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Agile Science: Co-Creating Research on Digital Transformation

Samuel T. Simon & Josephine B. Schmitt

The dynamics of the digital transformation generate important and complex research questions: disruptive technological upheavals are entangled with serious social consequences and their effects and mechanisms need to be researched to be better understood. But the complex societal changes brought along by digital innovations also challenge science and research. So far, research on digital transformation often does not adequately meet the challenges created by the intersection of social and technological aspects. Borrowing from participatory and co-creative innovation approaches, we suggest the concept of “Agile Science”, i.e., a balanced structure for disciplined work and interdisciplinary collaboration, which allows for adaptability and participation. With this, we want to shape the future of innovative and responsive research on digital transformation. We aim to support a shift toward an understanding of, and accountability for, increasing complexities while staying in touch with affected citizens and generating relevant findings and solutions for them. The present paper introduces the main ideas of this concept and illustrates this exemplarily by describing the Research Innovation Hub (RIH) at the Center for Advanced Internet Studies (CAIS).

Die komplexen gesellschaftlichen Veränderungen, die mit der digitalen Transformation einhergehen, fordern auch Wissenschaft und Forschung heraus. Die bisherige Forschung zu digitaler Transformation wird den Herausforderungen, die sich aus der Überschneidung von sozialen und technologischen Aspekten ergeben, jedoch oft nicht gerecht. In Anlehnung an partizipative und co-kreative Innovationsansätze schlagen wir vor diesem Hintergrund das Konzept der „Agilen Wissenschaft“ vor. Darunter verstehen wir eine balancierte Struktur von interdisziplinärer Kollaboration und disziplinärem Arbeiten. Diese soll Partizipation und Anpassungsfähigkeit gewährleisten. Wir wollen die Zukunft einer innovativen und reaktionsfähigen Forschung zur digitalen Transformation so gestalten, dass die zunehmende Komplexität verstanden und verantwortet wird, während gleichzeitig der Kontakt zu den betroffenen Bürgerinnen und Bürgern aufrechterhalten wird und relevante Erkenntnisse und Lösungen für sie geschaffen werden. Der vorliegende Text stellt die Grundgedanken dieses Konzepts vor und veranschaulicht es exemplarisch anhand des Forschungsin kubators des Center for Advanced Internet Studies (CAIS).

Keywords: Agile Science, innovation, co-creation, participatory science, digital transformation

Digital Transformation as a Societal Challenge and Subject of Research

The digital transformation of society has reached an extent where technological changes

influence not only technical things but all areas of our lives as well. For example, smartphones change our daily interactions and communication styles. The way our social interactions work, in turn, impacts how digital innovations come to life. Therefore, it's not exaggerated to say that the digital transformation affects all aspects of life from work to communica-

tion, shopping, business, or administrative tasks. Consequently, there is also a great amount of scientific research investigating the implications and effects of social, political, economic, cultural, and technical changes brought about by the digital transformation. Of course, scientific research itself also does not remain unaffected by social developments. The dynamics of the digital transformation with disruptive technological upheavals and serious social consequences also challenge science and research. However, the established realities of the science system (e.g., the long time it takes from a technological disruption to generating a research idea and publishing it) often fail to meet these challenges. Against these backdrops, in this article, we want to introduce readers to an innovative approach for research on digital transformation, which takes perspectives of various societal stakeholders strongly into account: *Agile Science*.

But first, who are we? We, Josephine and Samuel, are working at the Center for Advanced Internet Studies (CAIS), where we developed and tested the idea of *Agile Science* together with different colleagues¹. The CAIS is a research institute for digital transformation research in North Rhine-Westphalia funded by the regional ministry for culture and science. Developing potentials of digital transformation for human interests, needs and capabilities is one of the central challenges of democratic societies. By proposing evidence-based solutions, at CAIS we contribute to shaping the digital transformation in a way that puts people at the center. As we want to contribute to the people-friendly and trustworthy design of a digital society, our research also includes a strong focus on the dialog with the public. With this paper we would like to introduce our idea of *Agile Science* in more detail to a broader public. With this we do not only want to provide mere information about what we were - and are - doing. We also want to open the space for a discussion about aims, tasks, and responsibilities of scientific

research in general and research on digital transformation in particular. Before we elaborate on Agile Science and show how scientific research can learn from other societal fields such as business innovation, we want to dive deeper into the challenges for digital transformation research.

