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Knowledge and Technology Transfer under Digital Conditions: Transfer Intermediaries in Eastern Germany and the Role of Digital Means, Trust and Face-to-Face Interactions

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Knowledge and Technology Transfer under Digital Conditions: Transfer Intermediaries in Eastern Germany and the Role of Digital Means, Trust and Face-to-Face Interactions

Anika Noack

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Knowledge and Technology Transfer under Digital Conditions: Transfer Intermediaries in Eastern Germany and the Role of Digital Means, Trust and Face-to-Face Interactions

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Abstract

Even before the corona pandemic broke out in 2020, the role of digitalisation became more and more apparent within Knowledge and Technology Transfer (KTT) processes. Since the pandemic, intermediary organisations that bridge the distance between academia and the world of business to pave the way for successful university-industry linkages have not primarily been able to build on face-to-face-encounters to create those relations. Based on an ongoing research project, this paper examines how digitally mediated communications potentially enhance or limit knowledge and technology transfer that is primarily based on face-to-face interactions. On the one hand, the use of digitally mediated communications seem to foster the spatial expansion of networks, save travel times and costs and foster a special form of social inclusion. University-industry-relations, on the other hand, still rely on a positive evaluation of face-to-face contacts and geographical proximity for trust to develop between heterogeneous partners. Here, actors with bridging functions like transfer scouts are vital in enabling a regular communicative exchange to create commitment, social cohesion and cooperation in digital contexts. Although the relevance of digitalised transfer processes has been increasing over time, an important set of activities, involving face-to-face contacts and co-location, currently still plays a major role for transfer intermediaries in university-industry-relations.

Keywords

Knowledge and technology transfer (KTT), transfer intermediaries, face-to-face interactions, mutual trust, focused ethnography

1. Introduction

Even before the corona pandemic broke out in 2020, the role of digitalisation and the usage of digital tools became more and more apparent within Knowledge and Technology Transfer (KTT) processes (Heller 2010). Respectively, this places high demands on professionals engaging in KTT such as transfer scouts (Noack and Jacobsen 2021), Technology Transfer Organizations/Offices (TTOs) (Bessant and Rush 1995; Pollard 2006; Siegel, Waldmann, Atwater and Link 2004), Technology Transfer Professionals (TTPs) (Takata et al. 2020), Technology Transfer Agencies (Hassink 1997), Industrial Liaison Offices (ILOs) (Fisher and Atkinson-Grosjean 2002; Muscio 2010), technology transfer advisors (Skalecki and Vieten 2014) and other institutionalised actors when setting up transactional relationships between scientists and entrepreneurs. The practices of many intermediary organisations at universities or Higher Education Institutes (HEIs) are, nevertheless, still based on recurring face-to-face interactions and trust-based personal relationships (Collier, Gray and Ahn 2011; Pollard 2006). "The most important task of transfer professionals is the development of trustful contacts between actors from science and industry. They represent a necessary prerequisite for successful cooperative knowledge and technology transfer" (Schmauder 2012: 37; translated by the author). Through personal encounters based on intensive and recurring face-to-face interactions, the participants establish a more personal relationship with each other (Kloke and Krücken 2010: 39; Pollard 2006: 166; Rauter 2013: 140; Siegel, Waldman and Link 2003), develop a common language much faster and can thus create a basis of trust for cooperation (Schmauder 2011: 9). Since the pandemic, in contrast, transfer intermediaries have not primarily been able to build on face-to-face contacts, but are forced to deal with digital tools and means of communication to temporarily replace the former in creating university-industry-relations.

Although a lot has been written about the benefits and challenges of virtual communication in comparison to face-to-face interactions (Heller 2010; Storper and Venables 2004), this is rarely done in the context of university-industry-linkages (Canhoto, Quinton, Jackson and Dibb 2016; Sapsed, Gann, Marshall and Salter 2005), especially with regard to the recent situation where, for more than a year, KTT professionals have not been able to rely on face-to-face interactions as their primary medium of exchange. This paper sheds light on the research gap with respect to how intermediaries create communication processes, commitment and mutual trust in order to develop university-industry-relations and potential innovation processes in an Eastern German region under circumstances of Covid-19 in a predominantly digital communication environment.

