cocreaid

Synthesis Report

Report on digital solutions for co-creation (PR1)

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List of Abbreviations

HEI	Higher Educational Institution
GUI	Graphical user interface
MUAS	Münster University of Applied Sciences
NGO	Non-governmental organisation
S2BMRC	Science-to-Business Marketing Research Centre

1 Introduction

1 Introduction

1.1 Disclaimer

The authors prepared this document using data from an Erasmus+ project funded by the European Commission. The report reflects the views only of the project consortium, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

1.2 Acknowledgments

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1.3 Introduction to the project

Project Background

HEIs are increasingly engaged in society and therefore play a growing role in regional and social development. Consequently, they are faced with a rapid expansion of their responsibilities (Klein & Pereira, 2021). To achieve sustainable higher education, HEIs must respond to societal challenges in an entrepreneurial manner and promote co-creation (i.e., continuous cooperation) with external stakeholders (Bikse et al., 2016).

The European Commission's latest Higher Education Modernisation Agenda points out that since 2011 a significant contribution has been made in strengthening collaboration between higher education, research, and business. But beyond the economic impact, social or civil responsibility is less developed and must be emphasized (European Commission, 2017). Therefore, academic literature calls for more comprehensive knowledge on co-creation between HEIs, NGOs, and/or citizens to improve its practical implementation (Mooney et al., 2022). The CoCreAid Kit 4.0 project will have a direct impact on social engagement by fostering collaboration between NGOs and HEIs. This will address social challenges and the needs of citizens while providing inclusion.

Nowadays, co-creation is increasingly taking place in digital environments due to international projects with physical distance between stakeholders or as a consequence of the COVID-19 pandemic (De Silva et al., 2021). With increasing international collaboration, successful cooperation in the digital domain is becoming more and more critical. However, to date, social entrepreneurship in the digital sphere has been somewhat neglected, leading to a lack of insights into successful digital co-creation between HEIs and NGOs (Polese et al., 2021). In addition, traditional co-creation methods have also shown little to no suitability for the digital space as they are primarily based on face-to-face interaction between individuals (Alam, 2020). So far, a holistic perspective on digital co-creation that integrates academics and practitioners has been missing.

Project Objectives

Given the pandemic situation, the urgency of successful digital co-creation has been highlighted. The project focuses on overcoming barriers to cooperation arising when HEIs and NGOs co-create digitally. Therefore, this research contributes to closing the prevalent knowledge gap by analysing current success factors and barriers to digital co-creation and identifying appropriate methods and digital platforms for collaboration. Based on these findings, a graphical user interface (GUI) with digital co-creation tools will be developed to overcome existing barriers and facilitate collaboration. Among these digital co-creation tools are digital platforms and methods that can be applied there.

The CoCreAid Kit 4.0 is intended to serve as a guide for the implementation and development of high-quality co-creation projects digitally. The aim is to increase social impact in participating European countries and beyond. Furthermore, digital competencies will be strengthened among the project partners through practical application.

The project is split into four stages: exploration, development, implementation and refinement, and exploitation and valorisation. The objectives of this project are:

PR1	To create greater awareness and understanding of success factors and transfer barriers in co-creation projects between HEIs and NGOs. Thus, to define requirements for digital work in terms of platforms, methods, and digital skills.
PR2	To develop an "easy-to-use" graphical user interface (GUI) to ensure an equivalent "face-to face-activity" in the digital space. The GUI offers different selection options and guides the user to the co-creation methods depending on the project progress.
PR3	To pilot test and validate the graphical user interface and finally modify it to create a final version of the platform.
PR4	To scale the use of the digital platform to a broad target group through multiplier events. This comprises the dissemination of the user guide.

Table 1. Project goals

1.4 Who we are

We are an **ERASMUS+ Strategic Partnership** project team led by **FH Münster**, Germany. MUAS originated the project idea and convened excellent consortium partners from three HEIs and an NGO based in four different countries – Denmark, Poland, Turkey, and Italy. Our broad expertise and strong reputation build a solid foundation for achieving the intended project results and long-term impact.

FH Münster University of Applied Sciences **(Project Coordinator)**

FH Münster was founded in 1971 out of eight public and private schools and has developed into a modern, achievement-oriented university. The university has approximately 15.000 students and 400 staff and is one of the most important institutions of its kind in Germany. MUAS is part of the Germany-wide initiative "Innovative University" (Innovative Hochschule) that focuses on the "third mission" alongside teaching and research: transfer. Every day at MUAS, new ideas and knowledge are generated in the higher education landscape. MUAS believes that only through direct and reciprocal exchange with actors from business, culture and society can innovations emerge that ensure prosperity and quality of life.

EGE University **(Turkey)**

EGE University, one of the important universities in Turkey, has academicians experienced in education and research. Being a university with an international perspective, the educational system of Ege University is based on the principle of creative teaching and participatory learning. EGE University is a research-based, teaching-oriented institution, training students up to the Doctorate level. In total, 70,000 students are enrolled at EGE University, and the number of the academic staff is approximately 3,500. Today, EGE University has 19 Faculties, 9 Institutes, 3 schools, and 10 Vocational Training Schools, 6 Rectorate Units. EGE University is the first fully internationally accredited university in Turkey, by the internationally recognized Higher Education Quality Board (YOKAK) on 26.06.2021. EGE University carries out crucial studies in cooperation with various regional and national institutions and participates in many international projects in different fields. EGE University Project team is responsible for the CoCreAid Kit 4.0 user guideline (PR4) and supports other project group studies.

University of Szczecin (Poland)

University of Szczecin (US) has, in under 30 years, established itself as the leading HEI in West Pomerania, Poland. It has over 15,000 students in full-time, evening, and part-time studies at seven faculties, covering all areas of university education. The Institute of Management, which will be mainly involved in the project, is one of the most dynamically developing University units. Being a part of the Faculty of Economics, Finances, and Management, it currently educates over 1000 students in two significant courses: management and logistics at the bachelor, master, and doctoral levels. The Department of Corporate Management, a part of the Institute, has specialised in innovation management with a strong emphasis on services. To strengthen the education process, since 2012, the faculty has developed a Centre for Innovation and Knowledge Transfer for the Service Sector SERVICE INTER-LAB. Being a specialised unit connecting University with its business environment and providing research and education focused significantly on a real problem.

Based on its traditions, the Institute of Management provides education strongly focused on service management, emphasising process management and process engineering. The Institute keeps up to date with digital transformation and implements digital tools in education programs. This also relates to innovation programs, which are constantly transformed due to the growing supply of digital tools to support the innovation process; this will be of vital importance to the DI project.

European E-learning Institute (Denmark)

European E-learning Institute (EUEI) specialises in creating powerful online platforms, immersive educational environments and providing resources and tools to create truly valuable learning experiences. Eight full-time people are in the EUEI staff team, and all are competent in leadership, teamwork, and the application of diverse quality management frameworks. In addition, they work closely with a network of designers, programmers, and pedagogic consultants. They prioritise end-user participation and robust qualitative-quantitative feedback as the chief components of quality and promote individual and organisational learning throughout all their projects. Over 6000 students access their online courses each year.

EUEI was founded on the concept of 'continuing education'; a post-secondary education programme that provides further enrichment to learners in a wide range of sectors, covering professional and/or personal topics.

EUEI courses build on the expertise of our European collaborators, who are mainly academic specialists in VET, HE, and lifelong learning. Each of their online courses

is delivered via a state-of-the-art learning system. The course content theory is combined with practical application supported by case studies, movies, and interactive presentations.

Collaboration and peer learning form an important part of EUEI courses: Learners can directly connect with the professors and trainers who created the course content and are encouraged to join a peer learning platform.

Meridaunia Scarl (Italy)

Meridaunia, established in 1998, is a joint limited liability Consortium. It's formed of partners belonging to the public sector, including: 30 Municipalities of the Monti Dauni, the University of Foggia, the Foggia Chamber of Commerce and private companies representing civil society and the world of local entrepreneurship. The mission of the Meridaunia is to be a real "Development Agency" for the territory, with the overall function of supporting development and the creation of businesses and jobs. The institutional work of the Meridaunia essentially consists in drawing up and carrying out strategies for the development of the territory through the involvement of the greatest possible number of local socioeconomic actors (public and private) as well as the local community. Meridaunia will assist MUAS and the other partners to conduct research on the status and form of digital solutions for co-creation projects, and in particular those between HEIs and NGOs. Meridaunia will support MUAS with dissemination and quality assurance activities. It will also take responsibility for survey generation (PR3) and disseminate the CoCreAid Kit 4.0 through its strong network. Furthermore, based on their experience with multiplier events, they will create a structure for multiplier events and take responsibility for it.

2 Research

2 Research

2.1 Executive Summary

As part of the ERASMUS+ Cooperation Partnerships 2021 project CoCreAid Kit 4.0, a project consortium of five partners from five European countries analysed the current success factors, barriers, and requirements to digital co-creation between HEIs and NGOs. By means of desk research, digital platforms and methods were identified and checked for their suitability for digital co-creation. To get a deeper understanding of the needs and requirements of involved actors towards graphical user interfaces (GUIs) and digital methodologies in co-creation projects, 80 semi-structured qualitative interviews with experts in digital co-creation from HEIs and NGOs were conducted. The insights gained are later consolidated into a GUI that serves as an all-in-one user platform for digital co-creation by integrating a knowledge base, existing platforms, and methods.

The initial desk research reviewed more than 100 academic papers, grey literature on platforms and methods, and best practices. It has been shown that there is a broad variety of platforms suitable for digital co-creation. Based on the initial research, the interview guide was developed, aiming to understand the current landscape of digital co-creation between HEIs and NGOs, including the platforms used, success factors, barriers, and requirements for an integrated solution. The interviews confirmed that there are barriers to digital co-creation, including external and internal factors. Among others, a lack of digital literacy, hardware, or software issues (e.g., internet connections) were frequently mentioned. The findings underline the importance of interpersonal relationships, which are often neglected in digital collaboration. According to respondents, the lack of a social component often leads to a lower attention span and less engagement. Yet at the same time, the desk research has shown that these barriers can be reduced or even overcome with methods (e.g., icebreaker games) that promote engagement.

Many respondents indicate that while they have a good understanding of basic functions and programs, they see their digital skills as needing improvement. It has also been shown that NGO partners sometimes lack even basic digital skills. In terms of platforms and methods, HEIs and NGOs use only a small selection of the available options. Due to limited availability, they often have no time to study new tools in-depth; thus, they only work with tools they are already familiar with. To overcome given barriers, experts wish for an easy-to-use and intuitive all-in-one platform. Additionally, they need more guidance, advice, and training material for a successful digital collaboration.

In summary, the research contributes to the body of knowledge about digital co-creation. The study provides an overview of the status quo of digital literacy in HEIs and NGOs, thereby revealing gaps in digital skills. Furthermore, digital platforms and methods were examined regarding their practical applicability.

These findings can help select the right platforms and methods aligned with the stakeholders' goals.

2.2 Introduction to the research

As mentioned earlier, previous research has focused on traditional, non-digital co-creation. So far, however, a holistic perspective on digital co-creation that integrates academics and practitioners is missing. Semi-structured expert interviews were conducted to explore the various facets of co-creation in the digital world. These were later analysed through systematic combining as an abductive approach. Systematic combining can be specified as "a process where theoretical framework, empirical fieldwork, and case analysis evolve simultaneously" (Dubois & Gadde, 2002, p. 556).

To correctly identify the needs and requirements for digital co-creation, the research was split into desk research and qualitative research, whose results were consolidated later. This logic is maintained for this report. Part one (see **chapter 2.3**) presents the desk research results. More than 100 academic papers and grey literature on platforms, methods, and best practices were reviewed to do this. The chapter will review available and frequently used digital co-creation platforms and methods. In part two (see **chapter 2.4**), the qualitative insights from the expert interviews will be listed. The following steps were undertaken in the creation of this report:

1	**Desk research on digital co-creation platforms and methods** As a first step, the project team started with a review of the research: a. Review of 50+ academic papers and grey literature on platforms and methods b. Review of 50+ academic papers and grey literature on good practices
2	**Development of questionnaire** Based on the findings from the desk research, a list of questions was developed to check the current practical implementations in the field.
3	**Search for digital co-creation experts** The project partners (Germany, Italy, Poland, and Turkey) reached out to national and international experts from HEIs and NGOs to get a good overview of the status quo of digital co-creation in different parts of Europe.
4	**Qualitative research** Semi-structured in-depth interviews (45 interviews with HEIs, 35 interviews with NGOs) were conducted to get a deeper understanding of the needs and requirements of involved actors towards graphical user interfaces (GUIs) and digital methodologies in co-creation projects.

5	**Consolidation of findings**
	In the final step, the findings from the desk research and qualitative interviews were consolidated in the synthesis report.

Table 2. Steps for the creation of the synthesis report

2.3 Desk research

2.3.1 Literature review

The literature review provides the foundation for the qualitative research by analysing existing studies and research concerning digital co-creation, thereby identifying prevalent knowledge and knowledge gaps.

Collaboration between HEIs, NGOs, and citizens has been the subject of numerous studies. This connection comes about through the increasing engagement of HEIs in society, working with NGOs in this area. Assuming that NGOs aim to improve citizens well-being, they often involve citizens in their projects.

However, so far, co-creation between HEIs and NGOs has been primarily analysed from a traditional, non-digital perspective, and research focused on digital co-creation is scarce (Polese et al., 2021). Therefore, we provide an overview of the current body of knowledge and later enrich our findings with qualitative research to identify pains and gains in digital collaboration. We will first clarify the understanding of digital co-creation in the context of HEIs and NGOs, outline the current state of research and highlight the most relevant success factors and barriers to digital co-creation.

Co-creation

According to research, co-creation occurs whenever individuals or institutions make a joint effort to create value. Traditional co-creation is characterized by face-to-face interactions, continuous collaboration, and long-term relationships, which require a high resource integration. It involves the individual actors in the different stages of value creation, such as the design phase, the management, or the delivery and evaluation phase, in which all actors contribute their own experiences and knowledge (Alam, 2020). Thanks to the active involvement of users in the value-creation process, the needs of all affected individuals are most likely considered (Ciasullo et al., 2018).

While co-creation received increasing attention in the private and business sector, the public sector mainly was neglected due to its higher complexity. This complexity results from the great diversity of actors and their competencies but also from the strict legal and organisational requirements that must be met (Alam, 2020). Thus, more academic attention is needed to ensure that participatory practices can also be applied in the public and private sectors. Collaborations can be initiated by all actors involved along the value chain and do not require a top-down approach anymore (Lember, 2017).

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In evaluating the success of co-creation projects, a distinction can be made between three critical areas: environmental circumstances, the relationship between the organisations and involved actors, as well as internal structures or processes (Alam, 2020). Within the course of this project, all three areas will be investigated. Still, due to the project's scope, the outcome will only focus on the external relationships and internal structures. Thereby, the main challenges can be addressed and solved. The external factors, though equally important, depend on multiple factors which cannot be controlled or influenced by the HEIs or NGOs.

