Perceived Value of IS Collaboration Support in an SME Ecosystem's Innovation Activity

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Abstract: Networks and ecosystems are involved in Open Innovation (OI) initiatives, their collaboration mediated by technology. A central element of OI is the generation of value as perceived by involved actors. The paper investigates how information systems supporting collaboration (CIS) facilitate the generation of perceived value for OI participants. As multi-method qualitative research, the study uses interview and survey data derived from an innovation activity jointly implemented by two small and medium-sized enterprises and their ecosystem (ten participants), facilitated by two tools: video conferencing and online whiteboard software. The findings suggest specific functionalities and characteristics of these tools to support the development of three types of value: excellence, efficiency, and emotional value. The identified adverse impacts of the CIS encourage providing transparent guidelines for behaviour when using the CIS for an ecosystem's innovation activity. The tools' functionalities proved appropriate, with the Perceived Usefulness independent from prior experience. The research advances the understanding of the role of technology in value generation in an ecosystem's innovation activity and supports practitioners in their decisions for digital support for OI. The study is limited by its small, qualitative approach and focus on the ideation phase of innovation.

1 INTRODUCTION

Value provision is a central topic in open innovation (OI) research (Chesbrough et al., 2018; Kazadi et al., 2016; Tidd & Bessant, 2018), yet the role and design of technology to support the generation of value in innovation processes need to be further understood (Chesbrough et al., 2018; Lusch & Nambisan, 2015). Analyzing calls for future OI research, West & Bogers (2017) identify network collaboration as a topic, where the aspect of motivation and value as perceived by the various actors partaking in OI activities is relevant for designing such initiatives (Chesbrough et al., 2018; Kazadi et al., 2016; West & Bogers, 2014).

OI is "a distributed innovation process based on purposively managed knowledge flows across organizational boundaries" (Chesbrough & Bogers, 2014, p.17). Chesbrough et al. (2018) define value in OI "as all actor-perceived consequences arising from the deployment of a resource in a process" (p. 932). Value is subjective (Lepak et al., 2007; Rivière & Mencarelli, 2012); thus, the value perceived by the actors involved in OI can differ. The concept of perceived value originating from marketing literature takes up this understanding (Holbrook 1999; Rivière & Mencarelli 2012; Sweeney & Soutar 2001) which we suggest applying to study the participation of actors in OI initiatives.

Technology is applied to enable the participation of actors belonging to networks and ecosystems in OI initiatives (Lusch & Nambisan, 2015; Moore, 1993; Perks et al., 2012; Radziwon & Bogers, 2018). Although facilitating technology is acknowledged to support innovation efforts in intra- and inter-organizational settings (Abbate et al., 2019; Cui et al., 2018; Scuotto et al., 2017), how specific functionalities support individually perceived value remains to be understood. The research presented in this paper aims to contribute to filling this gap by

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addressing the research question: How can collaboration information systems facilitate value generation in an innovation activity of a small and medium-sized enterprise (SME) network's ecosystem? The term collaboration information systems (CIS) denotes a category of information systems (IS) dedicated to supporting collaborative or group work (cf. section 2.3). The exploratory study applies a multi-method research design using interview and survey data collected from an innovation activity of two SMEs and representatives from their ecosystem. The results aim to both increase the understanding of the role of CIS for the generation of value for participants and support practitioners in their decisions on digital support for OI initiatives.

2 BACKGROUND

2.1 Perceived Value in Innovation Activities

The consequences of innovation activities shall be studied beyond the direct innovation output, the value proposition that generates revenue, argue several authors (e.g. Burdon et al., 2015; Reypens et al., 2016; Sjödin et al., 2020; Westergren, 2011). Reypens et al. (2016) state that "traditional firm-level outcomes such as patents or market share no longer fully represent the range of value created for diverse stakeholders in a network" (p. 40). This shift from the single firm view toward the value derived for various stakeholders is especially apparent for OI initiatives, where "we need to investigate value as the motivating factor for participation in both outside-in and inside-out open-innovation projects" (Chesbrough et al., 2018, p. 931). Participants in OI initiatives attribute, e.g., time resources for which a consequence results: the actor specific value (Chesbrough et al., 2018). Value depends on the perception of the beneficiary (Edvardsson & Tronvoll, 2013; Grönroos, 2011; Lusch & Nambisan, 2015; Nardelli & Broumels, 2018; Prahalad & Ramaswamy, 2003; Rubalcaba et al., 2012; Vargo & Lusch, 2016).