Challenges for Digital Transformation Research

We identified three main challenges for digital transformation research.

Challenge 1: The General Public as important Stakeholders

In digital transformation research, the interests and needs of the general public should be considered from the very beginning as they are the context in which the digital transformation happens and shape its conditions. This is important for several reasons: The mission of science is to gain knowledge for the benefit of the public. It is therefore necessary to produce scientifically sound insights into the manifestations and consequences of the digital transformation that are useful for society at large. In many countries, scientific research is, furthermore, mainly funded through public funds. Thirdly, the importance of research that can interact with society outside the proverbial ivory tower seems to be important to ensure relevance.

In many other contexts (e.g., economics), responding to the needs of customers or stakeholders in the development of products and services is critical to success (Stickdorn et al., 2017). While, of course, science is intentionally different from producing industries, let's still play with the analogy for a moment. Focusing on the customer directly helps the success of a service. This is not to say that science should stick to economic principles of selling things quickly and in huge amounts. Here, the success would be societal relevance. In this case,

¹ We thank Matthias Begenat, Christoph Bieber, Maximilian Brenker, Anne Goldmann und Daniel Zimpel.

the product or service would be the solutions created by scientists. This does not necessarily call for immediate solutions, keeping in mind that, for example, Arts and Humanities aim for rather long-term impacts on society. If scientific research is supposed to successfully create impact, and real-world applicability, scientists should orient their work towards the needs of societal stakeholders. Ideally, while doing scientific work, the people – as the target audience for the scientific service (i.e., relevance-oriented research) – could even be included at specific points in the process (e.g., in the context of citizen science). Additionally, it is possible to enable exchange with relevant stakeholders through reappearing feedback loops at multiple moments in the research process.

Unfortunately, these ideas often remain unused. Regularly, research topics are defined top-down, meaning that institutions that fund research specify topics which they consider as societally important. Or, in other cases, scientists define them, for example, based on personal interests or a certain research project they are part of. Society usually interacts with research either as a passive subject to be explored or only at the end of a project when results are presented to the public, for example, in the media. The danger here is that scientific research – even when done with the utmost professional excellence – might miss the points that are most relevant to society.

Challenge 2: The Complexity of the Field

A second challenge lies in the constantly evolving novelty of the field of digital transformation. The complexity and rapid change of research questions increase the need for productive synergies through innovative inter- and transdisciplinary collaborations, for instance between social scientists and computer scientists. For example, when investigating how new technologies like social networks and dating platforms are changing our social relationships, both sets of expertise are crucial: We need to know how social

relationships work *and* we need to know how the digital platforms operate. This can be difficult to achieve because interdisciplinary collaboration does not just mean putting researchers of different backgrounds together. It also requires time, structure, and effort to make sure researchers can reach and maintain disciplinary expertise on top of having to work in an interdisciplinary manner. Moreover, it is usually necessary to reach common definitions of theories, methods, and data, to arrive at a shared understanding. Yet, this is often hindered by rigid hierarchical, and often disciplinary organizational structures at universities and other research institutions, or by the uncritical pursuit of disciplinary research paths. The problem with this approach of limited disciplinary perspectives is that this does not account for the complexities of real life, and, therefore, does not create the desired impact for other societal stakeholders. In short: Complex research questions about the digital transformation require interdisciplinary teams with diverse backgrounds to work on them. However, such diverse teams also need suitable supporting structures to render them effectively.