Accordingly, face-to-face contacts on the one hand, and the growing importance of digitally mediated communications on the other, constitute a field of tension in KTT that needs further research. The corona pandemic offers almost ideal conditions to explore this topic in more depth. "Face-to-face exchange and regional proximity may take a back seat as factors, or may be of particular importance for this very reason" (Rauter 2013: 315;

translated by the author). Respectively, this paper asks: How do digitally mediated communications enhance knowledge and technology transfer which is primarily rooted in face-to-face interaction? How do transfer intermediaries initiate university-industry-relations via digitally mediated communications, and how do they assess its importance compared to face-to-face contacts? How do intermediaries manage to establish commitment, mutual trust and cooperation between heterogeneous actors in digital contexts, and what role do those intermediary figures themselves play in this endeavour?

Based on an ongoing research and development project, this paper presents detailed findings about transfer scouts engaged as intermediaries and co-constructors in KTT processes and how they deal with university-industry-relations under digital conditions. This paper starts by describing the interplay of face-to-face interactions and digitally mediated communications in university-industry-relations on the basis of a literature review (section 2). Methodologically, a focused ethnography (Knoblauch 2005) is used to closely observe the daily practices of intermediating persons with respect to the creation of commitment, social inclusion and trustful relationships between academics and entrepreneurs by using digital (communication) tools (section 3). Empirical data (section 4) will illustrate partly ambiguous experiences with regard to the potential of digitally mediated communications. On the one hand, they seem to foster the spatial expansion of university-industry networks, save travel times and costs and enable a special form of social inclusion. On the other hand, university-industry-relations still rely on a positive assessment of face-to-face contacts and geographical proximity for trust to develop between heterogeneous partners. Therefore, the analysis (section 5) reveals that in times of limited face-to-face interactions, actors and organisations with bridging functions like transfer scouts become vital in these processes in order to establish commitment and cooperation, as well as to foster social group dynamics and social cohesion among researchers and entrepreneurs in digital contexts. In particular, this is a result of their professional usage of digital communication tools and a variety of communication channels to create a regular exchange between researchers and entrepreneurs. Although the relevance of digitalised transfer processes has increased over time, the final considerations (section 6) conclude that face-to-face interactions will still be essential to the transmission of complex tacit knowledge as is the case in a potentially innovation-enabling KTT environment. Thus, an important set of activities, involving face-to-face contacts and co-location, continue to play a major role for transfer intermediaries in current university-industry-relations, and potentially those of the future.

2. The interplay of face-to-face interactions and digitally mediated communications in university-industry-relations

Science and industry are subject to different demands: research groups on the one hand follow principles with regard to openness, the free production of knowledge (Weingart 2016) and the publication of this knowledge in order to connect to the previous knowledge canon. Corporate requirements include secrecy, confidentiality and short-term perspectives (Skalecki and Vieten 2014). As specialised organisations, intermediaries bridge cognitive and normative variances between different systems and link diverse functions. To fill this role, transfer intermediaries need to understand the coding schemes on both sides of the border and be well connected both internally and externally (Comacchio, Bonesso and Pizzi 2012; Tushman and Scanlan 1981).

2.1 Transfer intermediaries as boundary spanners and co-creators

In their role as boundary spanners (Tushman 1977), transfer intermediaries need to balance different, sometimes contradictory expectations in order to provide important translations between science and industry. "Boundary spanning is typically performed by people who mediate flows of advice, information and trust between two distinct groups or actors" (Champenois and Etzkowitz 2018: 30). In the case of transfer scouts, apart from mere mediation, they are directly involved in processes of multidirectional knowledge-production as co-creators of new knowledge and technologies in transfer processes (Noack and Jacobsen, 2021). A successful translation of scientific knowledge into applications, as well as the translation of societal questions and problems into the scientific context, not only requires a common language but, in particular, mutual trust (Wissenschaftsrat 2016: 37). Here, the establishment of trustful relationships through intermediaries is essential to ensure cooperation and to reduce information deficits and transaction costs between university and industry (Rauter 2013: 22; Schmauder 2012: 41). Through trust-building, transfer intermediaries reduce transfer barriers and create more transparency in the knowledge and technology market (Czarnitzki, Licht, Rammer and Spielkamp 2001: 41; Muscio 2010: 186). Mistrust, in turn, can result in a withdrawal of potential partners from a joint project (Barnes, Pashby and Gibbons 2002).