The term perceived value stems from marketing literature, investigating consumers' perceived value of market offerings (Holbrook 1999; Rivière & Mencarelli 2012; Sweeney & Soutar 2001). A market offering could be a service defined "as the application of specialized competences (knowledge and skills) through deeds, processes, and performances for the benefit of another entity or the entity itself." (Vargo & Lusch, 2004, p. 2). The participation of various actors in OI activities of firms could be interpreted as a mutual service, with the firm creating the opportunity for participation, the actors applying their specific competencies, thus consuming the offering of the innovation activity providing their time resources. For their competencies and time resources, they achieve actor specific value (Chesbrough et al., 2018). We, therefore, suggest analyzing the participation in the innovation activity via the concept of perceived value.

A typology for perceived value is suggested by Holbrook (1999), distinguishing extrinsic versus intrinsic value as well as self- and other-oriented. Coutelle-Brillet et al. (2014) adapt Holbrook's structure suggesting six different value categories: excellence, efficiency, emotional, social, altruistic/ethical value, and interactional value, stemming from the interaction of the actors. As the present research investigates a joint innovation activity of various actors, we assume that most value experiences relate to interaction with others, which is why we see it not as a separate category but inherent to the other value types. For this research, we describe the following perceived value categories with examples inspired from (Chesbrough et al., 2018; Coutelle-Brillet et al., 2014; Mahr et al., 2014) displayed in Figure 1:

- Excellence value: A means to an end, to achieve a goal (e.g., results achieved, knowledge acquired, money received) ("one admires … some experience for its capacity to accomplish some goal or to perform some function" (Holbrook, 1999, p. 15), "derived from the utility characteristics, quality, performance, and "excellence" of the offer" (Coutelle-Brillet et al., 2014, p. 166)
- Efficiency value: Ratio of outputs to inputs, e.g., time savings, convenience, monetary compensation versus resources ("measured as a ratio of outputs to inputs" (Holbrook, 1999, p. 13)
- Emotional value: Feelings, emotional, or affective reaction including play and aesthetics/beauty for its own sake, e.g., enjoyment, the fun of challenges, being part of something important ("derived from the feelings or emotional and affective states elicited by a product" (Coutelle-Brillet et al., 2014, p. 166), unites the concepts of play: "self-oriented experience - actively sought and enjoyed for its own sake" (Holbrook, 1999, p. 18) and aesthetics/beauty: "aesthetic value in general or beauty in particular is that it is enjoyed purely for its own sake" (Holbrook, 1999, p. 20)
- Social value: Status or esteem to be gained from others, e.g. improving own image or reputation ("relates to building a self-image that an

individual reflects to 'others' (Coutelle-Brillet et al., 2014, p. 166), unites the categories status and esteem to be gained from others (Holbrook, 1999))

- Ethical value: For the benefit of "others", e.g. good citizenship ("ethics involves doing something for the sake of others" (Holbrook, 1999, p. 21))

Holbrook also counts spirituality, a value by adoration of, e.g., a Divine Power, which we consider non-relevant in the field of industry and is not subject in Coutelle-Brillet et al. (2014).

	Extrinsic	Intrinsic
Self-oriented	**Excellence value** **Efficiency value**	**Emotional value**
Other-oriented	**Social value**	**Ethical value**

Figure 1: Typology of perceived value based on Holbrook (1999) and Coutelle-Brillet et al. (2014).

2.2 Networks and Ecosystems in Innovation Activities

Networks have been increasingly discussed since the 1990ies (Sydow, 2003), yet, the term is not uniformly defined (Provan et al., 2007). The terms network (e.g. Sydow, 2003) and network organization (Moretti, 2017) are used synonymously and distinguished from the organizational entity of the network administrative organization (Provan & Kenis, 2007). Sydow (2003) identifies a network as a form of cooperation within or between relatively autonomous organizations or units, tied in a net of relations. Moretti (2017) defines in a similar direction yet focusing the inter-organizational perspective: "The network organization is constituted by autonomous and independent organizations (or individuals acting on behalf of the organization), which are connected by enduring and repeated exchange relationships, and which may or may not pursue a collective common goal" (p. 24). Interorganizational networks are rarely researched for initiating OI (Sydow & Müller-Seitz, 2020).