Challenge 3: The Dynamics of the Field

Third, research should be adaptable and react flexibly to changing conditions to achieve socially significant results. Science usually has a long reaction time for processes, such as topic identification, data collection, or publication. This can be problematic, especially for digital transformation topics due to rapid technological change. Take, for example, the platform Twitter, which has recently undergone intensive and quick changes, which, in turn, also affect the work of the scientific community. In contrast to this, traditional project management approaches with long-term and rigid planning have been the norm in many parts of the science system up to now. This leaves little to no room for the adaptation of research questions and processes. It only allows for a few cumbersome feedback phases and may

lead to creating a perfectionist error culture, which inhibits flexibility and innovation.

» ***The necessity of a strictly structured process that creates fertile ground for focused disciplinary expertise and productive, participatory collaboration.*** «

Against this background, we at the Center for Advanced Internet Studies (CAIS) are developing a concept for *Agile Science* to shape the future of responsive and responsible research on digital transformation. At first, the task of fostering productive research activities may seem paradoxical or at least never fully achievable if flexibility and openness to uncertainty as well as relevant application-oriented results are demanded. Nevertheless, as we will show later, there are ways of structuring uncertain processes without limiting adaptability to invite a constructive approach toward uncertainty and facing potential failure. This can be called structured heterogeneity, meaning intentional diversity within a process that still provides an organized and beneficial way of dealing with challenges, diverse stakeholders, and unpredictability.

How can Science become “Agile”?

As Agile Science, we understand science in accordance with the analogy from the beginning of this paper: Science as a service to society. From this perspective, Agile Science refers to scientific research that can continuously integrate new and socially significant questions and challenges, as well as the affected stakeholders, into the research processes. Ideally, it combines interdisciplinary research with responsiveness and adaptability in the face of

a rapidly changing subject matter. To be clear, this does not mean that scientific research should be done rapidly and superficially. On the contrary, it points to the necessity of a strictly structured process that creates fertile ground for focused disciplinary expertise and productive, participatory collaboration.

For the concept of Agile Science, we adapt approaches from agile project management. The concept of agile project management has come a long way since first being introduced in software development in the early 1990s. Since then, it has been experimented with and adapted for various areas of application. One of the current conceptual versions – called „Modern Agile“ (modernagile.org) – remembers the initial core principles and generalizes them in a way so that they can be applied to any project or situation. The focus of agile project management is on individuals and interactions, the functionality of systems, customer orientation, and the permanent willingness to adapt project goals and processes in order to be able to react to changing conditions in the best possible way (agilemanifesto.org, 2001). Moreover, for our understanding of Agile Science, practical experience and methods from the field of strategic organizational development (e.g., design thinking, service design) are examined regarding their transferability to digital transformation research.

We suggest applying Agile Science at least to two areas in the scientific process: 1) identification of research topics and 2) scientific collaboration, as shown in the following.

Identifying Relevant Research Topics in a Complex and Dynamic Environment

As discussed above, we understand digital transformation research as an area of dynamic and sometimes unpredictable changes. New platforms emerge, new technologies are invented or significantly improved, the legislation keeps changing rapidly, and so are the social norms that guide how technologies are used. Because of this, achieving participation, interdisciplinarity, and relevance is particularly

challenging in this field. Consequently, a structured approach is needed to successfully integrate the needs of relevant stakeholders (see Challenge 1) and an iterative procedure amidst the uncertainties of the context (see Challenge 3). The innovation framework Double Diamond (British Design Council, 2005, see Figure 1) provides such a structure.

The main elements of this framework are the iterative changes between diverging and converging phases that allow both the focus on exploring as well as specifying a problem. Thus, the framework is especially helpful for identifying potentially relevant research topics in digital transformation research that are yet unknown. The structure, moreover, calls for integrating diverse perspectives of various societal stakeholders to meet the scope of the problem.