Digital co-creation

Increasing digitalization significantly influences co-creation projects (Ciasullo et al., 2018). As international collaboration grows, co-creation increasingly occurs in digital environments due to the physical distance between participants (De Silva et al., 2021). As such, technology is credited with enabling the inclusion of all relevant participants (Alam, 2020). New technologies are thus impacting not only the technical processes but also the way people collaborate and innovate the thinking (Ciasullo et al., 2018). Some of the existing projects have shown that digital solutions can increase the efficiency and effectiveness of co-creation projects with citizens while simultaneously reducing the costs linked to such projects (Lember, 2017).

Additionally, by enabling innovative approaches to civic engagement, challenges that could not be addressed with traditional methods can be overcome. Thereby, citizens can actively contribute to facilitating quality of life. Here, a differentiation can be made between technologies that affect co-creation processes indirectly, transform the traditional ways of collaboration, or those that substitute traditional co-production (Lember, 2017).

As researchers predict, the web and emerging technologies will develop an immersive experience connecting digital and virtual worlds where users can interact in real-time (Ciasullo et al., 2018). Therefore, representatives of HEIs and NGOs need to be prepared to encounter such developments to ensure the continuance of co-creation projects in the future. Missing competencies must be trained, and processes must be adapted to meet the requirements of digital collaboration. Increasing effort is needed to shape the digital environment to the benefit of society and educate citizens on how to make use of the new opportunities for the sake of everyone.

Success factors to co-creation

The author's literature search did not yield any valuable results on the success factors of digital co-creation. However, there is a general understanding of the success factors of co-creation in the literature. This confirms the suspected research gap on success factors in digital co-creation, while there is a general understanding of success factors in co-creation.

According to Suhari et al. (2022), success factors in co-creation include the following. Firstly, project members must create a clear and realistic outline of the project goals to ensure that all parties share the same vision. Secondly, all members must be equipped with similar competencies and skills to conduct a successful co-creation project. This can be achieved through tandems of experienced members with newcomers. Furthermore, it is essential to integrate the practitioner's context with the scientific context to align their project needs and avoid misunderstandings. Lee et al. (2018) emphasise the importance of ensuring that both parties are compatible before the project starts. This is one of the main challenges that can be avoided by verifying if there is a shared objective. Additionally, a framework should be defined well before the project begins, and all participants should bring a shared knowledge and a unique perspective to the project.

- Clear and realitstic outline of project goals
- Similar competencies and skills
- Alignment of pratice and science
- Compatability of partners
- Clear defintion of framework

Figure 1. Success factors to co-creation (Own illustration, adapted from Suhari et al. (2022) and Lee et al. (2018))

To the authors' knowledge, there has been no academic research on success factors for digital co-creation. However, as there is a general understanding of success factors for traditional co-creation, the authors seek to gain insights into the perspective of digital co-creation. For this purpose, experts in digital co-creation were interviewed in the second part of the study, the qualitative interviews.

Barriers to co-creation

When different disciplines and sectors collaborate, the players involved repeatedly encounter obstacles that impede or even prevent successful knowledge and technology transfer. These obstacles are also referred to as transfer barriers. Based on a systematic literature review and participatory action research, Kurzhals et al. (2022) identified 12 transfer barriers to transdisciplinary collaboration. Each barrier is assigned to a specific phase in the project life cycle (see **Figure 2**). However, these barriers can be overcome with adequate platforms and methods (Kurzhals et al., 2022).

Again, it is important to note that the transfer barriers have only been validated for traditional, face-to-face co-creation. As part of our qualitative research, we aim to identify which barriers exist in digital collaboration.
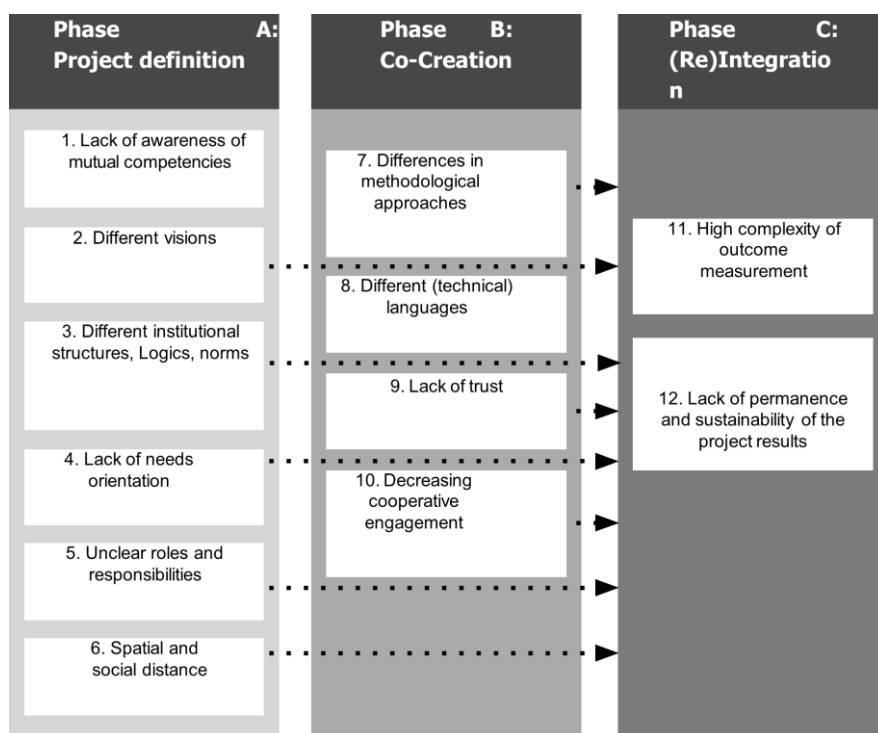
Figure 2. 12 transfer barriers to co-creation (Kurzhals et al., 2022)

An explanation of each transfer barrier is listed in **Table 3.**

Transfer barrier	Description
Lack of awareness of mutual competencies	Actors from different sectors are often unaware of the competencies of the other actors involved in cooperation. This lack of knowledge can lead to insufficient use of each other's competencies or no consideration at all.
Different visions	Especially in transdisciplinary collaborations, there is a risk that the actors develop different visions without a clear orientation and focus on the project.
Different structures, logics, norms	Each of the four sectors (academia, business, civil society, and politics) has its structures, logics, and norms that complicate knowledge transfer within a collaborative project.
Lacks needs orientation	A lack of orientation and reference to the different needs of all project actors can inhibit the cooperation's success.
Unclear roles and responsibilities	Unclear responsibilities, guidelines, and assignments of tasks between the project participants, as well as asymmetrical role

	assignments, make transdisciplinary collaboration difficult, especially regarding management and its organisation.
Spatial and social distance	Collaborations with many different actors can be confronted with spatial and social distance, making personal contact, effective communication, and organisation difficult.
Differences in methodological approaches	Cooperations between scientists and social actors quickly find differences in methodological approaches and orientations. Regarding the research methods used, there is a risk of not meeting scientific requirements and, at the same time, not being relevant for the social actors.
Different (technical) languages	Different technical languages can lead to communicative misunderstandings that complicate cooperation and coordination.
Lack of trust	Lack of trust prevents a good relationship among the different actors of a project.
Decreasing cooperative engagement	As the project continues, there is a risk that the commitment of the individual actors in the project will decrease and that there may even be a loss of participating actors.
The high complexity of outcome measurement	The results of a transdisciplinary project are difficult to measure because they often involve long-term changes in attitudes and behaviour. Due to this non-quantifiable impact measurement, the project's social relevance may not be sufficiently considered.
Lack of permanence and sustainability of the project results	With the termination of the project, there is the risk that the results are not secured in practice and/or that a continuation of the project is missing.

Table 3. 12 transfer barriers to co-creation (Kurzhals et al., 2022)

Although given transfer barriers can repeatedly impede or even hinder successful co-creation, the barriers can be overcome with adequate platforms and methods (Kurzhals et al., 2022). Digital platforms (see **chapter 2.3.2**) and methods (see **chapter 2.3.3**) are evaluated in the following.

2.3.2 Digital platforms

The success of digital co-creation depends, among other things, on internal structures and processes (Alam, 2020). This also includes the methods and platforms used for cooperation. In the digital environment, various platforms are used to facilitate collaboration and communication with project members. Digital platforms are also an essential basis and opportunity for project work at a distance because the geographical distance is often an important factor that must be overcome, especially in science with and for society projects involving NGOs from rural areas, for example.

Through online research, frequently used digital collaboration platforms were collected (see **Table 4)** and reviewed regarding their suitability for digital co-creation (see **Table 5**). To achieve a better overview, the platforms were divided into five categories regarding their function: collaboration, communication, creativity, file sharing, and engagement (Kurzhals et al., 2022). A brief description of the categories follows.

> ***Collaboration***. Digital collaboration platforms help transdisciplinary teams structure their project. This includes assigning roles or responsibilities or holding notes, availabilities, or to-dos in a shared workspace.
>
> ***Communication***. Digital communication platforms range from simple chat functions to video conferencing to sharing project data, exchanging files, and performing tasks together. They also keep other team members up to date on the progress of the project.
>
> ***Creativity***. Digital creativity platforms support brainstorming, being creative together, or developing prototypes. For this purpose, there are some digital platforms to build a digital mind map or prototype quickly, easily, and cooperatively.
>
> ***File sharing***. Cloud-based digital platforms allow project participants with different devices to access the same files and edit them collaboratively and simultaneously.
>
> ***Engagement***. Digital engagement platforms foster interaction with the participants during an online workshop. They include polls or quizzes.

It is important to note that only a small selection of the total available platforms has been chosen here. There are far more platforms, but they are all similar in their functions. The selected platforms cover a wide range of platforms well. Depending on the area of application, one should consider what kind of platform is needed. Often digital platforms are offered as a freemium model, i.e., the platforms can be used free of charge with restrictions, but you must pay for additional functions.

Table 4 offers a detailed description of the selected platforms, including their language availability and price options.

	Description	URL	Language	Fare option
Collaboration				
asana	asana is a workflow management platform that allows for online team collaboration and is designed to help teams organize, track, and manage their work.	https://asana.com/de	Various	**Free** (basic). Paid plans are available.
Calendly	Calendly is a meeting scheduling software for individuals, teams, or external partners.	https://calendly.com/de	English, French, Spanish, Portuguese, German	**Free** (basic plan). Three paid plans available.
Evernote	Evernote is a platform to organise and manage tasks and notes.	https://evernote.com/intl/de	Various	**Free** (max. 60 MB upload, limited functionality). Paid plans are available.
Notion	Notion is a platform that provides different components to create an own management system.	https://www.notion.so/	English, French, Korean, (Japanese)	**Free** (personal plan). Three paid plans available (50% discount of team plan for NGOs)
Trello	Trello is a Kanban-style project management platform that organizes tasks into boards. It is a web-based application and can be used collaboratively.	https://trello.com/de	Various	**Free** (10 boards per work desk and unlimited cards). Three paid plans available.
Communication				
Cisco WebEx	Cisco WebEx is software for video conferences and online meetings. It can be used for webinars as well.	https://www.webex.com/de/index.html	English, German, Spanish, French, Italian, Portuguese, Asian languages	**Free** (1 host, max. 50min, max. 100 participants). Two paid plans are available.

Google Meet	Google Meet is a platform for video and chat communication via Google.	https://meet.google.com/	53 languages available	**Free** to use if Google account is available (max. 60 min per session, up to 500 participants)
Microsoft Teams	Microsoft Teams is a communication platform for group and team chats focusing on digital collaboration.	https://www.microsoft.com/de-de/microsoft-teams/log-in	Various	**Free** to use if Microsoft account is available (max. 60 min per session). Paid plans are available.
Slack	Slack is a workplace communication platform that organizes conversations with their specific team and workgroup. It is a messaging and file-sharing program.	https://slack.com/intl/de-de/	English, German, Spanish, French, Italian, Portuguese, Asian languages	**Free** (limitation to 10.000 messages in Teams; only 1:1 Audio/video calls in the team). Paid plan is available.
Zoom	Zoom is an online video conferencing platform that allows holding meetings, webinars, and interactive workshops. It encourages collaboration via a whiteboard function and breakout sessions.	https://explore.zoom.us/de/products/meetings/	English, German, Spanish, French, Italian, Portuguese, Polish, Asian languages	**Free** (up to 100 participants, max. 40 minutes). Two paid plans are available.
Creativity				
Adobe XD	Adobe XD is a collaborative user experience design prototyping platform that lets its user wireframe and prototype interactive web and mobile applications. The websites or apps can then be shared for user testing.	https://www.adobe.com/de/products/xd.html	Various	Free trial, monthly fee afterwards
Canva	Canva is a graphic design platform that provides different templates, images, and other material to create graphics and	https://www.canva.com/de_de/	Various	**Free**, free Pro-Version available for NGOs

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	visual content, such as social media posts, presentations, and posters.			
Figma	Figma is a web-based prototyping platform for graphics editing and user interface designing that encourages team-based collaborative design projects.	https://www.figma.com/	English, French, German	**Free** (three Figma + 3 FigJam files). Paid plans are available.
Miro	Miro is an online collaborative whiteboard platform that can be used for brainstorming & ideation, meetings, and workshops, various mapping activities, or project management.	https://miro.com/	English, German, Spanish, French, Italian, Portuguese, Chinese	**Free** (three editable boards). Paid plans are available.
Mural	Mural is an endless collaborative whiteboard platform that creates a blank digital workspace and provides templates and tools to visualise ideas, organize brainstorming activities and visualise project components.	https://www.mural.co/	English	**Free** (five murals and unlimited members). Paid plans are available.
File sharing				
Dropbox	Dropbox is a cloud-based file-sharing platform that includes collaboration platforms so that teams can work together on shared files.	https://www.dropbox.com/	Various	**Free** (one user, 2GB storage, three devices). Paid plans are available.
Google Drive	Google Drive is a file-hosting service provided by Google LLC. It allows users to store documents in the cloud, share files, and edit documents together.	https://www.google.com/intl/de/drive/	Various	**Free** (15 GB shared storage for several Google Tools). Paid plans are available.
OneDrive	OneDrive allows users to store files, photos, and other documents on multiple devices. A user can automatically	https://onedrive.live.com/about/de-de/signin/	Various (all Microsoft languages)	**Free** (5GB storage and for Microsoft users 1TB for free).

				Paid plans are available.
Sciebo	Sciebo is non-commercial cloud storage by universities for universities, where you can securely store your research, study, and teaching data.	https://hochschulcloud.nrw/	German	**Free**
Engagement				
Kahoot!	Kahoot! is a global learning platform that allows any individual or corporation to create, share, and host learning sessions that drive compelling engagement.	https://kahoot.it/	Various	**Free** (for Students and Teachers). Paid plans are available.
Mentimeter	Mentimeter creates interactive presentations with real-time feedback. Its features include quizzes, polls, gifs, and surveys to make presentations more engaging.	https://www.mentimeter.com/	English, Portuguese, Spanish	**Free** (limited number of questions). Two paid plans are available.
Slido	Slido is a platform for real-time Q&A polls and surveys.	https://www.sli.do/de	English, German, Chinese	**Free** (up to 100 Participants, three polls per event). Paid plans are available.

