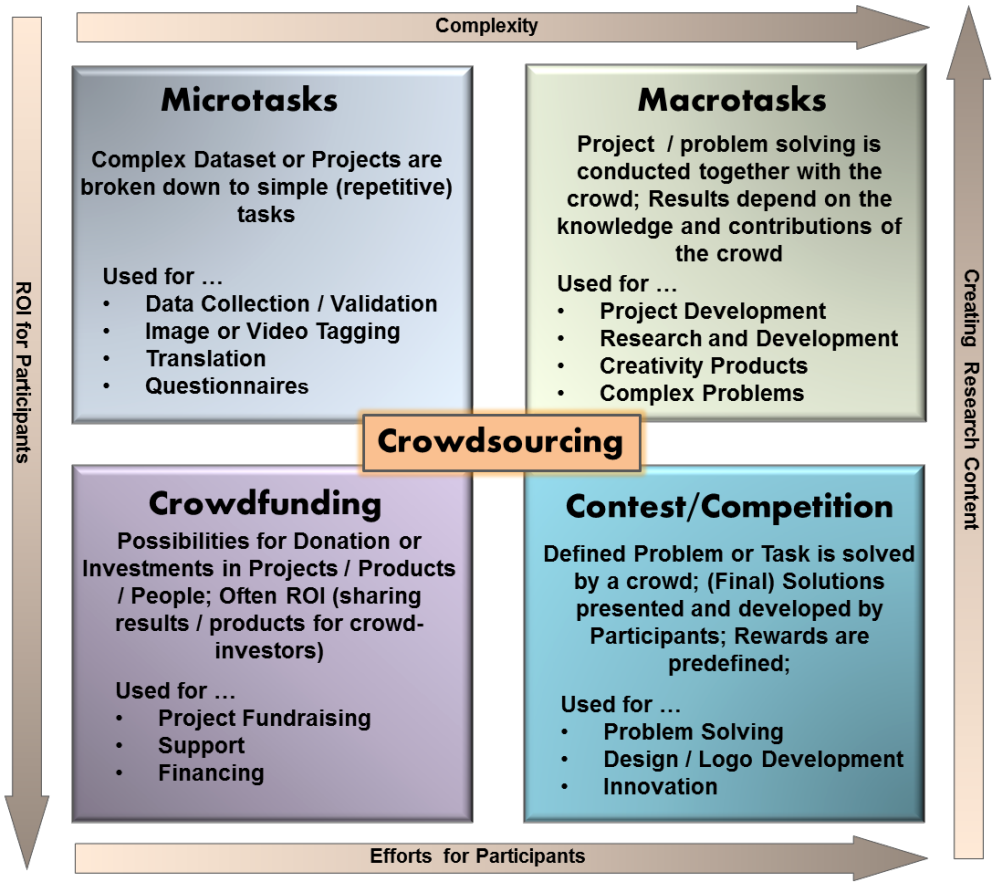

Fig. 1: The 4-Fields Model of Crowdsourcing in Practice – A framework for a definition of Crowdsourcing in the Connecting-Ideas4Research project.

First, the **microtasks** aspect is similar to the definition by Haklay (2013), where “cititzens” are used as “sensors” for projects. In this field, individuals of the crowd perform simple, mostly repetitive, tasks. The simple tasks are often used to improve or validate complex datasets or for translations of sources.

Second, the back to front approach—**macrotasks**: Here, initially the project and its tasks are only defined rather generally, and project results depend significantly on the knowledge of the crowd. Research results or problem solutions are developed together with the crowd in a process that is often time and resource consuming. This is especially interesting for generating new research questions together with crowds—or to develop complex solutions.

The third aspect, **contest and competitions**, is related to macrotasks: A predefined problem or task is solved by a crowd. In contrast to the macrotasks approach however, the solution is not developed in the project with the crowd itself. Rather, the crowd has to deal with a problem and individuals, or teams submit a possible solution and might be rewarded if the solution works. Collaboration between groups is not necessary, but competition is the driving force here.

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Fourth, **crowdfunding (or crowdinvesting)** aspect is often used for funding projects, innovations and ideas. The crowd's input is usually money and therefore the influence on the development of the final product is limited. For the participants, the return on investments is important. After the projects are (successfully) finished, participants get monetary refunds, the developed product or access to specific outputs of the project.