The first diamond holds the phases *Discover* and *Define*, which serve to “understand [...] what the problem is (e.g., which topics are relevant in digital transformation research). It involves speaking to and spending time with people who are affected by the issues. [...] The insight gathered [...] can help you to define the challenge in a different way” (ibid.). The second diamond contains the phases *Develop* and *Deliver*. It “encourages people to give different answers to the clearly defined problem [...] and co-designing with a range of different people” (ibid.). Meaning that: Potential solutions are tested at early stages of the process with relevant stakeholders (e.g., citizens, politicians), rejected, or improved. The separation between the two “diamonds” helps overcome one crucial challenge that – as already pointed out above – we often see unaddressed: Making sure to identify the *right* problem, before attempting to solve it.

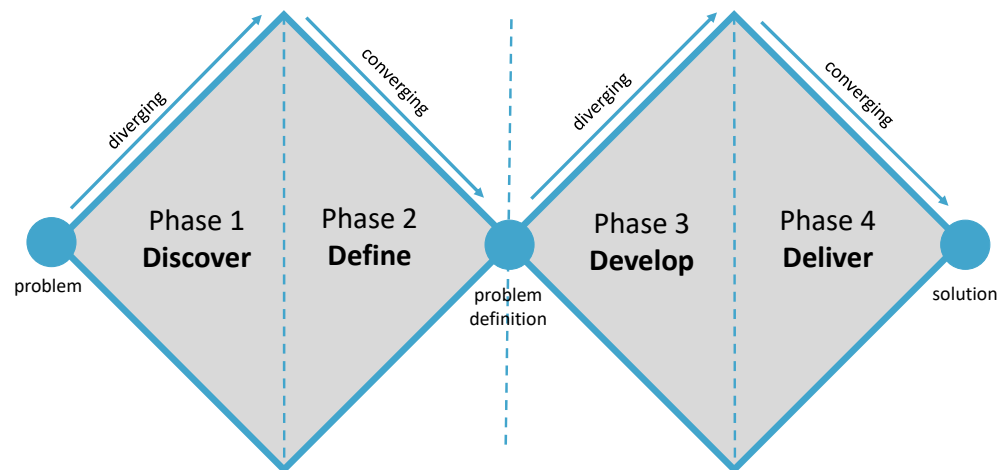


Figure 1 The four phases of the Double Diamond

» **Principles of agile project management are very helpful to foster interdisciplinary exchange and collaboration between researchers.** «

Following the path laid out by the Double Diamond, researchers can define research topics and ensure participation, interdisciplinarity, and societal relevance. Building on to that structure with elements of agile project management the challenges of reacting flexibly to changing framework conditions can be met productively.

Agile Elements in Scientific Collaboration

To address the second challenge of digital transformation research, principles of agile project management are very helpful to foster interdisciplinary exchange and collaboration between researchers. These principles are usually applied through three features working together – which are worth to be transferred to research on digital transformation: stakeholder-centricity, the encouragement of taking a constructive approach to failure through frequent feedback cycles, and an iterative procedure. The first feature can be implemented, for example, as a process as described

in the previous paragraph. The other could mean feeding back interim research results to key societal stakeholders at regular intervals in order to review relevance and impact and, if necessary, strengthen them through readjustments in the research process (e.g., adaptations of research questions, methods, etc.). This approach is complemented by a clear distribution of roles within the team. According to agile project management, these roles are task-based rather than referring to a strict hierarchy in the traditional sense. One of these roles is a so-called facilitator, aiming to help team members to be courageous and solution-oriented with their expertise instead of shying away from a potentially critical opinion.² The facilitator takes up a role similar to that of a workshop host, a project manager, or what has recently been described as a *neo-generalist* (Kern, 2021): a person especially skilled to bring together experts from specific backgrounds – here researchers from different disciplines – and helping them to collaborate effectively. This serves to shift the responsibility of managing the overall structure of the process of a research project to the facilitator. This, in turn, frees the other team members to focus on the content-related challenges at hand. In short: The facilitator plans, oversees, and manages the structure of the process, and, thereby, creates enough room and security for the other team members to maneuver through any potential change in circumstances and the uncertainties brought about by them. Both aspects – the concise structure of the process through iterative phases and the use of a facilitator – serve as the main adaptations to make scientific research processes more agile, flexible, and participatory while still being focused on the societal relevance of findings and solutions. In the following, we will illustrate the implementation of Agile Science exemplarily by giving an overview of the Research Innovation Hub (RIH) at CAIS.