2.2 Face-to-face interactions and the development of trust

The establishment of such a trustful relationship can be supported by various measures. Including in particular, the exchange between personnel of scientific institutions and companies—representing an effective way of transferring knowledge (Wissenschaftsrat 2007: 49). Hemmert, Bstieler and Okamuro (2014) also refer to the relevance of strong ties between partners, their reputation and contractual safeguards in order to reduce uncertainty

and develop trust. Moreover, longstanding personal relationships based on intensive and recurring face-to-face interactions are of general importance (Hameri 1996: 52; Kloke and Krücken 2010: 39; Pollard 2006: 166; Siegel et al. 2003; Rauter 2013: 140). Through personal encounters, the participants establish a personal relationship with each other, develop a common language much faster, and can thus create a basis of trust that is the prerequisite for initiating cooperation (Schmauder 2011: 9).

Schmidt, Müller, Ibert and Brinks (2018: 190) also value face-to-face interactions "as critical when it comes to sharing tacit knowledge and to building trustful alliances for innovation." Face-to-face as a "technology of communication, coordination, and motivation" permits "a depth and speed of feedback that is impossible in other forms of communication" (Storper and Venables 2004: 354). Following Villani and Phillips (2021: 9), in face-to-face interactions, intermediaries draw on multivocal communication tools including the use of "words, labels, and other symbolic representations that are simultaneously understood by culturally diverse individuals." Through face-to-face interactions, actors communicate via multiple channels simultaneously (language, gestures, facial expressions) and can assess associated moods immediately (Piller, Hilgers and Ihl 2013: 57). Face-to-face interaction "allows actors to align commitments and thereby reduces incentive problems" (Storper and Venables 2004: 353). Insofar as different actors are placed in the same situation, they typically want to gain each other's esteem, and that through commitment and cooperation, rather than by making insufficient effort or provoking conflicts (Storper and Venables 2004: 359). "Commitment refers to the questions of how much a person identifies with the collaboration and its goals, how loyal this person is to this collaboration and whether they are willing to put sufficient effort into it" (Rybnicek and Königsgruber 2018: 231).

2.3 Proximity and the development of trust

Van Weele, Steinz and Van Rijnsoever (2018) emphasise that face-to-face interactions build robust relationships among members, particularly for start-up communities that are established locally and within collaborative workspaces and regions. This also seems to be characteristic for the establishment of trust through locally based university-industry relations. "Because trust is important, SMEs often search for information in close proximity, not only geographically, but also sociologically and sectorally" (Hassink 1997: 355ff.). Geographical proximity facilitates communication processes between heterogeneous partners based on the exchange of tacit knowledge (Villani, Rasmussen and Grimaldi 2017) "since members of the same community share experience and understanding [and] having worked with the same processes, tools, rules-of-thumb and circumstantial constraints" (Sapsed et al. 2005: 833). Thus, face-to-face contacts can be seen as the "most fundamental aspect of proximity" (Storper and Venables 2004: 352), referring to activities like deal-making, evaluation and relationship adjustment. Villani et

al. (2017: 99) also assume that "proximity dimensions […] can be an important means through which specialised intermediary organizations can reduce collaboration barriers". They show "how different proximity dimensions interact and mitigate the cognitive distance between collaborating parties" adding to "recent attempts to combine geographical proximity with institutional, technological, social and organizational proximity" (Villani et al. 2017: 99). Accordingly, the factor of trust in another person is also very closely related to the dimension of social proximity (Rauter 2013: 140; Villani et al. 2017: 99).

2.4 Digitally mediated communications in university-industry-relations

In contrast to face-to-face settings as "interactions between people at the same location and at the same time," digitally mediated communications can be defined as "interactions between people who are working at different locations and often in different time zones" (Zimmermann et al. 2008: 322). Examples for digitally mediated communications are e-mail, video-conferencing, teleconferencing, or any other IT system. The use of digital tools, which are conveyed via electronic media, offer the advantage that existing knowledge can be stored, found and used by all partners at any time (Schmauder 2011: 62). In this context, researchers on processes of knowledge and technology transfer primarily deal with the potentials and challenges of digital platforms for establishing matches between university and industry partners. Czarnitzki et al. (2001: 41) assume that the cost of finding a suitable partner can be reduced by combining knowledge supply and demand on a digital platform. "It is desirable to have one or more intelligent internet portals that enable quick and efficient information about the knowledge and technology offered by research in a specific subject area and that allow direct contact between scientists and companies" (Czarnitzki et al. 2001: 48). Hossain and Heidemann Lassen (2017: 57) also see that "companies can benefit significantly from various digital platforms that can work as catalysts for digital transformation. Therefore, companies can consider digital platforms as an integral part of their digital transformation agenda." Czarnitzki et al. (2001: 41) note, however, that digital knowledge exchange can hardly be made efficient by contacts alone. Trust and cooperative arrangements still play a major role. Consequently, "if the results of an automated project are inadequate, the customers would be unsatisfied, which impacts the trust that the organization possesses" (Larsson 2018). Burgos (2020) also sees a limit to the potential of digitally mediated communications for knowledge transfer processes, because online technology is only valid for some of the diverse range of processes.