Table 4. Overview of the selected digital platforms

Desk research has shown that there are many different platforms for digital co-creation. Due to different functionalities, not all platforms are equally suitable for every project. Furthermore, very few platforms can be used for digital co-creation without incurring additional costs to fully access all features. Most platforms offer at least three paid plans with different levels of accessible features. For example, all video conferencing platforms have a limitation on time and the number of participants, which is only removed with the paid plans. For file sharing platforms, there are limitations on storage capacities.

The languages available also vary from platform to platform. Most platforms are offered in several languages other than English; however, some of the platforms are only available in English (e.g., Mural) or in a small number of European languages (e.g., Mentimeter, Figma).

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Table 5 displays the functionalities of each selected platform.

Functionalities	External collaboration	Internal collaboration	Process flexibility	Project Management	Screensharing	Breakout rooms	Recording option	Chat function	Participation via phone	Free storage	Live collaboration	Sharing function	Gather customer / user insights	Organizing and planning	Iterating processes	GDPR compliance	Scoping ideas	Prioritizing & selecting ideas	Selecting concepts	Generating concepts	Generating ideas	Assessing ideas	Tag function	Compatibility with other	Backup function
Collaboration																									
asana	x	x	x	x				x		x	(x)	x	x	x	x	x	x	x	x	x	x	x	X	x	x
Calendly	x	x		x										x	x									x	
Evernote	x	x	x	x						(x)		x	x				x	x	x	x	x	x	X		
Notion		x	x	x						x	(x)	(x)	(x)	x	x	x	x	x	x	x	x	x	X	x	
Trello	x	x	x	x						x	x	x	x	x										x	
Communication																									
Cisco WebEx	(x)	x			x	(x)	(x)	x	(x)		x	x		x			x	x	x	x	x	x		x	(x)
Google Meet	x	x			x			x	x		x	x		x		(x)	x	x	x	x	x	x			
Teams	x	x	x	x	x	(x)	x	x	(x)	x	x	x	(x)	x	x	(x)	x	x	x	x	x	x	X	x	x
Slack	(x)	(x)		x	(x)			x			(x)	x		x			x	x	x	x	x	x	X	x	
Zoom	x	x		x	x	x	x	x	x		x	x	x	x		(x)	x	x	x	x	x	x		x	
Creativity																									
AdobeXD		x	x									x								x	x				
Canva	x	x	x	x						x		x								x	x				
Figma	x	x	x	x						x		x												x	x
Miro	x		x	x							x	x	x	x	x	x	x	x	x	x	x	x		x	x
Mural	x	x	x	x							x	x	x	x	x	x	x	x	x	x	x	x		x	
File sharing																									
Dropbox	x	x	x	x							x	x	x	x											

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Google Drive									x										
OneDrive	x	x	x	x					x	x	x	x							x
Sciebo									x										
Engagement																			
Kahoot									x										
Menti-meter	x	x	x				(x)		x	x	x				x	x			
Slido	x	x							x	x	x				x		x	x	x

Table 5. Functionalities of the digital platforms

To classify the available platforms based on their suitability for digital co-creation, all platforms were examined with regard to their gains and pains.

	Gains	Pains
Collaboration		
asana	- Handling and keeping an overview of extensive projects - Workflow builder - Task automation with rules - Integration with various platforms such as Slack, Google Drive, Microsoft Office, Figma, Canva, etc. - Tracking progress with timelines - Progress reports on teams and tasks - Collaboration with external partners - Allocation of roles and rights	- Tasks cannot be allocated to multiple persons - Pricing - Limited functionality in basic plan - Focused on long-term collaboration in internal teams with repetitive tasks
Calendly	- Automation of e.g., sending out meeting minutes - Facilitation of meeting coordination - Meeting polls (alternative to Doodle) - Meeting invitations can be sent without email - Easy to integrate in various platforms like e.g., Zoom	Limited functionality: Organises only meetings and no tasks
Evernote	- Entry can be allocated to multiple categories - Perfect to make quick notes - Interoperability	- Only 60 MB free upload - Deadlines can only be marked with personal and professional plan

	• Various templates available for project management • Neat and clear GUI thanks to customized widgets • Web clipper • Task planning and delegation • Easy digitalisation of paper-based documents and notes	
Notion	• High flexibility in process, project, and workflow design • 50+ starter templates • Various tools such as table, list, calendar, Kanban board, gallery, and timeline views • Interoperability with other programs such as GitHub, Slack, Gira, Asana	• Bulk export as PDF only possible with Enterprise option • No integration of MS Office solutions – only option is to upload such files • Only limited languages available – App must be handled in English probably • Time needed to familiarize with the set-up of own systems
Trello	• Offers various templates for different projects and methodologies • Easy prioritization and organisation of tasks (including allocation of tasks to team members) • Mobile app for Android and iOS • Two-factor identification	• Calendar option only available for enterprise and premium plan
Communication		
Cisco WebEx	• Visual collaboration inclusive digital whiteboards • Real-time translation • Integration of 100+ other Apps and programs used in companies • File sharing option with paid plans • Multi-device compatibility • Breakout sessions • Interactive whiteboards • Chat function	• No further adaption of video and audio quality possible • Free version offers only 50 minutes meetings (paid options 24 hours) • Participation via phone (free only for individual contracts) • Not available in e.g., East European languages
Google Meet	• Opportunity to host meetings with many participants (up to 100 in free version, 500 in Enterprise version) • Chat function • 53 languages available • Easy access • Live translation/subtitles	• Little opportunities to control the meeting session • Same safety standards applied by Google, only limited control in free and Essential plan • Only 60 min sessions for group meetings, 24h in 1:1 call • Limited functions with free version (no recording option, no breakout sessions, no Livestream Option for 100K viewers, etc.) • Enterprise plan = only plan that offers polls, Q&A option, or participation reports

Microsoft Teams	• Good Accessibility • Chat across organisations possible • File sharing possible • Live collaboration • "All in one" solution • Interoperability with many other apps • Available in various languages	• Limited functions with free version (limited meeting duration, allows only 100 participants, no breakout sessions • Number of participants limited (even with paid plans max. 300) • Microsoft account necessary to set up meetings
Slack	• Quick file sharing • Opportunity to tag people • Lower risk of phishing (in comparison to email correspondence) • Channel organisation • Integrated Survey-Tool for quick surveys • Data security certification FINRA, HIPAA und FedRAMP	• Free version offers only limited accessibility • Just one workspace • Only 5 GB storage capacity • No cooperation between external organisations • Not available in e.g., East European languages
Zoom	• High flexibility regarding packages and add-ons, e.g., cloud storage, audio conferencing, or conference room connector • Participation as a guest possible • Individual settings for audio and video • Recording and transcription options • Integrated tools for collaboration • Sharing PowerPoint presentations as virtual background to elaborate presentations • Free participation for more than 55 countries • Connectivity to other apps	• Free plan offers only 40 min group meetings (1:1 meetings are unlimited)
Creativity		
AdobeXD	• Various functionalities • Sharing prototype with others via link • 100GB Cloud storage	• Training needed to use full potential
Canva	• Large library of stock material • Free Pro-version available for NGOs • 100GB Cloud storage • Template for multiple formats including Social Media channels, websites, and print material	• Data protection • No real-time collaboration
Figma	• Unlimited file storage • Multiple Plugins • Large template library and community support • Sketch import • Interactive prototypes • Use for prototyping and feedback loops	• Training needed to use full potential • Free version offers only limited Figma files • No option for plugins from other apps

Miro	• High flexibility • High number of templates and ideas for collaboration • Supports either creative or organisational work • Can be used for most co-creation methods	• Difficult handling in the beginning • Limited integration in other platforms • Limited free version (No role option, no backup option, board exports are limited, only three boards and 20 members etc.)
Mural	• Offers templates for workshop design • Real-time collaboration (incl. reactions, comments, likes, etc.) • Timer box to keep teams running on track • Resizable canvas • Voting option • Templates available • Digital whiteboard • Interoperability with other platforms such as Dropbox, Slack, MS Office, Git Hub, … • Data privacy and security	• Less entertaining than Miro • Needs some time to familiarise with functionalities
File sharing		
Dropbox	• Automatic data backup and restore • Integration of Microsoft Teams & Slack	• Difficulties with file search via the search function
Google Drive	• Documents can be created independently (Google Docs, Spreadsheet etc.)	• no Linux client available • Shares storage with Google Mail
OneDrive	• More than free version if O365 is used anyways • Data protection	• Free version only offers 5GB storage
Sciebo	• Data Security (data hosted in Germany)	• No integration with mobile office apps like Word, Excel etc. possible.
Engagement		
Kahoot	• Fun-learning platform • Gamification approach • Easy to set up • Brings interactions to presentations and workshops	• No significant pains available
Mentimeter	• Offers multiple designs for questions/answers e.g., graphs, percentages, word clouds • Easy to set up for quick polls and very simple questionnaires • Build interactive presentations	• Free version offers only a limited number of questions • No export of the results in free version • Data comparison over time only available in paid plans
Slido	• 30+ templates • Integration of Google Slides, PowerPoint, and Teams	• Free option does not include image polls and surveys • Only one subject for a brainstorming and one quiz per event • Branding only with paid option

Table 6. Evaluation of digital platforms

In the next step, the identified pains and gains were weighted against each other to assess the platforms in terms of their general suitability for digital co-creation.

Collaboration
***Asana**.* Large projects can be well organized, and an overview is maintained. Focused on long-term collaboration in internal teams with repetitive tasks (mainly marketing and sales functions). ↳ Can be used for digital co-creation, but check out other platforms too ***Calendly**.* Can be well used for meeting coordination and the automation of iterating processes. However, it is quite limited in its functionalities (no organisation of tasks). ↳ Can be used for digital co-creation, but check out other platforms too ***Evernote**.* Easy platform for digitalisation of paper-based documents and notes. However, the free version only offers limited functionality. ↳ Suitable for digital co-creation projects ***Notion**.* Intuitive to use, clear team and project organisation platform. Still, the user needs some time to get familiar with the set-up. ↳ Suitable for digital co-creation projects ***Trello**.* Free version offers already a practical set of functionalities for small teams, individuals, and projects. ↳ Suitable for digital co-creation projects
Communication
Cisco WebEx. A proven platform for video conferencing and webinars. Has common limitations in terms of time and number of participants. ↳ Suitable for digital co-creation projects ***Google Meet.*** A proven platform for video conferencing and webinars. Few opportunities to control the meeting session. Security standards are managed by Google; hence sometimes not allowed in companies. ↳ Suitable for digital co-creation projects ***Microsoft Teams.*** A proven platform for video conferencing and joint project work. Easy access for project partners when other Microsoft applications are also used. However, a Microsoft account is required to set up meetings. ↳ Suitable for digital co-creation projects ***Slack**.* The free version does not allow external collaboration across organisations and only limited storage opportunities for files and messages. ↳ Probably not suitable for digital co-creation projects ***Zoom.*** A proven platform for video conferencing and webinars. High flexibility in terms of packages and add-ons like cloud storage, audio conferencing, large

meetings, or conference room connector.
↳ <u>Suitable</u> for digital co-creation projects

Creativity

Adobe XD. Powerful UX design platform for prototyping. Belongs to the Adobe universe, therefore rather expensive.
↳ Suitable for digital co-creation projects

Canva. Creativity platform to create posters, social media posts, and communication materials. However, it does not allow real-time collaboration.
↳ Can be used for digital co-creation projects, but check out other platforms too

Figma. Can be well used for prototyping and feedback loops. Training is necessary to familiarize with the platform.
↳ Can be used for digital co-creation, but check out other platforms too

Miro. Great platform for interactive brainstorming workshops. Free plan offers only three boards; therefore, it is quite necessary to buy a plan.
↳ Suitable for digital co-creation projects

Mural. Digital whiteboard bears excellent potential to visualize and facilitate collaboration. However, it needs some time to familiarise with the functionalities.
↳ Suitable for digital co-creation projects

File sharing

Dropbox. An easy-to-use platform for file sharing.
↳ Suitable for digital co-creation projects

Google Drive. A good service that offers pretty much everything cloud storage should have. Yet, Google has had privacy issues as it collects much user data.
↳ Can be used for digital co-creation, but check out other platforms too

OneDrive. High integration of Microsoft platforms is possible.
↳ Suitable for digital co-creation projects

Sciebo. It has been rated as the most trusted cloud service, as data is stored in Germany.
↳ Suitable for digital co-creation projects

Engagement

Kahoot. Platform to make workshops more interactive by following a gamification approach.
↳ Suitable for digital co-creation projects

Mentimeter. Turns answers into visual results and therefore creates high engagement in workshops.
↳ Suitable for digital co-creation projects

Slido. Great platform to ask questions to the audience and engage them. Various templates are available.
↳ Suitable for digital co-creation projects

Table 7. Suitability of platform for digital co-creation projects

As already described, the suitability of the platforms for digital co-creation varies with the purpose of the platform. Therefore, an additional classification was made for which project phase and target group they are suitable for.

	Process Step						Target group			
	Opportunity Identification	Ideation & Idea	Concepting	Development	Pilot Testing & Validating	Launch	Project leader	Project partner	Associated partners	Citizens
Collaboration										
asana			x		x		x	x	x	
Calendly							x	x	x	x
Evernote	x	x	x	x	x	x	x	x		
Notion	x	x	x	x	x	x	x	x		
Trello	x						x	x		
Communication										
Cisco WebEx	x	x	x				x	x	x	x
Google Meet	x	x	x				x	x	x	x
Microsoft Teams	x	x	x				x	x	x	x
Slack	x	x	x				x	x		
Zoom	x	x	x				x	x	x	x
Creativity										
AdobeXD			x	x	x		x	x		
Canva			x	x		x	x	x		
Figma			x	x	x		x	x		
Miro	x	x	x	x		x	x	x	x	x
Mural	x	x	x				x	x	x	x

File sharing										
Dropbox	x	x	x	x	x	x	x	x	x	x
Google Drive	x	x	x	x	x	x	x	x	x	x
OneDrive	x	x	x	x	x	x	x	x	x	x
Sciebo	x	x	x	x	x	x	x	x	x	x
Engagement										
Kahoot							x	x	x	x
Mentimeter	x	x	x	x	x		x	x	x	x
Slido		x			x		x	x	x	x

Table 8. Suitability of platforms for process step and target group

2.3.3 Methods

Most traditional co-creation methods were developed for face-to-face interaction between individuals. Therefore, the question arises whether and how easily such methods can be transferred to the digital space. To find out whether there are suitable platforms for the existing methods, the platforms and methods were compared side by side. The selection of methods is based on literature research.

Each methods helps to overcome a specific transfer barrier (see **chapter 2.3.1**). Not all methods are equally suitable for every project phase; thus, the transfer barriers were assigned to three different project stages: start, implementation, and closure. In the following, the selected methods are briefly described before they are evaluated.

Method	Description
Project Start	
Competence Sun (Kurzhals et al., 2022)	The method Competence Sun offers a simple and creative way to find out about the character and competencies of another person, to discover commonalities and differences in the group, and thereby strengthen the ability to work in a team.
Appreciative Inquiry (Kurzhals et al., 2022)	Appreciative Inquiry is a value-oriented approach to team and organisational development. It promotes an appreciative attitude in teams, which helps to develop a shared vision. The focus is not on the problems but on the resources and potential of the project or team.