² Cf. previous similar concepts such as the ‘boundary spanner’ (e.g., Bednarek et al., 2018) or the ‘knowledge broker’ (e.g., Bergenholtz, 2011) carry great resemblance to the ‘facilitator’.

The CAIS Research Innovation Hub as a Practical Example

In 2017, the CAIS started as an institution for funding international guest researchers, working groups, and smaller conferences. However, the main aim of the CAIS always has been to develop into a proper research institute with permanent researchers investigating societally important topics in the field of digital transformation. Nevertheless, it had to wait for the appropriate funding from the state of North Rhine-Westphalia. In the starting phase between Summer 2019 and Spring 2021, when the CAIS prepared for becoming a full research institute, the RIH was established to develop and test a concept of agile science. This had two main areas of responsibility: 1) identifying topics for the future CAIS research programs in a participatory process ensuring actuality and societal relevance, and 2) developing and testing methods for interdisciplinary collaboration in digital transformation research.

Identifying Topics for CAIS Research Programs

In a structured process that combined surveys, workshops, and group discussions with researchers as well as representatives of the public and various fields of practice, topics were identified for the first four CAIS research programs. This aimed at the two-fold goal of identifying socially relevant research topics in the field of digital transformation research while, at the same time, including different stakeholders as a participatory human-centered process. The project was structured along the four phases of the Double Diamond (see above). Each phase included at least one qualitative or quantitative study conducted between September 2019 and February 2021. For an overview of the process and the different studies included in the process see Figure 2.³

³ You can find an overview of *all studies, methods, and results here*.

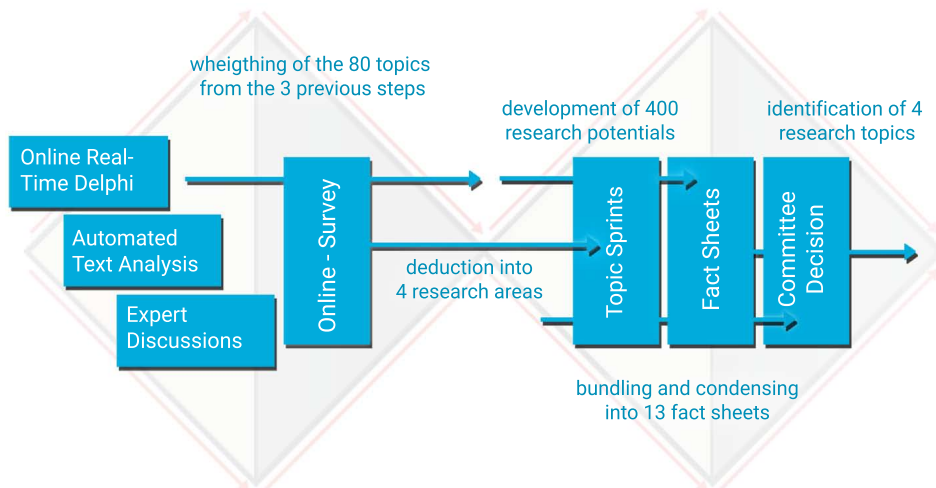


Figure 2 Overview of the process of identifying research topics.

We involved the whole spectrum of stakeholders (e.g., researchers, practitioners, laypeople) to make sure that the future research output will match actual societal needs. Key stakeholders were frequently engaged and repeatedly included into the different steps of the process to validate and improve on intermediate results. Based on this process, the four topics for the CAIS research programs were selected: a) Politics, Inclusion, and Participation, b) Education and Digitalization, c) Ethics and AI, and d) Sustainability.