The term ecosystem has gained considerable attention in innovation and service-related literature (Lusch & Nambisan, 2015; Moore, 1993; Perks et al., 2012; Radziwon & Bogers, 2018). In 1993, Moore suggested looking at the business ecosystem collaborating for innovation to gain an advantage competing with other business ecosystems. Radziwon and Bogers (2018) define four elements of such an ecosystem: co-evolution, interdependencies, orchestration, and proximity. The definition of a service ecosystem by Lusch & Nambisan (2015) instead focusses the self-containing aspect as a possible distinction from a network: "relatively self-contained, self-adjusting system of mostly loosely coupled social and economic (resource-integrating) actors connected by shared institutional logics and mutual value creation through service exchange." (p. 162). Following this definition, we conclude that relations are consciously built with a set of mainly organizational actors engaged in repeated relations for a network, while an ecosystem is broader in terms of individual actors of mutual influence. Despite the attention to the ecosystem view in innovation, Kazadi et al. (2016) conclude that "few studies consider firms that simultaneously include a diverse set of stakeholders in their innovation projects" (p. 525). We conclude that an organization might engage in innovation activities in organizational networks yet also involve a broader ecosystem.

While Fasnacht (2018) claims that there is "evidence that the most effective innovators succeeded because of their creative communities where a community consists of individuals or a group, interconnected through a digital platform" (p. 144), the design of such IT support is recommended for further research (Chesbrough et al., 2018; Lusch & Nambisan, 2015).

2.3 Information Systems in Innovation Activities

As part of the service innovation framework, Lusch and Nambisan (2015) regard information technology (IT) as an enabler and facilitator in the process of value creation across a network of actors. In an empirical study, Cui et al. (2018) confirmed that IT-enablement in the inter-organizational innovation process supports OI performance measured by innovativeness and speed to market. Scuotto et al. (2017) also found a positive relationship between the use of information and communication technologies for facilitating communication, information exchange, and workflow and the innovation performance in SMEs. Abbate et al. (2019) research an OI platform used for knowledge co-creation in a B2B regional network in Italy, concluding that such a platform has to provide support for specific services in the innovation process, such as identifying and relating to participants or facilitating collaboration. While functionalities seem to be investigated to some extent, understanding how IS supports the development of the perceived value of different participants in innovation activities remains to be

further understood. Different categorizations of IS have been proposed in the literature (see, e.g., Laudon and Laudon 1988)). The category in the focus of work is IS supporting collaborative work in an organization. The term collaborative information systems (CIS) will be used for this category (see also Lehner et al., 2008) that is strongly related to groupware systems and computer-supported collaborative work (CSCW) (Rodden, 1991)).

To investigate this aspect of technological support, we use selected constructs and items of the technology acceptance model TAM3 (Venkatesh & Bala, 2008), widely used and well-accepted (Marangunić & Granić, 2015), and the D&M IS Success Model (DeLone & McLean, 2003). The TAM3 constructs in focus for our research project are Perceived Usefulness, Perceived Ease of Use, and Behavioral Intention, which shall help understand the benefit of the used digital platform to support the innovation activity across an SME ecosystem. Perceived Ease of Use affects both Perceived Usefulness and Behavioral Intention. This effect is moderated by experience, in that with increasing experience with the information system for Perceived Usefulness, the effect becomes stronger, while for Behavioral Intention, the effect becomes weaker (Venkatesh & Bala, 2008). Therefore, we assume that with a different level of experience of applied systems facilitating the innovation activity, the results of the selected constructs differ significantly in favour of the system for which participants have prior experience.

The construct relevant to understanding value in the updated D&M IS Success Model (DeLone & McLean, 2003) are the net benefits, later adapted to net impacts (DeLone & McLean, 2016). DeLone and McLean (2016) define net impacts as "the extent to which information systems are contributing (or not contributing) to the success of individuals, groups, organizations, industries, and nations" (p. 11). The understanding of net impacts would also allow negative impacts. Our research focuses on the individual participants, the group (ecosystem) and the organizations (the SMEs); we approach identifying net impacts on these levels.

2.4 Research Question

Given the importance of CIS facilitating the value creation in innovation processes, the value individually perceived by the actors involved might help decide for IS solutions to attract participants into OI activities. We, therefore, ask: How can collaboration information systems facilitate value generation in an innovation activity of an SME network's ecosystem? We break this question down into the following sub-questions: To which types of perceived value can the CIS contribute? What functionalities and characteristics of the CIS contribute to the perceived value perceived by the actors? Do the Perceived Ease of Use, Perceived Usefulness, and Behavioral Intention differ with previous CIS experiences?