World Café (Kurzhals et al., 2022)	The World Café is a flexible and creative method that leads to an intensive dialogue between the participants. This way, problems and questions on a specific topic can be intensively discussed in small transdisciplinary groups.
Six Hats (Kurzhals et al., 2022)	The method "Six hats" is used to design group discussions. In the process, the participants take on six roles, which are represented by hats in different colours. This method aims to approach a topic from different angles and thus create a constructive and uniform basis for discussion.
Lean Canvas (Kurzhals et al., 2022)	The Lean Canvas is a tool from the field of strategic management for the development of innovations, which has been adapted for co-creation projects, e.g., in the healthcare context. By using this tool, you get to know your target group(s) and their needs better and can work out the specifics of your offer.
How-Now-Wow Matrix (Damiani et al., 2019)	The How-Now-Wow Matrix helps project participants to implement features that make the product or problem solution unique and differentiate it from competitors. This method facilitates "out-of-the-box" thinking and supports the implementation of the new ideas.
Roleplay (Kurzhals et al., 2022)	In a roleplay, team members take turns slipping into the role of the target group. The goal is to take on the perspective of the user. This makes the project accessible to the target group and reveals optimization potential for the product or service relevant to the project's further course.
Persona (Kurzhals et al., 2022)	Persona is a widely used tool in Design Thinking that helps create an exemplary user type for a product/service. This allows the definition of concrete characteristics and behaviours to be better understood.
Prototyping (Kurzhals et al., 2022)	Prototyping is an approach that originated in software development. Prototypes are used to make the selected ideas tangible and experienceable early. The product/service is created with simple materials to test a function or experience. The feedback from the tests is used to optimize the product/service.
Expectation Matrix (Kurzhals et al., 2022)	With the help of the Expectation Matrix, the user expectations and potential contributions of the various actors can be worked out. This helps to assess possible conflicts of interest and difficulties of the actors as well as to define clear roles and responsibilities.

Stakeholder Salience (Kurzhals et al., 2022)	The Stakeholder Salience Model is a strategy tool for segmenting stakeholders. Classifying and evaluating all stakeholders based on three attributes (power, legitimacy, and urgency) provides an overview and prioritization of all stakeholders with a claim or interest in the problem and a potential solution.
Ego Network (Kurzhals et al., 2022)	The primary purpose of a network is to exchange knowledge, ideas, and competencies. The Ego Network method helps to work out the relationships among the stakeholders of a transdisciplinary project group to use them as effectively and efficiently as possible.
Network Moderation (Kurzhals et al., 2022)	A network moderator has the task of methodically leading the group meetings without participating in the content or influencing the group's decision-making. This leads to a practical design of group communication.
Project Implementation	
Star Fish Game (Gonçalves & Linders, 2014)	The Star Fish Game is a method that promotes critical reflection and mutual understanding. It helps team members understand the value of certain actions and how that value is perceived by others. The approach includes five questions areas: Stop Doing, Less Of, Keep Doing, More Of, and Start Doing.
Smart PICO (Kurzhals et al., 2022)	The Smart PICO method is a modified scheme used to prepare a strategy for scientific literature review or the development of research questions and/or an interview guide. This scheme has been extended and adapted for Science/Society projects by the SMART criteria from project management.
6-3-5 Brainwriting (Kurzhals et al., 2022)	6-3-5 Brainwriting is a creativity technique that promotes the generation of new ideas in a group and sorts and prioritizes similar ideas. This generates many ideas in a short time. In addition, different disciplines often have similar ideas that seem very different because of the different jargon. This method identifies the commonalities in the ideas and can be further developed.
Nudging (Kurzhals et al., 2022)	Nudging comes from behavioural economics and serves as a tool that can be used to motivate people at the beginning and during a project. It is more subtle than incentives and therefore does not pressure the recipient. A nudge increases the personal well-being and motivation of the recipient, is easy to implement, inexpensive, and does not limit the choices of the recipient.
River of Life (Kurzhals et al., 2022)	The River-of-Life method makes it possible to document a project or development in a team visually and to show the

common milestones and obstacles in the course of the project. The metaphor of a river represents the development of the project or team. The method allows multiple perspectives to be brought together, providing an opportunity to maintain cooperative engagement in the team.

Project Closing	
UTAUT Model (Kurzhals et al., 2022)	UTAUT (Unified Theory of Acceptance and Use of Technology) is a model that measures users' acceptance of innovation to gain access to individual user behaviour. This is done by evaluating four influencing factors: performance expectation, effort expectation, social influences, and facilitating circumstances. From this, measures for the development and communication of the innovation can be derived.
Testimonial Concept (Kurzhals et al., 2022)	The Testimonial Concept is a tool for training interested parties to become experts and thus enable them as multipliers to disseminate knowledge. The aim of the concept is to create structures that will allow the independent and sustainable dissemination of specific knowledge.

Table 9. Description of selected methods

Table 10 analyses the selected digital platforms' compatibility with the chosen co-creation methods. It is important to note that any method that is to be conducted digitally requires the use of a video conferencing platform (e.g., Zoom or MS Teams) and in most cases a digital whiteboard (e.g., Miro or Mural). Afterwards, the results of the project work can be downloaded and saved on one of the file sharing platforms (e.g. MS Teams or Sciebo).

Platforms	Competence Sun	Appreciative Inquiry	World Café	Six Hats	Lean Canvas	How-Now-Wow Matrix	Roleplay	Persona	Prototyping	Expectation Matrix	Stakeholder Matrix	Ego Network	Network Moderation	Star Fish Game	Smart Pico	6-3-5 Brainwriting	Nuding	River of Live	UTAUT Model	Testimonial Concept
Collaboration																				
asana		(x)			x		x			(x)					(x)	(x)				
Calendly																				
Evernote					x					(x)					(x)	(x)				
Notion	x				x		x			x	x			x	x		x			
Trello		(x)			x		x			(x)					(x)	(x)				

Communication																				
Cisco WebEx	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Google Meet	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Teams	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Slack																				
Zoom	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Creativity																				
AdobeXD									x	x										
Canva	x	(x)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Figma									x	x										
Miro	x	x	x	x	x	x	(x)	x	x	x	x	x	x	x	x	x	x	x	x	x
Mural	x	x	x	x	x	x	(x)	x	x	x	x	x	x	x	x	x	x	x	x	x
File sharing																				
Dropbox	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)
Google Drive	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)
OneDrive	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)
Sciebo	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)
Engagement																				
Kahoot																			x	
Menti-meter									(x)							(x)			x	
Slido									x										x	

Table 10. Compatibility of platforms with selected methods

The desk research has shown that very few traditional co-creation methods can be transferred to online without additional effort. Offline workshop equipment such as flipcharts or sticky notes must be replaced digitally. New guidelines or templates need to be created to be used on the digital platforms.

To avoid a loss of quality, the researchers conclude that existing methods must be prepared for use in the digital space. To increase the digital usability of the method and reduce the burden on practitioners, a digital co-creation platform must provide guidelines and templates for the efficient use of the methods in the digital domain.

To develop a platform that meets the requirements of HEIs and NGOs, these must first be captured in a practical way through qualitative research. The following chapter discusses the results of the interviews that aimed to identify just these requirements.
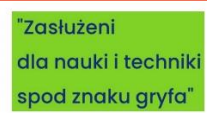
2.3.4 Good practices of digital co-creation

Exploring digital co-creation literature for good practices has brought forward several studies in the public sector, such as in the field of public open space developments (Mačiulienė, 2018), urban planning and innovations (Lieven et al., 2021), collaborative policymaking (Tocchetti et al., 2021), open government movements (Linders, 2012), or cultural value co-creation (Ciasullo et al., 2018). Different digital components were used, varying from social media platforms (Alam, 2020) to open innovation (Abbate et al., 2019) or collaboration platforms (Mačiulienė & Skaržauskienė, 2016), or various e-content platforms such as Canva (Nahar & Cross, 2020). Platforms were usually used to find and connect project partners (Abbate et al., 2019), disseminate or share information (Alam, 2020), or allow partners to contribute ideas or feedback (Alam, 2020).

However, despite some scholarly work on digital co-creation, the phenomenon remains a relatively underexplored field of research (Polese et al., 2021).

From a practical perspective, the authors have identified several successful digital co-creation projects on a local, national, European, and global level. Below, good practice examples are presented.

	Description	Partner organisations	Digital collaboration
Local level			
Marketing project for Kinderneuro-logie-Hilfe Münster e.V. (Münster, Germany) **Click here**	Every semester the Science-to-Business Marketing Research Centre (S2BMRC) of the Münster School of Business carries out at least one pro bono project with a social actor to actively participate in human and social development. To increase awareness of the association in Münster, the student project aimed to identify the target group, develop a unique communication concept for social media and other advertising and reach new potential donors.	**Kinderneurologie-Hilfe Münster e.V.**, (NGO from Münster region with a focus on children's neurology help) **FH Münster** (Master and Bachelor students from Münster School of Business) **Science-to-Business Marketing Research Centre** (Münster School of Business, FH Münster)	Due to the COVID-19 pandemic, the semester project had to be completed online in the winter semester of 2020/21. Therefore, the entire classroom had to be set up virtually. This included video conferencing, digital project management or shared drive. **Digital skills of partners:** Medium **Used platforms:** - Zoom - MS Teams - Miro - WhatsApp **Used methods:** - Treasure Hunting - 6-3-5 Brainwriting

			What worked well: Digital communication via video conferencing and WhatsApp group

Learning: Create a WhatsApp group chat for fast communication, especially when working with students |
| **Building a sustainable business plan for Pelikanhaus (Münster, Germany)**

Click here | In cooperation with Alexianer GmbH, students from the marketing department developed a sustainable business plan for the "Pelikanhaus". The "Pelikanhaus" is a project of the Alexianer GmbH and the Clemenshospital, where parents of children, who are especially hospitalized for a long time, are offered a "home". | **Alexianer GmbH** (Company in the health and social economy with headquarters in Münster)

FH Münster (Master and Bachelor from Münster School of Business)

Science-to-Business Marketing Research Centre (Münster School of Business, FH Münster) | Due to the COVID-19 pandemic, the semester project had to be done online in the summer semester of 2020. Therefore, the entire classroom had to be set up virtually. This included video conferencing, digital project management or shared drive.

Digital skills of partners: Medium

Used platforms:
- Zoom
- MS Teams
- Miro

Used methods:
- 6-3-5 Brainwriting
- Business Model Canvas

What worked well: Business model design using Miro and Canvas method

Learning: Business model design can be done online using digital creativity tools |
| **6. BIODESIGN WORKSHOP (Izmir, Turkey)** | The theme of the workshop was determined as "Biodesign in Climate Change and Disaster Combat".

The aim is to raise awareness about Biodesign, to create a productive and creative discussion environment | **Dokuz Eylül University** (Izmir, Turkey)

EGE University (Bornova, Turkey) | The workshop was held online due to the pandemic in 2021.

Digital skills of partners: Medium

Used platforms:
- Zoom
- Discord
- Miro |

	with the participation of undergraduate and graduate students studying in different disciplines, and to guide young researchers interested in Biodesign.		**Used methods:** - Prototyping **What worked well:** - Digital communication via Zoom. - Discord group for video conferencing. - Digital collaboration in content creation with Miro board **Learning:** Digital platforms are essential for fast communication and content production in group work.
Lince (Pomeranian region, Poland) "Zasłużeni dla nauki i techniki spod znaku gryfa" Lince Erasmus+ LINCE - Learning Initiatives in Civil Environments	The project's main goal was to create an environment in which students are involved in initiatives that address local non-governmental organisations' needs using systematic project-based methodologies and digital media expressions. Within the project, academic students created digital stories about local symbols and well-known engineers.	**Polish Federation of Engineering Associations NOT** (NGO from West-Pomeranian Region, Poland) **Pomeranian Academy** (HEI in Pomeranian region, Poland)	Within the project, students were instructed to work closely with NGOs using digital communication and file-sharing tools. These two were critical for project success, as systematic work, involvement of diverse groups, and frequent communication were necessary. The project finished before the COVID-19 pandemic, so using digital tools for remote collaboration faced many challenges. **Used platforms:** - MS Teams - Dropbox **What worked well:** File exchange was much more effective with many stakeholder groups and long-term collaboration. **Learning:** Appropriately selected and employed digital channels enhance collaboration when NGO representatives, HEI teachers and students are involved.

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National level			
Marketing campaign for the Henri-Thaler-Association (Ennepetal, Germany) **Click here**	In a Science-to-Society semester project, the Münster School of Business students developed a campaign for the Henri-Thaler Association. This organisation supports families with children who have cancer, especially financially. However, the association from Ennepetal is hardly known outside its region. Additionally, it has been hard for them to get donations during the pandemic. This is why the students developed a concept for digital fundraising.	**Henri-Thaler-Verein e. V.** (Organisation from Ennepetal that supports families with children who have cancer) **FH Münster** (Bachelor and Master students from Münster School of Business) **Science-to-Business Marketing Research Centre** (Münster School of Business, FH Münster)	The semester project was completed online in the summer semester of 2021. The entire classroom was set up virtually, including digital communication and project management. **Digital skills of partners:** Low **Used platforms:** - Zoom - MS Teams - Dropbox **Used methods:** - 6-3-5 Brainwriting **What worked well:** Creating guidelines for project partners with low digital skills to help them use documents, digital platforms, etc. **Learning:** Creating guidelines for digital platforms takes effort but increases partners' performance.
Series of webinars about tech-based entrepreneur-ship (Poland) 	In 2018 Polish Federation of Engineering Associations (NOT) started an initiative to provide tech entrepreneurs with insights regarding starting up and developing a business. Thus, it established collaboration with several universities to deliver specialised training workshops.	**Polish Federation of Engineering Associations NOT** (NGO from West-Pomeranian Region, Poland) **Lodz Univeristy** (HEI in Lodz Voivodship, Poland) **Szczecin Univeristy** (HEI in West-Pomeranian Region, Szczecin, Poland)	As university trainers and workshop participants were located in different cities, it was decided that the workshops would be held online. **Skills of partners:** High **Used platforms:** - Clickmeeting - Dropbox **What worked well:** Training sessions were delivered remotely utilising the good trainers in a field without the necessity to cover travel cost

			Learning: It is difficult to deliver online training sessions without both-side interaction.
European level			
Digital work-based learning: eWBL (Netherlands, Germany, Slovenia, Italy) **Click here**	The project focuses on fostering students' transversal skills, such as collaborative problem-solving and interpersonal communication, which are critical for graduates' success in a work environment. By taking the COVID-19 pandemic, which forced educators to find new ways of offering work-based learning in an online environment as an opportunity, the project aims to collect and synthesise best practices.	**Rijksuniversiteit Groningen** (University in the Netherlands) **Momentum Business Consulting & Marketing Services Limited** (Consultancy from Ireland) **Univerze v Ljubljani,** (University in Slovenia) **Università Ca' Foscari Venezia** (University in Italy) **Fondazione Giacomo Brodolini S.r.l. SB** (Organisation for strategies and interventions for human capital, settled in Italy) **Science-to-Business Marketing Research Centre, Germany** (Münster School of Business, FH Münster)	Due to the geographical distance between the project partners, the best practices, frameworks, and replicable models will be developed virtually. Therefore, the entire communication and project management has to be set online. **Digital skills of partners:** Medium to high **Used platforms:** - Zoom - MS Teams - Mural **Used methods:** - World Café **What worked well:** Creating an understanding of the partners and their competencies at the beginning of the project led to an increase in performance. **Learning:** Placing value on getting to know the team project digitally pays off at a later stage.
ENHANCER (Spain, Netherlands & Cyprus, Portugal)	The joint project aims to develop educational approaches based on gaming techniques and digital Scape rooms to teach social entrepreneurship. Therefore, students from Germany, Portugal, The Netherlands, and Spain	**Universidad de Zaragoza** (University in Spain) **Hogeschool van Amsterdam** (University the Netherlands) **Questomatica Escape Experiences** (Escape	Due to the geographical distance between the project partners, the students will solve challenges in online collaboration. Therefore, the entire communication and project management had to be set online.