Canhoto et al. (2016) report ambiguous experiences with regard to digitally mediated communications in processes of knowledge and technology transfer. Their research illustrates that trust can develop even without regular face-to-face interactions between partners. Clauss and Kesting (2017) as well as Hong, Heikkinen and Blomqvist (2010) suggest communicating via different channels, such as e-mails, regular virtual meetings or face-to-face communication. Here, the frequency of communication seems to be more

important than the communication channel (Hong et al. 2010; Lee 2011) for the development of a shared understanding and mutual trust.

In the comparison between technology-based and face-to-face interactions carried out in the study by Ansarimoghaddam, Hoon and Yong (2017), the researchers found that face-to-face interactions allow for more rigorous discussion, in which members can provide and receive immediate feedback before reaching a consensus, while the group that used digitally mediated communication channels (in this case wikis) was, in contrast, able to come up with more ideas and displayed superior creativity and organisation in their collaborative learning. Aljuwaiber (2019), in his study on knowledge sharing in project teams, also examines which method of communication (technology-based vs. face-to-face interactions) does a better job in facilitating the creation of effective environments within the business realm. Although his study is limited to knowledge exchange processes inside business organisations, he points to an aspect that should also apply in the context of KTT—technology-based communication is helpful in the context of limited time and financial resources for personal exchanges, its capacity for knowledge sharing is limited by legal frameworks (data protection compliance). According to Heller (2010), benefits in terms of cost and time savings are accompanied by access to broader expertise as well as by reductions in "power differences (Bower, Hinks, Wright, Hardcastle and Cuckow et al. 2001) that inhibit equal participation, resulting in more equal levels of participation within heterogeneous groups" (Heller 2010: 10), and therewith, potentially increase the degree of creativity and innovation (Hertel, Geister and Konradt 2005). The absence of non-verbal cues and tacit knowledge (Powell, Piccoli and Ives 2004), however, causes interpersonal challenges that complicate relationship formation, cohesion and trust that are important for the success of university-industry-collaborations (Kloke and Krücken 2010; Rauter 2013). This can result in misinterpretations and interpersonal conflicts with a negative impact on productivity (Bergiel, Bergiel, and Balsmeier 2008).

2.5 A social constructivist approach

The importance of digitally mediated communications in processes of KTT has increased enormously during the last years, even more since the pandemic. However, relatively few studies (Canhoto et al. 2016; Sapsed et al. 2005) have investigated their interplay with face-to-face contacts in technology transfer activities, especially with respect to the role of transfer intermediaries and situations where those boundary spanning actors primarily depend on digitally mediated communications, as during the corona pandemic. To analyse how intermediaries manage to create commitment, mutual trust and cooperation between heterogeneous actors under digital conditions, a micro-sociologically oriented social-constructivist approach towards communication is pursued (Christmann 2016; Knoblauch 2020), considering negotiation processes in different actor constellations (Schulz-Schaeffer 2019: 5), in face-to-face interactions, as well as in digitally mediated communications. This

will be elaborated using the methodology of focused ethnography.

3. Methodology

This paper is based on extensive, process-accompanying research into the functions, roles and activities of transfer scouts – a special kind of transfer intermediary whose technical expertise and academic background generates synergies with industry partners in a new way by virtue of the transfer scouts' active participation in the co-construction of new technological knowledge. Transfer scouts are the subject of an ongoing research and development project that aims to intensify the transfer relationships between HEIs and the regional economy in a region of East Germany. The project area is located between the metropolises of Berlin and Dresden. Thus, the project integrates regions that benefit from the immediate appeal of large cities through population growth, settlement, and economic development, and those that are described as being peripheralised (Kühn and Weck 2013) regions in remote areas that are undergoing structural change.