3 RESEARCH METHODOLOGY

We conducted an exploratory, multi-method qualitative study to assess the perceived value of IS support in an ecosystem's innovation activities. To understand the perception of net impacts of IS, semi-structured interviews and a survey on the selected TAM3 constructs were applied. Although the data collection technique of the survey might qualify as quantitative, we still regard it as a qualitative study due to the small sample size and for its purpose as an additional amendment to the interview data. The study is embedded in a case study of a heterarchical network. Case studies are recommended for researching innovation (Elsahn et al., 2020) and are suitable to answer "how"-questions with limited control over the environment in which the research is conducted (Yin, 2006).

Table 1: Description of participants (company: A – B; status: O – Owner, E – Employee, F – Family/Friend; work experience: O - < 1 year, F - 1 to 5 years, S - 6 to 10 years, T - > 10 years; experience: y – yes, b – basic, n – no).

Participant No.	1	2	3	4	5	6	7	8	9	10
SME	A	A	A	A	A	B	B	B	B	B
Status to owner SME	O	E	E	F	F	O	E	F	E	E
Work experience	T	T	T	T	O	T	S	T	N	T
Interview in minutes	23	15	17	17	23	19	14	15	18	20
Experience VC Zoom	y	y	y	y	y	y	y	y	y	y
Experience OW Mural	n	n	n	b	n	b	n	n	n	b

The sampling technique combined self-selection and snowball sampling (Saunders et al., 2009). Two self-selected tour operator SMEs engaged in a heterarchical network invited four representatives from their respective ecosystems for a joint innovation activity. This joint innovation activity was facilitated online by the CIS Zoom (video conferencing (VC)) and Mural (online whiteboard

(OW)). The tourism sector seemed appropriate because of its networked nature, and further research on innovation in this industry is recommended (Hjalager, 2010; Rubalcaba et al., 2012). Ten individuals participated in the study: the two owners, five employees (one freelancer), and three belonging to the group family/friend. The snowball sampling by the SME owners resulted in no participation of customers. Although some respondents were also customers of the SME, they considered their primary relationship to the SME owner differently. Most participants had work experience of over ten years (Table 1). All participants had prior experience with the VC Zoom. Before the joint online innovation activity, they were introduced to the OW Mural's functionalities by a short demonstration of about five minutes.

3.1 Interviews

Ten interviews were conducted in April 2021, between three and seven days after the joint online innovation activity. Each interview had a length of 14 to 23 minutes. Based on the construct of net impacts (DeLone & McLean, 2016), we asked three questions regarding the CIS support: How did the CIS contribute (or not contribute) to the success of

- your individual participation in the innovation activity?
- the collaboration with the other participants in the innovation activity?
- the joint innovation activity for the SME(s)?

The semi-structured interviews were recorded and transcribed. For the qualitative analysis, we followed the six-step-process for systemic focused interview analysis with MAXQDA (Kuckartz & Rädiker, 2020):

- Prepare the data and explore
- From the interview structure to the category system
- Coding interviews (Basis)
- Coding (Detailed)
- Analysis
- Documentation

The first level categories were derived deductively based on the perceived value constructs in Figure 1. The second and third levels were identified inductively how the IS supported these types of value. Kuckartz and Rädiker (2020) recommend using methods for improving coding quality instead of working with coefficients such as Krippendorff's Alpha, especially applying intracoder-testing earliest two weeks after initial coding, which we performed 21 days after initial coding.

3.2 Survey

The survey investigated selected TAM3 constructs measured using a 7-point Likert scale (Venkatesh & Bala, 2008). The items for Perceived Usefulness relate to the purpose of use in original to the "job" in general of the user (Venkatesh & Bala, 2008). In our case, we focus on the Perceived Usefulness for the innovation activity that might instead be part of a task, not necessarily of the participant's job. Thus, the items were adapted for that purpose (Table 2). The study was implemented with German SMEs requiring translation of the TAM3 items. For the translation, we applied the method of back translation (Douglas & Craig, 2007), translating from the original to the target language, in our case German, and then translating back by a different bilingual person to the original language (Douglas & Craig, 2007; Sinaiko & Brislin, 1973), in our case by a professional translator. The questionnaire was pre-tested to ensure its comprehensibility (Behr, 2017; Douglas & Craig, 2007) by two bilingual persons, one assisted and one un-assisted by the researchers, while the wording was adapted accordingly.

Table 2: Selected constructs and items based on Venkatesh and Bala (2008, pp. 313-314) – adaptations in italic.