	will be able to work together in multicultural groups to solve global challenges.	room experience in Amsterdam) **Center for Social Innovation Cyprus (CSICY)** (Research and development centre for innovative and disruptive responses to social challenges) **Universidade de Aveiro** (University in Portugal) **Science-to-Business Marketing Research Centre, Germany** (Münster School of Business, FH Münster)	**Used platforms:** - MS Teams - Mural - Trello **Used methods:** - World Café - Six hats **What worked well:** Multiple tasks and responsibilities were structured in Trello, leading to a high-quality outcome. **Learning:** Working with digital organisation tools is extremely helpful for multiple tasks. Make sure that virtual boards are maintained regularly.
Digital Teachers Programme (Turkey) Dijital Öğretmenler **Click here**	The Digital Teachers Programme aims to digitalize teaching, become part of digital transformation, and transfer these digital competencies to primary and secondary school students.	**Habitat Association** (NGO which develops and conducts social impact oriented and capacity-building projects in coherence with the digitalizing world) **METU** (Middle East Technical University) **ING Bank Türkiye**	Starting late in 2020, due to the pandemic, the project had to be held online. **Digital skills of partners:** High **Used platforms:** - Zoom - MS Teams - Mural **Used methods:** - Canvas - Brainstorming **What worked well:** Digital communication via platforms **Learning:** Teaching methods and practices on platforms are important
LIME - Lean Innovation for Micro Enterprises (United Kingdom, Spain, Ireland,	Lean innovation offers an alternative route to innovation: a cost-effective and low-tech approach. It prioritises design thinking and agile experimentation to generate value-maximizing products	**EUEI** (European E-Learning Institute, Denmark) **Banbridge District Enterprise** (Ireland) **National Enterprise Network** (United Kingdom)	The project was implemented before the COVID-19 pandemic. Due to the geographical distance between the project partners, the activities were performed online.

Denmark, Poland) **Click here**	and services, thus helping small businesses grow despite their economic conditions. In addition, unlike traditional innovation, which is resource-dependent, lean innovation is a knowledge and skills-based approach, so vocational training organizations can play a key role in developing these skills. The project's overall goal is to introduce the lean innovation skillset to education system and economies.	**CEEI** (Centro Europeo de Empresas e Innovación, Spain) **Feltech Software Innovations** (Ireland) **Szczecin Univeristy** (University in Poland)	**Digital skills of partners:** Medium to high **Used platforms:** - Zoom - Google Drive **Used methods:** - Brainstorming - Brainwriting **What worked well:** Clear division of roles and responsibilities of individual project team members, regular meetings **Learning:** The use of digital tools in the project promotes outcomes that will benefit the audience (Lean Innovation Online Course)
ESCAPE2 project: Supporting the Development of a Transnational Thematic Tourism Strategy for Rural Regions in Europe **Click here**	ESCAPE2 is an Erasmus+ Project that responds to the tourism challenges faced by rural regions in Europe such as unemployment, or low levels of productivity. It is developed in rural regions of Europe countries as Spain, Italy, Ireland, Slovakia, Bulgaria, Portugal, Romania, Greece, and Turkey. As part of the project, an online course on "How to develop a quality rural tourism strategy" was developed. The course offers an intuitive, effective online and blended learning course, accessible from the project website and fully optimised for mobile use in the	**Consorci de la Ribera** (Company in Spain) **Meridaunia** (NGO in Italy) **Momentum Business Consulting & Marketing Services Limited** (Consultancy from Ireland) **New Edu** (NGO in Slovakia) **Athens Lifelong Learning Institute** (Research institute in Greece) **Woman and Young Entrepreneurship Centre Association** (NGO in Turkey)	Due to the geographical distance between the project partners, the online course was developed digitally. **Used platforms:** - MS Teams - Miro **Used methods:** - Prototyping **What worked well:** Clear division of roles and responsibilities of individual project team members, regular meetings **Learning:** Prototyping works well digitally if the product/course created is also designed for online use.

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	partners' languages as well as in English.		

Global level			
Young Aspiring Thinkers: Innovation Tool & KPI Dashboard (South Africa, Africa & Germany, Europe) **Click here**	As part of a S2BMRC project, students from the Münster School of Business developed various tools to help the NGO from South Africa and its learners. YAT (Young Aspiring Thinkers) is an NGO that helps students learn about different career paths. Learners spend four years in various programs and learn not only about other professions but also about their skills and preferences. One group of students built an innovation tool that allows YAT Learners to identify and solve regional problems. The other group of students developed a KPI (key performance indicators) Dashboard to enable the learners to track their development process during these four years.	**Young Aspiring Thinkers (YAT), South Africa** (NGO that helps students learn about different career paths) **FH Münster** (Bachelor and Master students from Münster School of Business) **Science-to-Business Marketing Research Centre** (Münster School of Business, FH Münster)	Due to the geographical distance between the project partners, the tool was developed in digital collaboration. Different milestones and results were presented to YAT online. **Used platforms:** - Zoom - Google Meet - Google Drive - Miro **Used methods:** - Six hats - Personas **What worked well:** Sometimes there were problems with the internet connection. Then solutions had to be found, such as having someone else write the notes on the digital board for you or turning off the camera. **Learning:** When working with NGOs in countries where the internet is unstable, try to find alternative solutions or methods for such cases in advance.
Knowledge-intensive entrepreneur-ship research studies	As part of the University of Szczecin research agenda, researchers representing the organisation have been engaged in the research project on knowledge-intensive entrepreneurship in Indonesia. They had to work closely with	**Szczecin University** (University in Poland) **Institut Teknologi Sepuluh Nopember** (Univesity in Indonesia) Several local NGOs in Indonesia	As part of the project, researchers have collaborated closely with Indonesian researchers and students to reach out to appropriate entrepreneurs in Indonesia and to establish research schemes.

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	Indonesia university and also with NGO organisations providing support for local businesses. Many students, entrepreneurs and some NGOs were engaged in the process.		**Used platforms:** - WhatsApp - Dropbox **What worked well:** The coordination of a mixture of student groups worked with WhatsApp, and establishing interview schemes through direct communication was very effective. **Learning:** When many actors who do not know each other are involved in one project, direct interaction through digital media, provides good support.

Table 11. Successful digital co-creation projects

2.4 Qualitative research

2.4.1 Sample and data collection

For primary data collection, a total of 80 semi-structured expert interviews were conducted. 45 interviewees from HEIs and 35 interviewees from HEIs were interviewed for 15 to 45 minutes about their experiences with digital tools and their needs and requirements for graphical user interfaces and digital methodologies in co-creation projects. On average, an interviewee lasted 30 minutes. A detailed overview of the interviewees is listed in **Table 12**.

The target population was defined based on two criteria: **(1)** The participant is from an HEI / [NGO] and **(2)** currently co-creates with an NGO / [HEI] digitally or has done so in the past, as specific knowledge and experience in the field was required. The interview partners were selected by the project partners in Germany, Italy, Poland, and Turkey through personal networks or individual research.

An interview guide was prepared to ensure that all topics related to the research questions were covered comprehensively. Nevertheless, a conversational approach was followed to ensure situational flexibility. To avoid data loss, the interviews were audio-recorded and later transcribed for analysis. The final coding was done with the software MAXQDA 2022.

#	HEI/ NGO	Highest degree / position	Focus field	Country
1	HEI	Master / Project Officer	University Engagement and Entrepreneurship	Germany
2	HEI	PhD / Professor	Evaluation of poverty reduction initiatives	Belgium
3	HEI	Research Associate	Citizen Science, Digitization, Political Education, Communication	Germany
4	HEI	PhD / Professor	Non-Profit, Profit, and Public Management, Social Entrepreneurship	USA
5	HEI	PhD / Associate Dean	Undergraduate Research, Experiential Learning, collaboration with global NGOs	USA
6	HEI	Master / Coach	Citizen Science, Co-creative research	Germany
7	HEI	PhD / Lecturer + Director	Non-Profit Management, Digital Transformation	Germany
8	HEI	Master / Accreditation Coordinator	University Engagement and Entrepreneurship	Germany
9	HEI	PhD / Lecturer	Data Analytics, Citizen Science	UK
10	HEI	PhD / Professor	Non-Profit and NGO Management	Germany

11	NGO	Public relations lead	Disaster relief and development cooperation	Germany
12	NGO	Director and project manager	Nature conservation training	UK
13	NGO	Project manager	Community-based education and empowerment	Germany
14	NGO	Founder and managing director	Youth development	Germany
15	NGO	Advisor	Children's healthcare	Germany
16	NGO	Project lead	Community conservation	Kenya
17	NGO	Founder	Social entrepreneurship	Germany
18	NGO	Fundraising Coordinator	Animal conservation	Germany
19	HEI	Researcher and PhD candidate	Digital transformation, digital innovation	Germany
20	HEI	Researcher and PhD candidate	Social innovation	Germany
21	HEI	PhD	Architecture, restoration	Turkey
22	HEI	PhD / Lecturer	Advertising	Turkey
23	NGO	Entrepreneur, coach, and consultant	Entrepreneurship	Turkey
24	NGO	Branch manager	Social science, social innovation	Turkey
25	HEI	PhD	Bioengineering	Turkey
26	NGO	Project manager	Social impact	Turkey
27	NGO	PhD	Nature and technology, Bio design	Turkey
28	NGO	PhD / Founder	Youth environmental education	Turkey
29	NGO	PhD / Founder	Civil Society, sustainable living	Turkey
30	NGO	PhD	Social and humanitarian innovation, disaster awareness	Turkey
31	HEI	PhD / Lecturer and Coordinator of Relations	Civil Society	Turkey
32	NGO	PhD / Founder	Rural development	Turkey

33	HEI	PhD	Bio Design Research	Turkey
34	HEI	PhD	Communications, Civil Society	Turkey
35	NGO	Founder	Cyber security, artificial intelligence	Turkey
36	HEI	PhD / Lecturer	Economic, Civil Society	Turkey
37	NGO	Director	Creative Economy Application	Turkey
38	HEI	PhD / Associate professor	Entrepreneurial technologies	Turkey
39	HEI	President	Women in business and entrepreneurship	Turkey
40	NGO	Member	Entrepreneurship and investment	Turkey
41	HEI	PhD / Professor	Economic geography	Italy
42	HEI	Researcher	Agriculture, biodiversity	Italy
43	HEI	Director	Agriculture-food sector	Italy
44	NGO	President	Social aggregation and innovation	Italy
45	HEI	Researcher	Third sector and social entrepreneurship	Italy
46	NGO	Spokeswoman	Social innovation	Italy
47	NGO	Technical assistant	Area development	Italy
48	NGO	Employee	Child education	Italy
49	NGO	President	Child education	Italy
50	NGO	Director	Children with disabilities	Italy
51	NGO	President	Agriculture, farming	Italy
52	NGO	Project assistant	Civil service, migration	Italy
53	NGO	Employee	Blood donation	Italy
54	NGO	President	Theatre	Italy
55	NGO	President	Civil service	Italy

56	NGO	President	Heritage protection	Italy
57	NGO	Member	Migration, integration	Italy
58	NGO	Employee	Social planning, Civil service	Italy
59	NGO	Member of the board	Territorial development	Italy
60	NGO	Communication lead	Innovation	Italy
61	HEI	Researcher	Innovation and entrepreneurship	Poland
62	HEI	Researcher and lecturer	Creativity, innovation, and technology transfer	Poland
63	HEI	PhD / Researcher	Innovation in healthcare	Poland
64	HEI	Master / Researcher	Marketing and Economic Engineering	Poland
65	HEI	PhD / Researcher	Economics	Poland
66	HEI	Researcher	Economics	Poland
67	HEI	Researcher and lecturer	Logistics	Poland
68	HEI	Researcher	Economics	Poland
69	HEI	Master / Researcher	Management	Poland
70	HEI	PhD / Researcher	Economics	Poland
71	HEI	Researcher	Economics	Poland
72	HEI	Researcher	Innovation, technology transfer	Poland
73	HEI	Researcher	Logistics	Poland
74	HEI	PhD / Researcher	Economics	Poland
75	HEI	PhD / Researcher	Entrepreneurship	Poland
76	HEI	PhD / Researcher	Economics	Poland
77	HEI	Researcher	Organisational development	Poland
78	HEI	Researcher	Economics	Poland
79	HEI	PhD / Assistant professor	Entrepreneurship	Poland
80	HEI	Researcher	Management	Poland

Table 12. Interviewees from HEIs and NGOs

Table 12. Interviewees from HEIs and NGOs

2.4.2 Interview results

Success factors to digital co-creation

The research aimed to identify success factors that support successful digital collaboration, even if there are difficulties or obstacles, as described in the subsequent paragraph.

Most respondents spoke of the beneficial new ways of communicating that enable collaboration that was not possible before. As digital work transcends geographical boundaries, experts worldwide can collaborate and contribute new insights, thus improving the quality of project outcomes in many cases. Several interviewees also mentioned the impact of the COVID-19 pandemic and how it has driven digital work by forcing people to do and learn it.

The respondents named several factors that the authors categorised into external (related to the environment) and internal (related to the individual) success factors for digital co-creation.
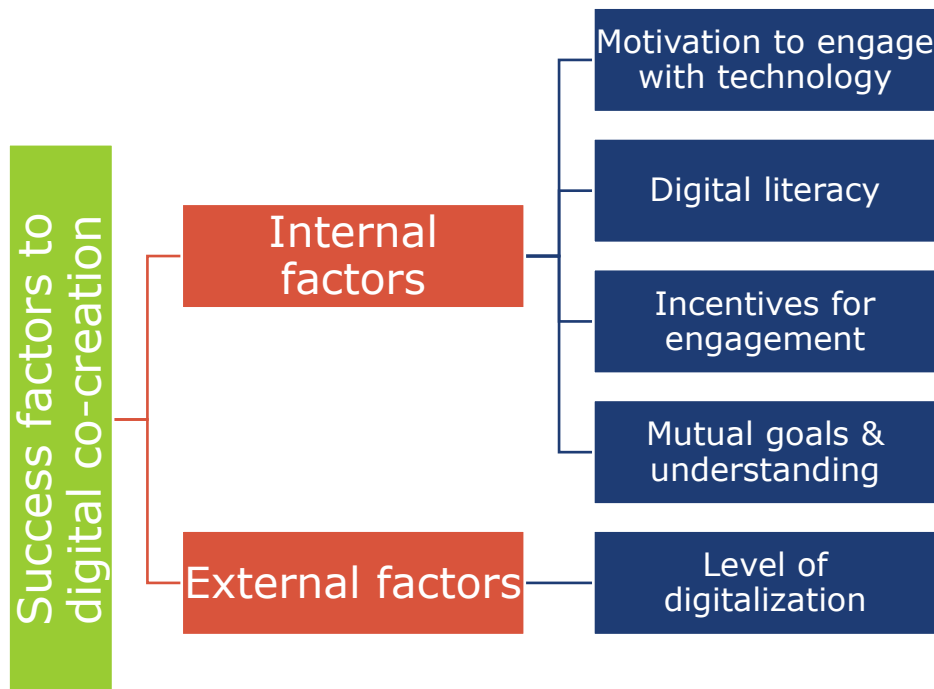
Figure 3. Success factors to digital co-creation (Own illustration)

External factors. One example of an external success factor is the **country's level of digitalization**, including policies related to the internet or public internet access or coverage. A high level of digitization facilitates successful digital collaboration. Nationwide stable internet access or sufficient financial resources for implementing digital platforms are an essential basis here.