With the topic-finding process, we aimed to account for the dynamic relations between society and science, exploring current topics around digital transformation and their requirements for participatory research. Structuring the phases along the Double Diamond supported a participatory, co-creative, and solution-oriented process. The systematic collection of topics is the starting point for a long-term monitoring, which intends to map how opinions on, and relevance of digital transformation topics change over time. The further institutionalization of this process is an important steppingstone for understanding the underlying dynamics of digital transformation, being able to effectively research them, and create sustainable outcomes with real societal impact.

Adding a specific role that carries the responsibility of structuring and managing the process – the facilitator – helped us to be less

bound by hierarchy and power structures that might discourage openness. Together with the clearly structured but adaptive setting, the use of a facilitator fostered psychological safety for all involved and thereby enabled a constructive approach to potential setbacks. This, in turn, was a fertile ground for real co-creative work: everyone in the process

could contribute honestly and freely without hesitation, drawing inspiration from the diversity of everyone involved.

Practicing Interdisciplinary Collaboration

In the RIH, we further examined and improved cross-domain networking and innovative interdisciplinary collaboration between researchers in digital transformation research in six pilot research projects. We used agile methods to improve the exchange between the research teams. Among other things, we employed methods from the field of design thinking, which are methodologically designed primarily for activation, feedback, creativity, and reflexivity.

Additionally, in this early stage of building the institute, we conducted group discussions with researchers of different disciplinary backgrounds.⁴ Through that, we identified researchers' needs and concerns in interdisciplinary settings as well as methods (e.g., researchers' call for a facilitator) to be applied and tested within the above-mentioned pilot

⁴ For more detailed information regarding the results of this study, see <https://www.cais-beta.de/forschung/inkubator/forschungsinkubator-expertinnen-diskussion/>.

» ***Responsible integration of various stakeholders while working within an iterative structure that allows for flexibility.*** «

projects. This served as a live testing phase with short feedback loops to generate insights on how aspects of Agile Science can be implemented in future research programs at CAIS.

Conclusion and Outlook

By implementing agile elements in different phases of the research process, we aim to address the above-mentioned challenges for digital transformation research. Focusing on agile principles in the RIH enabled the responsible integration of various stakeholders into different parts of the research process while working within an iterative structure that allows for flexibility. Keeping focus despite changing circumstances and ensuring the relevance of the identified research topics was achieved. At the same time, in the interdisciplinary working settings, this allowed for many points of contact and opportunities for participation and iterative collaboration with our broad set of stakeholders. Consequently, our agile, participatory approach not only provided us with a comprehensive and detailed number of insights but also safeguarded the relevance of output from the very outset. Of course, achieving such high levels of contextualization and human-centricity while managing the process requires additional effort. But investing this effort and, thereby, accounting for increased complexities with the extra effort of an agile approach only seems logical.

The use of the facilitator in digital transformation research is strongly recommended also

in other application contexts, for example, onboarding new members of research teams, enabling a common understanding of different disciplinary perspectives, creating space for early and safe feedback, or managing the balance between disciplinary expertise and interdisciplinary collaboration. Nevertheless, the potentially added value of those functions of the facilitator also needs to be investigated and evaluated systematically in the future.

Unfortunately, in recent years, the term “agile” has degenerated into a rather empty buzzword. What has been lost is in many contexts the knowledge, that agile refers to a certain mindset on one hand, but also to concrete methods for structuring solution-oriented work processes. Re-establishing this awareness is an important and necessary task for implementing innovative and reflexive research in a world characterized by volatility, uncertainty, complexity, and ambiguity. A facilitator could support this – not only in research on digital transformation.

To conclude, the agile, participatory, and co-creative approaches within the RIH at CAIS are crucial elements for successfully conducting need- and relevance-based research. Of course, all the methods described above require additional effort. To account for the complexities of the digital transformation and to guarantee societal relevance and applicability of responsive and responsible research on digital transformation this is not a sacrifice but both an essential requirement as well as an extremely promising long-term investment. This would seem a fitting approach to go along with the dynamic nature of digital transformation research. However, on the side of the university policy and the research institutions, openness to innovative and agile working methods is necessary so that they can be implemented sustainably.

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