Perceived Usefulness
- Using the system improves my performance in my job. → *Using the system improves my participation in the online innovation event.*
- Using the system in my job increases my productivity. → *Using the system in the online innovation event increases my productivity.*
- Using the system enhances my effectiveness in my job. → *Using the system enhances my effectiveness in the online innovation event.*
- I find the system to be useful in my job. → *I find the system to be useful for participating in the online innovation event.*
Perceived Ease of Use
- My interaction with the system is clear and understandable.
- Interacting with the system does not require a lot of my mental effort.
- I find the system to be easy to use.
- I find it easy to get the system to do what I want it to do.
Behavioral Intention
- Assuming I had access to the system, I intend to use it.
- Given that I had access to the system, I predict that I would use it.
- I plan to use the system in the next <n> months.

The items from TAM3 (Table 2) are measured separately for both IS. We then analyze differences

between the two software tools used, hypothesizing that the VC reaches higher results on the selected TAM3 constructs than the OW. With n≤10, the data is considered a small sample for which no normal distribution can be assumed, and nonparametric tests are preferable (Stiefl, 2018). The Wilcoxon signed-rank test is applied to analyze the data from a paired sample when no normal distribution can be assumed (King et al., 2011; Schulz, 2019; Siegel, 1956; Stiefl, 2018; Wilcoxon, 1946). The test relies on a minimum of 5 paired data sets (Schulz, 2019). For small samples of n≤25, specific critical values for the test statistic *T* apply (Siegel, 1956). The significance level α is set to 0.05.

To measure the effect size, we apply the matched-pairs rank biserial correlation coefficient (King et al., 2011; Tomczak & Tomczak, 2014), that calculates with the test statistic only, not via the z-value as in other approaches (Field, 2013; Schulz, 2019):

$$r_c = \frac{4\left|T - \left(\frac{R_+ + R_-}{2}\right)\right|}{n(n+1)}$$

Ties are those pairs in the test statistic T that show no difference and reduce n in the Wilcoxon signed-rank test. Varying interpretations are found in the literature on the n of the effect size for the test, e.g., generally the number of pairs (Marschall and Marquier, n.d.), the sample size (Fritz et al., 2012; Mayr et al., 2017; Rosenthal, 1994), or the number of observations (Field, 2013; Tomczak and Tomczak, 2014). We apply n as the number of pairs including ties, as they could be interpreted as reducing the effect. The effect size can thus only reach 1.0 if all pairs deviate in the same direction and no ties are amongst the samples. R is interpreted (Cohen, 1988): small effect size r = .1, medium effect size r = .3, large effect size r = .5. Due to the small sample size, distribution was not determined, preventing a meaningful power analysis (Rasch et al., 2014).

4 RESULTS

4.1 Interviews

The interviews identify three value categories supported by the two software tools used in the case study innovation activity - the VC and the OW: excellence, efficiency, and emotional value (Table 3). In general, more detailed replies were given for the OW since the VC was already known and such common practice to all participants, making it difficult for them to identify specific positive or negative impacts, as this software seemed fundamental to them to enable them collaborative work online.

Overall, it can be said that the combination of VC and OW seemed sufficient and appropriate, supporting various forms of perceived value. A few items were identified as having adverse effects as well.

Table 3: Value categories supported by CIS in innovation activity (unit = number of interview transcripts, n = 10).

Value category	VC	OW	Both
EX – Excellence value			
EX - Results achieved online			
Simplifies documentation	1	4	-
Visualizes ideas	-	3	-
EX - Work performed online			
Supports decision making	-	2	-
Enables synchronous individual work	-	4	-
Enables synchronous group collaboration	1	2	-
Enables asynchronous group collaboration	-	4	-
EX - Negative			
Reduced creativity	-	1	-
Not increasing creativity	-	1	-
EF - Efficiency value			
EF - Time savings			
Is technically reliable	1	1	-
Provides overview	-	3	-
Supports moderation	-	5	-
Standardizes	-	1	-
EF - Limited input required			
Is easy to use	2	3	-
Is well known	1	1	-
EF - Negative			
Distraction by using two CIS	1	-	1
Distraction by simultaneous work	-	1	-
Time effort new system	-	1	-
Uncertainty	1	-	-
EM - Emotional value			
EM - Seriousness			
Fosters politeness	-	-	1
Supports commitment	-	1	-
EM - Belonging to group			
Supports interaction with others	-	1	-
Visualizes others' work in progress	-	3	-
EM - Play			
Uses fun icons	-	1	-
Supports interactivity (entertainment)	-	2	-
EM - Express and perceive emotions			
Supports non-verbal communication	8	-	-
Supports verbal communication	4	-	-
EM - Negative			
Perceived non-seriousness	2	-	-
Personal dislike	-	1	-
No advantage	-	1	-
Lack of intuitive feeling	-	-	1
Lack of commitment	-	-	1

Excellence value is attributed to using a service or tool to an end and achieving a goal. Here, we identified that the CIS is used to achieve results of the innovation activity and the work performed in a group online due to the dispersion of the participants. The CIS supports this value by enabling documentation of results and the visualization of ideas. It both supports individual work, synchronous and asynchronous group collaboration, and decision-making processes with the group.