As most of the features on digital platforms are only accessible through a paid plan, it is not guaranteed that NGOs (can) work with different digital platforms. Higher education institutions are also free to decide whether to purchase extended access to the platform.

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Internal factors. Probably the most significant internal success factor is the **individual's motivation to engage with digital platforms and methods**. Many respondents perceive a general openness and willingness to engage with the digital sphere. Keeping up with technological innovations and the digital environment has been described as a highly motivating factor in fostering digital co-creation. This is also supported by continuous recognition of the added value of digital platforms. However, at the same time, a lack of this kind of motivation can be considered a barrier to collaboration.

According to the respondents, there is a connection between the individual's **familiarity with the digital world** (i.e., digital literacy) and their motivation. Project partners who have worked with younger partners have recognized a reasonably high familiarity with the platforms and methods. For them, working with new platforms seems intuitive and not complicated. However, if participants have a relatively low level of digital literacy, there is a possibility that they will find this demotivating. In this case, it is now up to the project or workshop leader to start precisely at this point and try to increase the individual's motivation. At the same time, the digital layer must be adapted to the target audience so that no one is left behind. With any digital collaboration, the project leader or workshop moderator can try to make it as easy as possible for less tech-savvy people by, for example, providing everything they need during a digital workshop already upfront (e.g., link to a digital whiteboard to test access, video explanations, or examples of digital sticky notes). If no one feels left behind and is somewhat involved in the process (e.g., by using platforms that everyone has access to and is familiar with), there is a greater chance of successfully co-creating.

In general, it is necessary first to define a process and methods that work for everyone before venturing into working with the platforms.

Related to this is the form of **incentives for engagement**. To foster engagement in digital collaboration, it seems necessary to put incentives in place. One example of this is the reduction of teaching effort when digital platforms facilitate tasks. Another incentive is the opportunity to expand your professional network more quickly than with regular face-to-face meetings. With digital meetings, you have a greater chance of meeting people you would not have been able to meet in the real world due to geographical barriers.

Another critical success factor is a **mutual understanding of the partner** you are collaborating with. This includes a sense of the local community, norms, values, or culture. This understanding must be maintained throughout the entire project and is particularly essential in situations of conflict or change. The individual must be able to adapt to understand the needs and demands of the project partners. If this understanding is given, it builds a solid foundation for **trust**. The way mutual understanding and trust is built is not the same offline and online; in the digital sphere, this is often perceived as more difficult.

In addition to the mutual understanding of the partner, **common goals, attitudes, and expectations** are also helpful. Defining such aspects right at the

beginning of the collaboration may prevent arising barriers to successful digital co-creation. Again, this is perceived to be more challenging in the digital space.

Barriers to digital co-creation

The question aimed to identify barriers to successful digital collaboration. The respondents often compared traditional, face-to-face cooperation to the new digital world.
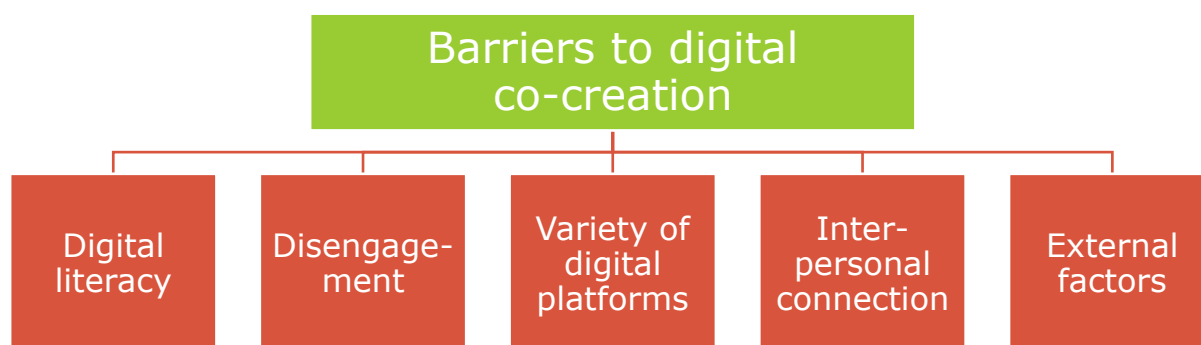

Figure 4. Barriers to digital co-creation (Own illustration)

Digital literacy. A lack of **digital literacy** is among the most frequently mentioned barriers to successful digital co-creation. This deficiency can have various causes. Often, it is attributed to the age of the individual. Consequently, this is not attributable to the individual but has to do with the habituation to the technology. For younger people, dealing with unfamiliar technologies seems more intuitive, as many have grown up with technology. Older people are relatively unfamiliar with technology and tend to be reluctant to work with it.

Another cause may be related to the state of digitalization in the country from which the project partner originates. In a country where digitalization is high, the chances to have project partners with high digital literacy are good. But given the example of an NGO that works with a less developed country, being less digitalized, one finds relatively lower levels of digital literacy.

Just as at the country level, digital literacy can also be looked at on the organisational level. Not all organisations are on the same level when it comes to digitalization. Instead, they are at different stages of the learning curve for digital platforms and collaboration. The majority have started this learning process, but many are not yet far enough and still have much work to do.

Variety of digital platforms. There is a jungle of platforms that may be **overwhelming** for some. Again, this is linked to the level of digital literacy. If one is unsure about working with digital media, the variety of platforms complicates things. This variety of platforms makes it challenging to identify the best platform to work with. Some respondents lack a guide for the use of different platforms. Understanding and getting used to new platforms also repeatedly takes time.

In addition, using **too many platforms** (e.g., multiple platforms for communication) simultaneously **risks losing information**, as all information is stored in different places and could be eventually forgotten at some point.

Moreover, to use each platform's features, it is usually necessary to **purchase an upgrade**. Given the variety of platforms, not every organisation has purchased all upgrades. Especially NGOs, who often have a limited budget compared to HEIs, cannot make such investments regularly. Therefore, there are differences in access to the functions, which makes external collaboration difficult. A similar example is that certain email addresses and/or extensions are often required to use certain programmes. In most cases, one must create a new account to be able to work with the platform. In another case, certain platforms are restricted by organisations through their privacy policies. Then another platform must be found that works for everyone.

All such factors can negatively impact the individual's motivation to work with the platforms.

Interpersonal connection. Respondents agree that interpersonal relationships are not the same in online and offline work. Online work entails a loss of personal aspects, including, for example, less empathy. Body language and facial expressions come across much better in a face-to-face conversation than online. They speak of difficulties establishing a solid foundation for the relationship, including a **lack of trust or mutual understanding**. Some even say you cannot collaborate online during specific phases of the project, e.g., the development phase. For example, the randomness of ideation cannot be recreated online.

Experts from HEIs mentioned that, especially when working with students, it is more difficult not to lose them than in the actual classroom. Working digitally often makes them feel less connected to the project and, therefore, less motivated to engage, making it harder to reach and motivate them.

Disengagement and decreased attention spans. Many respondents have encountered **reduced motivation to engage** during an online session. In an online meeting, one can disengage quickly by muting themselves or turning the camera off. In a digital workshop, for example, the project or workshop leader receives limited feedback and interaction. Some interviewees have even perceived forms of **rejection** to working with digital platforms (e.g., "I do not want to work in digital projects," or "I want to work with people, not machines"). Moreover, after two years of the COVID-19 pandemic, some have noticed a sort of **digital fatigue** setting in. They want to return to the pre-pandemic days when digital work was uncommon.

Respondents have noticed decreased attention spans in alignment with the increasing disengagement during online sessions. Since workshop participants can be distracted at any time by other tasks (e.g., checking emails), keeping the attention span has become much harder.

In combination, these circumstances make it difficult to establish continuity within and beyond the project duration. A lack of a sense of continuity can lead to less perceived responsibility for the project.

External factors. One example of an external barrier is the **country's level of digitalization**, including policies related to the Internet or general Internet access or coverage. This is strongly related to the general level of development of a country. Even within Europe, a stable Internet connection is not guaranteed. However, when a HEI cooperates with an NGO from a less developed, non-European country (e.g., in Africa or Latin America), successful cooperation is hindered at the lowest level, i.e., in establishing communication. This does not create equal opportunities for everyone but leaves certain groups behind.

Another obstacle to collaboration between organisations in Europe with organisations in Latin America, for example, is the **time difference**. Even though online collaboration enables worldwide partnerships with relatively little time investment, there is still the problem of time zones.

Also, **financial resources** play a crucial role here. Investing in digital technologies always comes with investment costs; therefore, limited resources restrict the options that can be chosen. Free and relatively cheap versions of the platforms do not include the full range of functionalities. One respondent stated, "In the beginning, we were looking for cheap, high-performance platforms, then we realised that these platforms did not offer all the functionality." In the long run, choosing to work with the platform's free version may lead to dissatisfactory results.

Platforms used in digital co-creation

The respondents were asked about which platforms they use. They use various platforms, but the majority say they work with a repertoire of platforms that are always the same. In addition, most respondents mentioned platforms for communication (e.g., Zoom). Fewer platforms were mentioned in the other categories. **Figure 5** shows a word cloud of the most frequently used platforms.

Figure 5. Most frequently used platforms (Own illustration)

Collaboration. For collaboration platforms, the interviewees rarely mentioned any. From the platforms analysed in the desk research (i.e., asana, Calendly, Evernote, Notion, and Trello), only **Trello, Notion,** and **asana** were mentioned by the respondents sporadically. For example, Trello was used to keep track of the processes in projects and for working lists.

Communication. Within the amount of all mentioned platforms, platforms for communication were among the most frequently mentioned ones. The participants cited all platforms analysed in the desk research (i.e., Cisco WebEx, Google Meet, Skype, Slack, Microsoft Teams, Zoom). Additionally, **Discord** was mentioned often. It has not been included in the previous desk research; however, it is a widely known platform for chat, voice conferencing, and video conferencing (discord.com, 2022).

Regarding the preference for a video conferencing platform, there are two major camps: those who prefer **Zoom** and those who use **Microsoft Teams**. In an institutional context (i.e., HEIs), Microsoft Teams is often selected because it allows the integration of various Microsoft applications used by the institutions. However, external partners often ask to use other platforms, as they cannot access Microsoft Teams sometimes. Some interviewees agreed that Zoom is more comfortable for collaborating with external partners, while Teams seems more useful for internal collaboration.

Creativity. Regarding creativity platforms, many respondents rely on **Miro** or **Mural** for digital workshops and collaborative brainstorming. Particularly Miro is often cited by HEIs to support idea generation with students.

File sharing. For file sharing platforms, **Google Drive** and **OneDrive** were the most frequently mentioned platforms. Again, the preferred platform is related to the preferred overall solution with which the organisation works (see Communication). Especially universities work in the Microsoft universe and therefore use OneDrive for convenience. From the NGO perspective, working with

Google Drive (and Zoom) is a frequently mentioned option for collaboration with external parties. Moreover, **Dropbox** was used by some respondents.

Engagement. Engagement platforms, such as **Kahoot** or **Mentimeter**, were well-liked options to increase workshop engagement. Again, this has been very useful in collaboration with students. One respondent explained they even use Mentimeter for workshop preparation to get a feeling for the audience, their knowledge, and their expectations.

Advantages of the digital platforms

Generally, the various platforms are described as **efficient** and **effective**: efficient in the sense that they reduce the time and money spent and effective as they increase the output quality. In addition, relevant working materials in digital format are accessible to everyone and can be shared more easily. This seems to lead to a reduced loss of information. **Figure 6** provides an overview of the mentioned advantages of the digital platforms per category.

Collaboration
- Setting deadlines

Communication
- Connect from anywhere
- Recordings
- Screen sharing
- Access for external partners
- All-in-one solution available, customisation (Microsoft Teams)
- Easy acccess (especially Zoom)
- Quick coordination/communication

Creativity
- Export
- Anonymous editing

File sharing
- Common production area

Engagement
- Quick barometers for mood and attitude

Figure 6. Advantages of the digital platforms (Own illustration)

Collaboration. One advantage of Trello is the option to **set deadlines** for specific tasks. This is said to be particularly helpful when working with students. Project partners can be reminded of their tasks directly on the board; this saves time, as no separate email is necessary.

One participant summarised that such collaboration platforms ease teamwork, as it provides a clear overview of all roles and responsibilities and tracks them along the project timeline.

Communication. Many advantages have been cited for video conferencing platforms. First, the platforms offer the ability to **connect from "anywhere,"** for example, from a car. The meeting can still be recorded if one cannot join – a viral feature. With almost no effort, the **screen sharing feature** makes it easy to view a shared document simultaneously.

Another appreciated feature is the ability to **create separate rooms** within a bigger video conferencing session, often called "breakout rooms." Such rooms allow a large group to be divided into smaller focus groups that can work autonomously on specific tasks. This is particularly used in student collaboration workshops.

Another important factor is **access** to the platform for **external partners**. Here, Zoom is convenient, while Microsoft Teams is the preferred option for internal collaboration.

However, Microsoft Teams bears an **all-in-one solution** where you can upload files and work on documents next to the video conferencing function. Microsoft Teams is also very popular because it is customisable; you can integrate all the functions you need in one common place. Therefore, it is popular for any kind of teamwork and project organisation. It also offers the possibility to set access rights to different folders or files, which is often necessary for experts working with multiple parties.

It has often been mentioned that **Zoom** is the easiest platform for video conferencing to **set up quickly**. No registration is required, and access is possible through a single link. It also seems easy to work with, even for people who are not so familiar with digital media. Several functions are easy to handle, e.g., setting up a breakout room or muting people.

The significant advantage of messaging platforms (e.g., Slack, WhatsApp) is that it allows **quick coordination** and exchange of information without having to set up a meeting. For the respondents, this is highly relevant in terms of time efficiency.