This approach defines crowdsourcing in research on a more neutral fundament than Haklay (2013). In our view Crowdsourcing starts in the collection of data and sorting it into information as well as it includes the interpretation of data and information. In addition, Crowdsourcing also refers to approaches that are based on collaborative work in group of persons in transdisciplinary settings in and outside of academia. Crowdsourcing deals with some possible cross-cutting issues of all forms of part of collaborative, open and participative science, without making a hierarchical classification, categorized in four fields Microstasks, Macrotasks, Crowdfunding as well as Contest and Competition, that can also be mixed in practice.

This simple and open approach to a definition to Crowdsourcing by the **4-Field model or "Simple Crowdsourcing" approach** promises to fit not only for "classical" and interdisciplinary research projects and the research cycle but also for Participatory and Citizen science projects, for Paid Clickworkers or other Outsourcing activities, etc. Therefore, this 4-Field model fits perfectly as reference framework for the diverse and interdisciplinary character of the Connecting.Ideas4research project.

Naturally, there are also some limitations with this model. A definition of crowdsourcing at such a meta-level offers many reference points but cannot be accurate in detail for all projects and may require individual adaptations. However, this model supports the development of a first foundation and understanding of crowdsourcing in projects that works with various approaches and methods of crowdsourcing. In addition, this simple model also be used to subsequently explain the different approaches and methods of crowdsourcing to potential participants in the crowd.

The choice of the type of the method for a project Crowdsourcing also heavily influence the possibilities of participation on the one hand but also determine the possibilities for the individual and the crowd on the other hand. While based on the 4-field model presented here, a Crowdsourcing approach via easy microstasks enabled participants to join with little time effort and few prior knowledge. In this approach, a diverse group of people might be able to provide input. But on the other hand, the creative leeway of each participant is very limited.

Similar low-threshold access for participation is provided by crowdfunding models that allows the crowd to support personal relevant projects with money or other assets. But likewise, with microstasks, participants ("the crowd") have a very limited creative

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leeway (only choosing) and decision making is interlinked with available financial resources of the participants.

Macrotasks (and to some extent also contests and competitions), however, are often limited to smaller groups of people with specific prior experiences, enough (time) resources and in general the opportunities and contributions for designing and develop a possible solution or result is higher.

In CI4R approaches via microtasks like for example questionnaires or digital open platforms as well as elaborate workshops for co-design, co-design for prototyping of communication tools, mini symposia, expert's roundtables and similar are used as tools. In addition, the focus on a specific professional group, "community of practice", provides limited access for all, but also ensure that focuses on needs and topics of R&I that are for particularly interest of the specific community.

4 Final Remarks

Both subprojects of Connecting.Ideas4Research—"Digital Ethics & RRI" as well as "Crowdsourcing in Research"—explore, in each case with specific perspectives, ways to increase responsiveness and responsibility of scientific research and innovation activities. In doing so, some options for mutual impulses become apparent.

On the one hand, insights from the digital ethics fields can be applied to the design of crowdsourcing processes. Crowdsourcing practices heavily rely on the use of digital environments for communication and collaboration. Hence, awareness for ethical aspects of technology use or choice of methods can influence the design of crowdsourcing projects. In turn, crowdsourcing can be used for widening ethical consideration in research and innovation. As crowdsourcing contributes to opening up STI activities for knowledge and problem views of people from respective application fields, for example awareness for (morally relevant) impacts of technology design decisions might be raised.

The 4-fields model for crowdsourcing presented in chapter 3 shows that the scope and depth of participation of non-scientists can vary significantly in crowdsourcing projects. The choice of approaches will thereby depend on topics, aims and research interests of a project. Accordingly, crowdsourcing may turn out to be an expansion of methods that can contribute to increasing the responsiveness in R&I. Then again, crowdsourcing in research can be conducted simply for pragmatic reasons and without a noteworthy normative claim. Regarding the choice of crowdsourcing approaches and corresponding sets of methods (including the decision if a crowdsourcing approach shall be chosen at all) the 4-fields-perspective proposed in this paper provides some useful orientation.

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