Possible adverse effects on the value caused by the CIS could be reducing or at least not increasing creativity, thus potentially diminishing the results achieved.

Efficiency value considers attributed outputs versus inputs, with efficiency value in this research stemming from time savings and limited required input. Time savings by applying the CIS result from a technically reliable system that is stable throughout the interaction, standardizes how participants provide input, allows a moderator to provide guidance, and provides an overview of tasks. The limited input required is based firstly on the perceived ease of use of the CIS and secondly on prior knowledge of the CIS. Possible adverse effects on the value of applying the CIS is the time effort to learn a new system. Another effect stems from using two systems in parallel, e.g., by switching devices or the software displayed in several windows. Using two CIS might even result in uncertainty if participant contributions have been made in the correct system and can be seen by other participants. Additional clarification might cost extra time. The OW, which visualizes the work of other participants simultaneously, might also cause distraction.

For the intrinsic emotional value, four value codes have been identified: the expression and perception of emotions, belonging to the group, play, and seriousness. The CIS supporting the display of emotions beyond voice is perceived to generate value, by firstly allowing to see other participants in general to get a personal impression, but also more specifically to display mimic and gestures oneself, yet also to interpret these of others to get a better feeling for what a person means and feels. Nevertheless, this functionality has to be taken with care. The VC transmitting non-work-related activities has caused a perceived non-seriousness by other participants, potentially reducing motivation for their engagement. The observed behavior might be explained by the different backgrounds of participants mixed from work and the personal background of the SME entrepreneurs, thus seeing their participation as either work or leisure. However, seriousness was established as a factor for emotional value, with CIS fostering polite behavior of participants, e.g., by not interrupting, raising hands, and making contributions tangible by visualizing them. Thus, the aspect of seriousness is relevant to participants, yet the contribution of CIS is discussed contradictory. The CIS fosters the value factor of belonging to a group or establishing a group feeling. It helps to interact with others to have the feeling of collaborative group work, which is appreciated, but also the CIS visualizes what others work on. This sense of activity visualized by the CIS drives motivation and a feeling of being part of a group. A final aspect is play, where the CIS uses, e.g., fun icons, but mainly supports interactivity of various kinds perceived as entertaining. Apart from the perceived lacking seriousness, other aspects potentially harming emotional value are an unspecific personal dislike, or seeing no direct advantage, a felt lack of commitment as participants could easily drop out of the online activity, and, despite video transmission, a lack of feeling for the group.

The frequency of third level categories was only counted once per interview (Table 3). The functionalities mentioned most frequently unprompted and unweighted by the interviewees were:

- supporting non-verbal and verbal communication for emotional value,
- allowing moderation, giving an overview, and being easy to use for efficiency value,
- enabling both group collaboration and individual work and documentation for excellence value.

Negative impacts seemed relatively rare in terms of frequency, with only one to two mentions. We identified some contradictions of positive and negative impacts. While a respondent said CIS increases commitment, another claimed it reduces it. As discussed before, the same applies for distraction versus improved guidance or supporting seriousness versus non-seriousness. From these findings, we conclude that not only do perceptions of value differ but also the effect CIS has on them.

Other-oriented value categories (SO - Social Value, ET - Ethical value) could not be identified in this study, although generally possible. Ethical value could be data privacy, e.g., allowing a background picture in the VC or a warning when recording starts, but the interviewees mentioned neither. Social value could be the display of badges, qualifications, or titles, but the interviewees did not mention it.

Table 4: Means and Wilcoxon signed-rank test of the two software tools (Pairs: ET – excl. ties, IT – incl. ties).

Construct	Mean		Pairs		Result Wilcoxon signed-rank test	Eff. size r_c incl. ties
	VC	OW	ET	IT		
Perceived Ease of Use	6.45	5.20	8	10	Reject one-tailed null-hypothesis for negative ranks, means VC > OW. ($T = 0$)	0.65
Perceived Usefulness	5.55	5.40	9	10	Accept null hypothesis. ($T = 20$)	
Behavioral Intention	6.17	4.43	7	10	Reject one-tailed null-hypothesis for negative ranks, means VC > OW. ($T = 2$)	0.44

4.2 Survey

While agreement on the items for the selected TAM3 constructs on the VC is high on all constructs 5.37-6.45 mean), it is less but still rather considerable on the OW (4.43-5.40 mean), treating the Likert scale as ordinal for calculating the mean (Table 4).