Creativity. **Miro** is a very popular platform for digital co-creation, especially in **workshop conception**. However, Miro can also be used for independent and asynchronous work beyond a workshop. The platform comes with multiple templates for workshop design, which the participants highly value. Also, it includes many more features that provide a supportive user experience. An example of a special element is the possibility to **export the board's content** in different formats (e.g., PDF, image). Especially compared to offline workshops with post-its, this option makes it easier to transfer the results of a workshop to another place. Another favoured aspect is that Miro allows you to do things **anonymously**. This can help people share their opinions or feelings more quickly, as they feel less pressure. This is especially helpful in an NGO context when working with people with a wide variety of fates. Participants also liked the **moving mouse pointer feature**, which allows them to follow the person presenting on the virtual board more easily.

File sharing. File sharing platforms are seen as more than a place to drop off files. Instead, it is considered a "**common production area**" where everyone can access all files or track changes. This is especially helpful when multiple people work together on one document. Again, here Microsoft Teams is a popular solution as it **integrates** file sharing and editing with video conferencing.

Engagement. Engagement platforms like Mentimeter can be used as quick **barometers** of participant **mood and attitude**. They can be used in workshop preparation or in a follow-up to give participants the chance to give feedback.

Disadvantages of the digital platforms

One disadvantage mentioned across platforms is the large number of functions that the platforms offer but are **not used** because there are too many, and one cannot know them all. An example is Microsoft Teams – an all-in-one solution with many apps, but large parts are not used because they are not known.

The same applies to the **number of available platforms** in general. The large variety of platforms is perceived as a disadvantage rather than an advantage, as it leads to more complexity and confusion. The high frequency of changes and updates has an additional negative impact, especially for less technically savvy people who might feel overwhelmed by it.

Another cross-platform drawback is the **language** in which the platforms are available. Often, the instructions on the platforms are mainly in English. It should be noted that not all cooperation partners know English equally well. Therefore, they usually must resort to Google Translate to understand everything.

Figure 7**7** provides an overview of the disadvantages of the digital platforms per category.

Collaboration

- •High complexity
- •Time intensive

Communication

- •Data security
- •Limited meeting duration with free plan
- •Technical complexity
- •External use limited

Creativity

- •Account neccesary
- •Anonymous editing

File sharing

- •Likelihood of errors

Figure 7. Disadvantages of the digital platforms (Own illustration)

Collaboration. One expert criticised the platform **Notion** and similar platforms for being **too complicated**. This is particularly hurtful when the project partners are not tech-savvy and cannot use such platforms intuitively.

Another expert criticises the high amount of time required for successful work with project management platforms such as Trello or Asana, as they must be regularly maintained with updates.

> **And I remember at one time, we were testing various such platforms and looking at which ones could be most effective for us. And basically, the result was that it took us more time to type in these individual tasks and distribute them to team members than to actually do the tasks.**

Communication. As mentioned earlier, different organisations prefer different platforms for video conferencing for various reasons. One possible reason is the data security standard. For example, **Zoom** has been publicly criticized for its inadequate **data security standards**. For compliance reasons, some organisations are therefore restricted from using Zoom.

Another factor that has been criticised about Zoom is the fact that **sessions are limited** to 40 minutes unless one subscribes to the paid plans. However, this is also the case with similar video conferencing platforms.

WebEx is said to be frequently used by some HEIs or the European Commission, for example. One respondent claims it to be less practical and more technically complicated than the alternatives.

About **Microsoft Teams**, it was mentioned again that the all-in-one solution is on hand, but its use outside the **internal environment** is very limited for some organisations.

Creativity. The creativity platform **Miro** was criticised for not always being able to access the virtual board without creating an account. This can be changed in the settings but is often forgotten. There was also criticism that understanding the platform and its functions is very **time-consuming**. Furthermore, participants perceived the fear of "breaking something". In other words, actors in digital collaboration are afraid of accidentally moving objects on the digital whiteboard or even **deleting information**.

File sharing. One limitation regarding shared documents is that errors sometimes occur when two people edit a document simultaneously. In some cases, it is not possible to **track** who made which **changes**. Sometimes information within the document or even entire documents or folders somehow **get deleted or lost**.

Requirements for GUI

Participants had a wide range of expectations and requirements for a possible graphical user interface, which includes a selection of available platforms and methods for digital co-creation. Many emphasized the importance of a user-friendly interface to ensure that the platform is used on a regular basis. Moreover, there is no need to reinvent the wheel, because there are already well-working platforms that may only need to be put together to form an all-in-one platform.

> **Many of my partners had objections concerning the use of digital tools, which they did not use on a daily basis. [...] And I think that these deficiencies can be eliminated, for example, by creating a simple application that would be understandable enough for those who do not use such solutions on a daily basis.**

A checklist of mandatory functions and features (Part A and B), as well as technical requirements (Part C) is provided below. Part D contains a list of favoured existing platforms that participants would like to see either integrated or linked on the platform.

A. General requirements

✓ **No need to re-invent the wheel.** Several platforms already work well, and people are used to working with them. Therefore, one should not try to invent new functions but rather try to open up the connection between the platforms. Often people are unaware of the variety of functions they could work with. They thus desire support in finding their best-practice solutions for their challenges and projects. Hence, some respondents called it an asynchronous learning platform.

> **The kind of tools we have right now are quite fast, smart and each one is missing something. We could perhaps use a tool that can include the best of the stimuli we have.**

✓ **User-friendliness.** Many respondents speak of user-friendliness as the number one requirement for any digital platform. This includes a fast and smooth user experience. Also, this is connected to intuitive control.

✓ **Intuitiveness.** Everyone, including all age classes or levels of digital literacy, must be able to work with the platform intuitively. Intuitiveness is provided by a simple structure and straightforward navigation on the website.

✓ **Reduced complexity.** Instead of many complex functions, respondents prefer a streamlined application with a limited number of functions that are easy to use and provide value. The reduced complexity also applies to the way the content is presented on the platform. It is recommended to reduce technical complexity and use simple language.

✓ **Motivating for digital work.** The platform should appeal to the individual's motivation to work with digital platforms. Thereby it may overcome current barriers of lacking the motivation to explore digital work.

✓ **High customizability.** Participants want the platform features to be highly customisable to meet the needs of a wide range of stakeholders. This includes allowing tech-savvy people to use advanced features and settings (e.g., controlling the actions of others) while keeping them as simple as possible for less tech-savvy people.

B. Platform content and features

✓ **Option to create a user profile.** Participants would like the option to create a user profile that can be used for networking. They prefer to have the option to customize their page as well and not just include their names. However, some respondents also require that it must work without any kind of registration.

✓ **Interactive features.** The platform must be interactive and fun to work with. This includes, for example, that the user can try out different features interactively rather than solely by reading.

✓ **User manual available.** The platform must be provided with instructions on how to use it correctly. All functions must be listed and explained. It should also contain a lot of tips for optimal use or warnings for incorrect use.

✓ **Best practice examples.** Participants would like to see best practice examples from other projects that can serve as inspiration for their projects or topics. In that, various case studies are uploaded to the platform, organized according to different categories (e.g., project scope, goals, etc.).

C. Technical requirements

✓ **Data security.** All user data must be stored safely in alignment with GDPR requirements.

✓ **Compatibility with multiple devices and operating systems.** The platform must be compatible with different devices (i.e., computers, smartphone, and tablets) as well different operating systems (e.g., Android or iOS for smartphones).

✓ **Software integration.** Participants wish for integration of existing software via links. This would allow users to be more time efficient.

✓ **Smooth collaboration with external partners.** Despite the disadvantage that working with external partners is difficult with some platforms, the participants demand that the collaboration with external partners on the platform runs smoothly.

✓ **Assignment of access rights.** Once there may be uploaded files or data that not everyone should have access to, people with higher user rights (e.g., project managers) need to be able to grant access rights to other stakeholders, including denying access if one is not allowed to see the specific data.

D. Platforms to be featured/integrated

✓ **Different communication platforms.** The experts wish for an integration of digital communication platforms, for written communication (i.e., chat function) and video conferencing. Since there is no common preference for a certain video conferencing platform, it is advised to link multiple platforms, including the ones identified in the desk research (e.g., Microsoft Teams, Zoom).

✓ **Different platforms for collaboration.** The experts would like to see an integration of collaboration platforms where they can organise, prioritise, and assign tasks to others. For this purpose, Trello was the most frequently mentioned platform.

✓ **Creativity platforms.** Among the respondents, Miro was the most favoured platform for digital collaboration. Participants wish for an integration to a GUI, including specific structures or templates for workshops

✓ **Different platforms for file sharing.** As there is no common preference for a certain file sharing platform, it is advised to link multiple platforms, including the ones identified in the desk research (e.g., Google Drive and Microsoft Teams).

✓ **Engagement platforms.** The participants would like to have an integration of engagement platforms, e.g., to create surveys.

Methods

Compared to the relatively high usage of digital platforms, most participants indicated that they rarely work with (digital) methods, and some do not use them at all. Those who work with them from time to time mostly use simplified methods, such as mind mapping. Most of the methods evaluated in the desk research were not mentioned at all (see **chapter 2.3.3**). In a second question, participants were asked whether the methods used could be easily transferred to the digital place or not.

As with the platforms, it seems that experts prefer simple but effective methods. They do not want a lot of extra effort when transferring a face-to-face method to the online world but want the method to be simplified when done online. At the same time, when applying more complex methods, it may be necessary to provide practitioners with guidelines for an optimal implementation online. Here, one must respect the individual's level of knowledge on methods. While HEIs seem more method-affine due to regular work with students, NGOs often keep it more practical and use their own ways to solve problems without following a specific method.

Easily adapted methods. **Brainstorming and mind mapping** were by far the most frequently mentioned methods. They are often used at the beginning of a project to develop initial ideas. To this end, digital workshop formats are very common. Many of the respondents indicated that brainstorming workshops can be easily transferred to online workshops, as there is a variety of platforms that work well (e.g., Miro, Mural). It was described as very beneficial that by working with the digital whiteboards on the platforms, everyone could see each other's ideas simultaneously. Here, templates for digital collaboration (e.g., workshops) can be created that can be re-used, thus saving time in the long run.

Lean Canvas has been mentioned multiple times. For example, it has been used for developing a business plan. According to some respondents, it was quite easy transferrable as well, as one could work with the online whiteboard platform, such as Miro.

Focus or interview groups were mentioned as well. Using digital communication software, this also works very easily online.

Not easily adapted methods. **The Think Aloud Protocol** was mentioned by one respondent. It is used to ask participants for specific reasons for their actions or thoughts about the same actions. According to the expert, the method is not entirely unsuitable for the digital world, but it was challenging to get started digitally. During the online workshops, it was difficult to get a conversation going, and there was a lot of silence. In face-to-face sessions, participants would respond

to the pressure of silence, but this was less the case with online workshops. However, this improved over time.

Team-building methods were cited among the methods that are not so easy to adapt digitally. They are considered more difficult because it is harder to establish personal connections. In a room full of people, conversations between different people happen naturally. In a digital environment, you must make sure that different people can talk to each other, for example in break rooms. This makes it difficult for people to approach the situation openly.

It was also mentioned that **prototyping** online is difficult once the prototype involves a physical product. If the project partners must design and build something, it is more difficult because you are not on-site and cannot work together on the physical product.

One interviewee summarized it as such that in any case where one depends on the live reactions of others, such as gestures, this can hardly be translated to the digital sphere.

Own digital skills

According to the participants' self-assessment, they have quite similar digital skills. The level of digital skills appears to be related to one's area of responsibility and the amount of digital work that occurs there. However, most participants have a solid level of digital skills, including the ability to work with basic programs (Microsoft Office, video conferencing platforms) or the ability to solve basic computer problems independently. Nonetheless, some experts indicated that they feel a need to improve their digital skills further; due to missing time capacities, however, they cannot work on that.

From a HEI perspective. Most participants from HEIs were quite confident about their digital skills, as they regularly work digitally in the education of students or their research activities. Many indicated their skills had improved significantly over the past two years during the COVID-19 pandemic. This includes, for example, the speed with which they solve regular computer tasks. They spoke of their eagerness to develop their digital skills, especially given the need to do so. All are confident they have the essential computer skills and knowledge to properly use basic programs (Microsoft Office, Zoom, etc.). Simultaneously, they can solve basic IT problems independently. If they lack any skill or knowledge, many seek help through online tutorials, for example.

However, there were also deviations in both directions. Some respondents were relatively more advanced in their computer skills. In addition to the basic Microsoft Office programmes, they work with design platforms, for example. Other experts rated their technical abilities as rather low. Some still prefer the old way, using paper and pencil.

From an NGO perspective. Many respondents from NGOs stated that their digital skills are primarily self-taught. As a result, they are equipped with the most

important digital skills and have a solid foundation for working with digital platforms. Some of the participants have skills that go beyond the basic level. In their area of responsibility, they have acquired the digital skills they need for this. Here it seems to be somewhat related to the NGO's scope of work; some have more digital work to do, others less. Some interviewees indicated they were not satisfied with their level of digital skills and wished to gather more knowledge.

Like the respondents from HEIs, many NGOs respondents stated that their skills have improved during the COVID-19 pandemic.

> **So, after this Covid, it taught me that you have to study, and so my skills are more than enough on their own to launch a meeting, to be able to participate, to share a screen. These are the basic elements, even a bit more.**

Skills of project partners

Among both HEIs and NGOs, there was no consensus about their partner's skills level. Some respondents cited differences due to factors such as financial resources or age. Other respondents, however, did not see significant differences in skill levels.

Participants identify a lack of skills once someone cannot work relatively quickly and efficiently with basic computer programs. Being fast also means becoming familiar with a new digital platform or website. However, when these skills are not present, respondents find it challenging to work with these partners and are unsure how to help them with their digital skills deficits.

From a HEI perspective. One respondent indicated that they finds it difficult to generalize about the skill level of partners. In fact, there is no consensus on one factor that determines the level of digital skills. Some respondents indicated that it is related to the partner's age; younger people seem more tech-savvy than older people. Another respondent stated that the digital skills of NGOs are generally low. Another expert somewhat agrees, saying that skill level is related to financial resources, meaning that NGOs with relatively low budgets have fewer digital skills. However, some respondents did not see significant differences in the digital capabilities of their partners.

From an NGO perspective. One respondent rated the digital capabilities of its private sector partners as much higher than those of the public sector (e.g., municipalities, local institutions, and governments). Another expert indicated that the level of digital skills increases with professionalism. Yet another interviewee rated the abilities of younger people higher than those of older partners. Again, there is no consensus on one factor determining the level of digital skills. Instead, there is a widespread of skill levels between sectors.

Necessary skills for GUI

Participants mentioned various digital skills that are required to work with a digital platform. The skills can be divided into six categories, as shown in **Figure** 8**8**.