Performing the Wilcoxon signed-rank test as described in 3.2, the null hypothesis must be accepted for the Perceived Usefulness construct. There is no significant difference in the VC and the OW evaluation.

For the Perceived Ease of Use and Behavioral Intention constructs, the one-tailed null hypothesis must be rejected, with a medium to high effect of the significant difference (r_c=0.65 and 0.44), supporting a significantly higher agreement with the VC. Therefore, although demonstrating general acceptance of these software tools in facilitating the innovation activity, the VC is perceived as easier to use with a higher intention of future usage.

5 DISCUSSION

The CIS prove to be an enabler for the inter-organizational innovation activity in line with Cui et al. (2018) and the generation of perceived value. Based on the perceived value model (Coutelle-Brillet et al., 2014; Holbrook, 1999), we identify extrinsic and intrinsic value types supported by the CIS, yet, only self-, but not other-oriented value. While this result is limited by the small sample, from this study, we conclude that CIS support is facilitating self-oriented value types: excellence, efficiency, and emotional value.

Specific functionalities can be attributed to help build perceived value. Apart from facilitating communication and collaboration in general (Abbate et al., 2019; Scuotto et al., 2017), we could attribute these functionalities to perceived value categories, with excellence value derived by documentation, visualization of ideas, and decision-making functionalities, efficiency value by technical reliability, providing an overview, standardization, moderation, ease of use, and former CIS experience, and emotional value by supporting seriousness, group identification, play, and transmission of emotions in the communication process. The study showed that not only is value subjective (Lepak et al., 2007; Rivière & Mencarelli, 2012) but also how the CIS supports the establishment of perceived value in the innovation activity individually, with single functionalities mentioned ranging in frequencies between one to seven.

In line with the understanding net impacts of CIS (DeLone & McLean, 2003, 2016), both positive and negative impacts were found. Special consideration needs to be given to emotional value that CIS can both support and harm. Extending the view from a network of organizations (Moretti, 2017; Sydow, 2003; Sydow & Müller-Seitz, 2020) with professionals towards an ecosystems view (Lusch & Nambisan, 2015; Moore, 1993; Perks et al., 2012; Radziwon & Bogers, 2018) mixes profit-oriented and non-profit-oriented actors (Kazadi et al., 2016). The observed behavior of participants partly in their private environment might harm emotional value. Thus, beyond giving instructions on how to use the CIS, further guidelines are needed on the effects and functionalities of the CIS for other users, e.g., what data the CIS transmits.

Both software tools used in the innovation activity received mean values above the midpoint for the TAM3 constructs of Perceived Ease of Use, Behavioral Intention, and Perceived Usefulness (Venkatesh & Bala, 2008) despite the different experience levels for both CIS. All participants knew the VC before and were thoroughly familiar with it; while 70% did not know the OW before, 30% had basic experiences. We found a significant difference in Perceived Ease of Use between the systems, which might be explained by experience moderating the

effect of various determinants to this construct (Venkatesh & Bala, 2008). The higher experience was expected to strengthen the effect of Perceived Ease of Use on Perceived Usefulness (Venkatesh & Bala, 2008), implying that with a significantly higher Perceived Ease of Use of the VC, the Perceived Usefulness should also be significantly higher with an even more significant effect. Despite the difference in experience, the construct of Perceived Usefulness did not produce significantly different results. This might be explained by other influencing determinant factors, e.g., image, job relevance, or output quality, that were not part of this study. However, it might also be affected by participants' motivation to join an OI activity, where the value of improving skills might extend towards getting to know new CIS, an expectation that the SME owners had for the online innovation activity. The overall positive results in the TAM3 constructs for both CIS applied in the innovation activity confirm the overall suitability of a VC and OW to support such online innovation activity. We conclude that while prior experience with the CIS might impact the Perceived Ease of Use and with that the Behavioral Intention, the Perceived Usefulness seems independent from prior experience.

Although limited by the small example from which we cannot generalize the descriptive findings, we propose a causal model based on the qualitative data in line with (Kuckartz & Rädiker, 2020) (Figure 2). The functionalities and characteristics of the CIS applied in an innovation activity with an ecosystem seem to facilitate the generation of individually perceived excellence, efficiency, and emotional value.

6 CONCLUSIONS

CIS enable innovation activities of networks and their ecosystem members. Their functionalities facilitate the achievement of participants' perceived value, a central element in OI research (Chesbrough et al., 2018; Kazadi et al., 2016; Tidd & Bessant, 2018). Understanding this value can help to attract participants to OI initiatives. Although CIS is accepted to bring about innovation activities among many participants, its selection potentially impacts the perceived value. The selection should be guided towards enabling excellence, efficiency, and emotional value, yet, with functionalities strictly and only suiting the task at hand, amended by behavioral guidelines for the participants. The most suitable software can only unfold its value-generating effect when applied by the participants in a beneficial way, thus, confirming the understanding of the digital facilitation in the innovation activity as an information system, inextricably linking technology and behavior (Hevner et al., 2004).

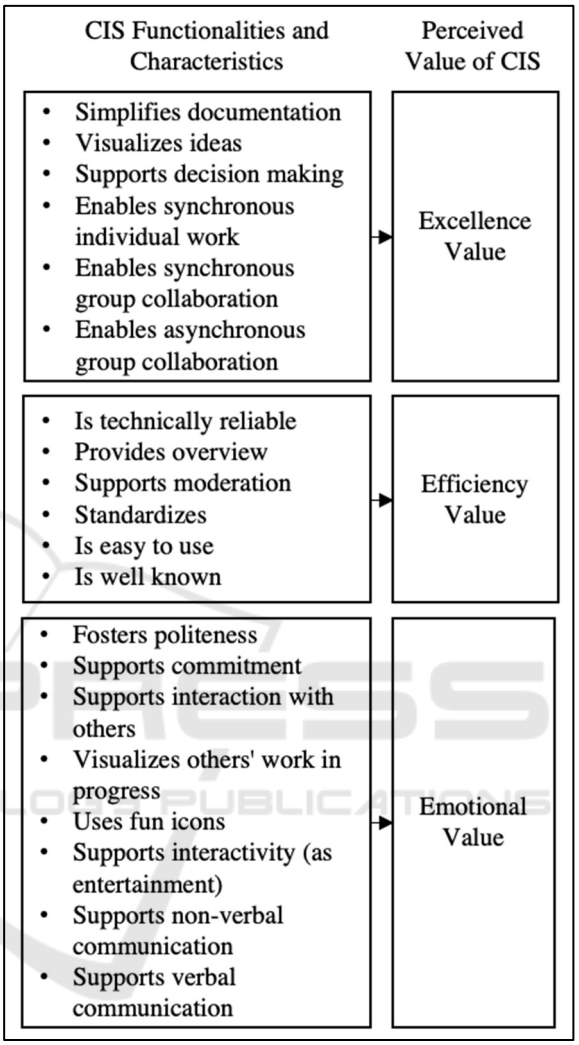

Figure 2: Contribution of CIS to perceived value in innovation activities in a network ecosystem

Contribution to Theory: This study contributes to the understanding of how technology and its functionalities and characteristics can support the generation of perceived value in a network ecosystem's innovation activity, thus both advancing the knowledge about technology's role (Chesbrough et al., 2018; Lusch & Nambisan, 2015) but also to the strand of research on OI in networks (West & Bogers, 2017). The identified perceived value types of efficiency, excellence, and emotional value supported by specific software tools functions can help understand actors' motivation for participating in OI initiatives facilitated by information technology. We

propose a link of the information system functionalities to the identified three types of perceived value and demonstrate how specific software functionalities can contribute to the perceived value for OI participants. We suggest that in the setting of OI, participants' prior experience with software is independent of Perceived Usefulness.

Contribution to Practice: Practitioners are informed about the digital facilitation of potential OI initiatives. The selection of the two software products, a VC and an OW, proved sufficient to support the ecosystem's innovation activity. The use of established tools familiar to the participants is recommendable, yet other systems that appear easy to use can help drive value generation. The tools should be as few as possible, accompanied with clear guidance on how to use them and how to behave appropriately in digitally facilitated activities, especially when involving people from work and personal backgrounds. The most important characteristics for choosing digital tools to support value generation in an OI innovation activity are: video streaming, ease of use, support both individual and group work, and document achieved results.

Limitations: The research is based on a small sample involving two companies from a network with selected representatives from their ecosystems, summing up to ten participants. The qualitative study provides exploratory insights yet needs further empirical research for generalization. The study is also limited by the two types of software used in the innovation activity, and this activity focuses only on the ideation stage of the innovation process.

Future Research: Future work is recommended in two directions extending the reliability of the findings: extending the number of participants and extending the research to further stages of the innovation process.

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