In general, respondents agree that cooperation partners need to receive some digital training in advance if their digital skills are not sufficient for the purpose of the project.
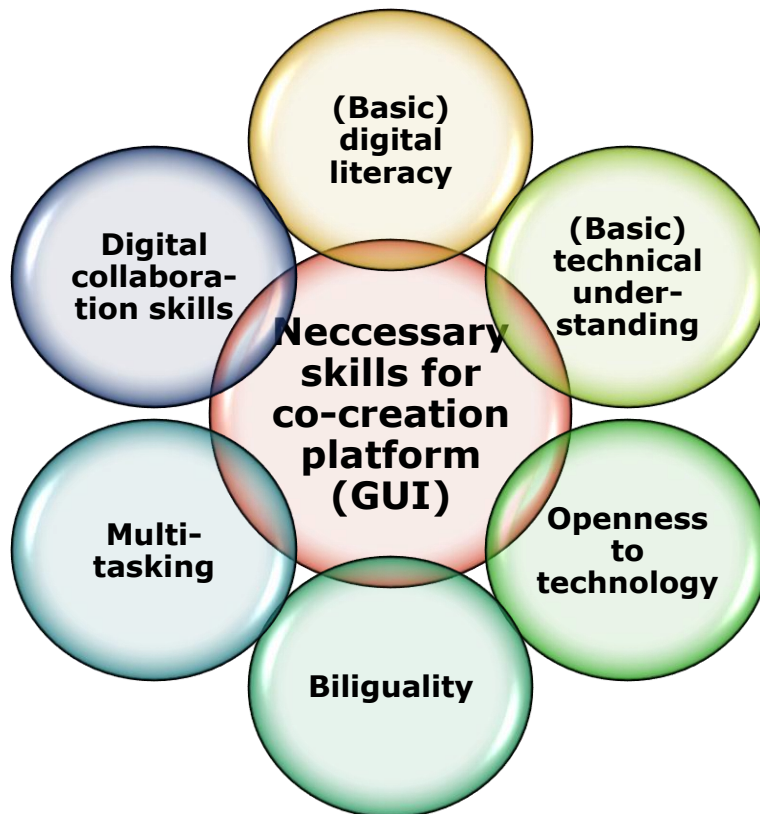

Figure 8. Necessary skills for co-creation platform (Own illustration)

Basic digital literacy. Among the most frequently mentioned essential skills was basic digital literacy. This includes the individual's ability to find, evaluate, and communicate information on the digital platform. This also involves a general understanding of cyber security, for example, in dealing with confidential data on the internet.

Basic technical understanding. To work with a digital platform, one must have basic computer knowledge. This includes how to use the computer or the internet in general. However, advanced knowledge is not required for an educational platform.

Openness to technology. As the initial research into the success factors for digital co-creation has shown, the motivation to engage with digital platforms is elementary to successful collaboration. A certain psychological willingness to familiarize oneself with the platforms and their possibilities is indispensable. This is closely related to a good understanding of the potential of digital collaboration.

Bilingualism. Depending on the platform's options, viewing the content in one's native language may not be possible. Therefore, most often, at least basic English knowledge may be required.

> **I would say it can be important also to have bilingual literacy depending on the tools that you're using, or at least know how to use Google Translate.**

Multi-tasking. Work with digital platforms often is done during a workshop session (e.g., working on a digital whiteboard). Here, the interaction or conversation with other workshop participants occurs while working with the digital platform. Therefore, multi-tasking is required often.

Digital collaboration skills. Here it is expected that one can work together on documents or files. This includes, for example, co-writing a Word document. It also includes the psychological ability to be patient and to exercise leniency when differences in digital skills lead to differences in work speed.

2.5 Limitations

Firstly, the data collection during the qualitative expert interviews was conducted with a focus on the perspectives of HEIs and NGOs in general and therefore did not focus on the sociodemographic background of the individual interviewee, including, for example, their country's level of digitalization. Thus, the research did not make any differentiation between sociodemographic variables. Moreover, as the respondents were researched from the partners' personal network, the country of origin of the respondents does not cover the entire European perspective.

Secondly, on the request of the interview partners, the interviews were conducted in the respective local languages. Thus, some insights might have been lost in the translation and summarization to English.

Thirdly, some research questions were summarised from a quantitative rather than a qualitative perspective during the research. For example, the use of digital platforms was analysed in terms of frequency of use. The assumptions made should therefore be viewed with caution, as the research initially took a qualitative approach.

3 Discussion

3 Discussion

3.1 Success factors and barriers

Success factors

To the author's knowledge, academic research on success factors for digital co-creation is limited. However, there is research on the success factors of co-creation in general. These factors include a clear and realistic outline of project goals, a shared vision, a team with a similar skill set, and compatibility between the parties (see **chapter 2.3.1**). To understand the success factors for digital co-creation, the qualitative expert interviews explored whether the general success factors also apply to digital work.

During the interviews, the individual's familiarity with the digital world was highlighted as one of the driving success factors. This idea was also found in the general success factors. A similar skill level is helpful to be more successful and efficient in digital collaboration. If there are major differences in the digital capabilities, this can cost the project high efforts in terms of time and output. Also, if the project participants are unwilling to engage with digital platforms, the output quality is negatively affected.

Another factor the actors mentioned was the mutual understanding between the project partners, which is supposed to build a solid foundation for trust. This understanding is aligned with a clear project structure, which includes an outline of the goals and a common vision. Two parties can be compatible when commonalities and differences are identified and discussed.

The authors summarise the following list of success factors for digital co-creation.

- Clear and realitstic outline of project goals
- Similar (digital) competencies and skills
- Alignment of pratice and science
- Compatability of partners
- Clear defintion of framework
- Motivation to engage with technology
- Incentives for engagement

Figure 9. Success factors to digital co-creation (Own illustration)

However, if the partners fail to define the success factors of their project, those can turn into barriers to successful collaboration, both in face-to-face and digital co-creation.

Barriers

The initial desk research presented 12 transfer barriers to co-creation (see **chapter 2.3.1**). Again, this question was posed during the qualitative interviews to examine whether these barriers apply to digital co-creation.

One of the barriers described by the experts concerned trust and mutual understanding, which is far more difficult to establish online than in face-to-face collaboration. If this foundation cannot be established, there is a high risk that several of the 12 transfer barriers occur digitally as well, including a lack of awareness of each other's competencies, a lack of need orientation, or different visions.

The transfer barrier of decreasing cooperative engagement can also be applied to digital co-creation. In addition to the "normal" decline in engagement, online collaboration faces the challenge of a particularly sharp decline in attention span and engagement. It is much more difficult to keep participants engaged in online than face-to-face collaboration.

Another transfer barrier deals with the social and spatial differences that can lead to difficulties in effective collaboration. Similar could be identified in the expert interviews. In the foreground here is the partner's digital literacy. Most of the experts perceive differences in the digital competencies of the partners. A lack of digital competencies can decrease the quality of the output.

In addition to the 12 transfer barriers identified previously, the expert interviews revealed further, more digitally specific barriers. These include, for example, the variety of digital platforms. Partners can feel overwhelmed by the availability of platforms and have difficulty identifying the most suitable platforms for the project. Differences in digital competence also cause a problem here, as partners may not be able to work on the same projects.

Figure 10 integrates the findings from the initial desk research with the aspects mentioned in the expert interviews. The digital barriers apply to all project phases if the project is entirely conducted online. Highly affected are the first two phases, project definition, and the actual co-creation phase. Here, platforms and methodologies for digital co-creation need to be defined to ensure successful collaboration. In Phase C, most digital questions should already have been clarified, whereby the barriers no longer have as strong an effect as in the first two phases.
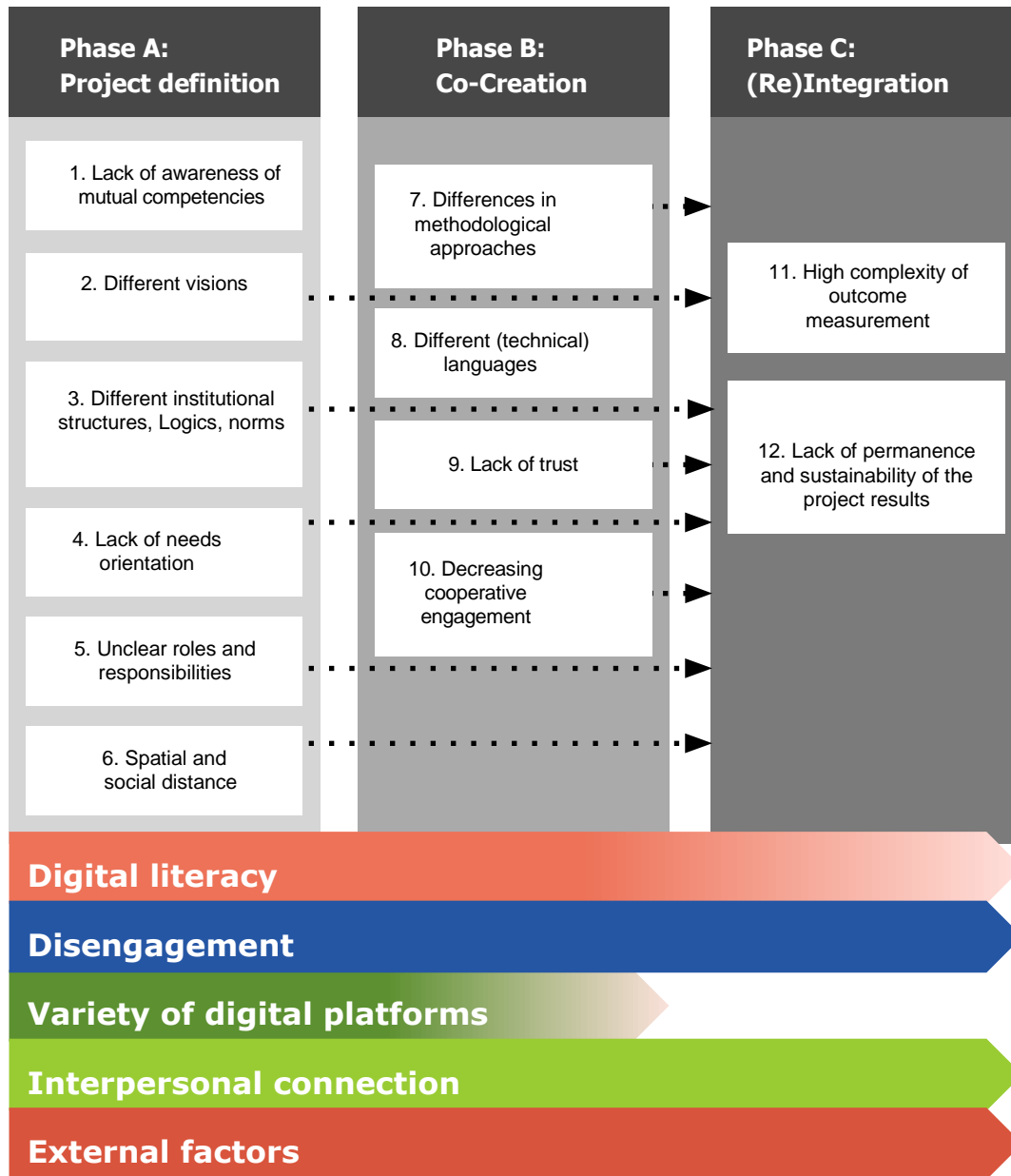
Figure 10. Barriers to digital co-creation (Own illustration, adapted from (Kurzhals et al., 2022))

3.2 Platforms and methods

Platforms

The expert interviews showed that HEIs and NGOs already use a variety of platforms; however, the majority work with a repertoire of platforms that are always the same. In this repertoire, the interviewees have a fairly good knowledge of the basic functions of each platform. However, for more complex platforms (e.g., Microsoft Teams), many respondents were not 100% familiar with the various functions. Instead, some feel somewhat overwhelmed and do not know which platforms to use and how.

Most respondents had their personal preferences in terms of preferred platforms, but often there was no consensus among all respondents (e.g., Zoom versus Microsoft Teams for video conferencing). Instead, they work with the platform that best meets their needs (e.g., feature set, data security). This suggests that there may not be one optimal solution for everyone, but rather an optimal solution for a particular organisation with its specific needs.

The problem, then, is not a lack of digital platforms in general but rather a lack of knowledge about how to use all the platforms' features. Consequently, it does not make sense to develop an entirely new platform but to find ways and best practices to generate value from already existing platforms.

Methods

The qualitative expert interviews revealed that HEIs and NGOs use a small selection of methods online. The most common methods are brainstorming, mind mapping, and Lean Canvas. However, there is no such variety in use, as identified during the desk research. Some experts stated they prefer to work with relatively simple methods regularly, as they do not have the time to invest too much effort into learning new methods.

Relatively simple methods, such as mind mapping, can easily be transferred to an online environment. However, if the methods are more complex, there may be insufficient knowledge on how to use them efficiently on digital platforms. Again, in such cases, the interviewees lack time to deepen their knowledge themselves.

Consequently, since a wide variety of methods are available, there is no need to develop entirely new methods for the digital sphere but rather to advise how to apply existing methods in the contemporary context. When building a GUI for digital co-creation, it is advisable to provide user guides for precisely these methods. As with digital platforms, knowledge about methods varies. Therefore, the methods need to be made accessible to all. This can be solved by determining the individual's methodological knowledge level and suggesting appropriate methods depending on the level of knowledge.

Time and effort are very relevant factors here, as experts have so far only limited capacities to expand their knowledge of methods for digital co-creation. A

knowledge base on a GUI should therefore be easily accessible and understandable.

3.3 Requirements for the platform (GUI)

The expert interviews have revealed a high need for an all-in-one platform that serves as a knowledge base on available digital platforms and methods for digital co-creation. Indeed, there is a great variety of digital platforms, and the problem is rather the lack of knowledge on how to use this variety efficiently. Often, managers or researchers lack the time to study new platforms and methods in depth, resulting in them using the same platforms repeatedly, which may not provide them with an optimal solution.

> **I don't want to deny, in short, the positive things that technology brings. But it should not be abused. And for design, certainly, there are many platforms that already exist which are effective. But, again, they always leave too much misunderstanding. Perhaps the thing that should be done is training before using a design platform. To enable everyone to use it at the same level.**

Based on the research findings, the research team makes the following suggestions for a GUI for digital co-creation.

Be intuitive. Most importantly, the graphical user interface must be easily accessible to everyone, including the tech-savvy and the less tech-savvy. Anything that is a bit more complex must be accompanied by a guide on how to use it correctly.

Provide knowledge to everyone. To make the GUI accessible and useful for everyone, two major aspects must be considered: the individual's level of digital literacy and their specific situation (e.g., work context, project phase).

The research shows that the level of digital literacy, including knowledge on digital tools and skills, varies between organisations. To provide tools that match the needs and standards of the individual, it is advisable to work with classifications on different levels. This classification is most likely to be made in the form of a self-assessment.

The idea is to develop a platform that identifies the digital standpoint of the individual, including their problems, requirements, and specific situation (e.g., project phase). Based on their answers, they are then given recommendations for digital platforms and methods suited to them.

Provide templates for digital collaboration. The participants frequently mentioned a lack of time to study platforms and methods in depth. Facilitating digital co-creation through greater time efficiency implies two steps. First, the user must acquire new knowledge through the information database. Second, having gained new knowledge, one needs to apply it. To avoid having to stop again for lack of time after the first step, a graphical user interface can provide templates that can be easily copied and adapted to similar workshops or events. The user

then does not have to start from scratch with the design of their workshop but can fall back on existing templates and thus save time.

Provide best practices. As mentioned during the interviews, some participants were still unsure about the best way to work digitally. To support them in finding their way, best practices can provide guidance and inspiration. Thus, it is advisable to include a best practice section on the website.

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