The methodology of focused ethnography (Knoblauch 2005) was used to examine the unfolding process of the transfer scouts' occupational experience during the course of their work activities, starting in 2018, and including the beginning of the corona pandemic in Germany since March 2020. Focused ethnography goes beyond the time-intensive method of participant observation as undertaken by representatives of "conventional ethnography" (Malinowski 1922), but is temporally limited and concentrated on a comprehensive (not holistic) process-oriented exploration (Noack and Federwisch 2020). "In addition, the lack of intensity of subjective experience in conventional ethnography is compensated for by the large amount of data and the intensity and scrutiny of data analysis" (Knoblauch 2005). Hence, focused ethnography does not seek to test hypotheses, but instead pursues an inductive approach which is highly appropriate for the study of new research objects such as the potential tensions between the role of face-to-face contacts and digitally mediated communications in establishing commitment and personal trust by intermediary organizations in KTT processes. Focused ethnography allows for the integration (triangulation)1 of diverse qualitative data. Here, focused participant observations and problem-centred interviews were combined in order to gain a comprehensive and process-oriented understanding that takes into account multiple perspectives: *First*, participant observation data were collected in "ordinary" communication settings in which the transfer scouts meet each other, during public events such as exhibitions, or while accompanying transfer projects. Over a period of two and a half years, a total of 82 observation sessions have been undertaken to date, most of them in face-to-face settings (46), but with a growing body of digital project meetings (26) and digital match-making processes between

1 Despite, or even because of the need to become familiar with different qualitative methods and to methodologically control their triangulation – which poses a challenge in this approach – the triangulation of qualitative procedures is instructive with respect to the use of a single method (Kelle 2008).

researchers and entrepreneurs (10). In total, to date more than 200 pages of observational material has been produced in the form of memos and minutes.

Qualitative, problem-centred interviews (Witzel 2000) were conducted with all of the ten transfer scouts, recorded on audio and transcribed, but also with 16 transfer intermediaries from all over Germany (including TTOs from HEIs, but also private transfer agencies), in order to find out more about their assessments of the relevance of face-to-face contacts with regard to the necessity of digitally mediated communications during the Covid-19 pandemic. They were chosen based on their relationship to the observed HEIs, their longstanding experience in intermediary organisations, as well as their geographical proximity, but also their distance from the research region. In terms of data analysis and interpretation, qualitative content analysis and grounded theory were used to analyse and interpret the qualitative data and thereby (re-)construct the role of face-to-face contacts compared to digitally mediated communications of transfer intermediaries in recently established university-industry-relations.

With regard to the consistency and validity of the interpretation, the method of communicative validation (Stracke, 2009) was used. In this case, communicative validation was implemented through the mutual control of the researchers (one researcher in the empirical field, the other with a necessary distance to the field), who mutually compared their analyses to reach agreement about codes in order to group similar ones into categories. Furthermore, the transfer scouts were re-interviewed and confronted with the results (among others, in the context of a focus group discussion) to check their validity.

4. Findings

This section begins with the assessments of the participating transfer intermediaries (based on 26 interviews and 82 participant observations) with respect to the role of face-to-face interactions for the development of mutual trust in their daily work of transferring knowledge and technologies as it was in 2018 and 2019. Thanks to the continuous observation of the transfer scouts and the repeated questioning of further selected transfer intermediaries, it can be shown to what extent these assessments have potentially changed during the pandemic, which is associated with a greater use of digitally mediated communications. For the transfer scouts in particular, as they are at the focus of our observations, we will see that since the beginning of 2019 their interactions were already oriented towards the active promotion of new digital transfer formats, which has increased even more since March 2020, and has now become a continuous means of interaction. To qualify these observations, statements from the scouts behind these codes with special emphasis on their experiences with digitally mediated communications in matching processes, the temporary loss of face-to-face interactions and the challenge of building commitment and trust-based personal relationships under digital conditions (4.2) will be

interpreted and analysed with respect to the vital role of professional boundary spanners, such as transfer scouts, who organise regular communicative exchange and foster social cohesion and cooperation in a digital KTT environment (4.3).

4.1 Transfer intermediaries and their assessments of the interplay between face-to-face interactions and mutual trust before the pandemic

The vast majority of all 26 interviewees are in favour of face-to-face contacts and their relevance for the creation of trustful relationships in KTT processes.

> "To the majority of people, we have an absolute relationship of trust. […] We know the corporate landscape relatively well here in the region." (Manager 1 of a TTO in the Federal State of Brandenburg, 2019).

> "So it's just a very, very strong relationship that I have with the professors, so that um, they just talk about what they're doing and just meet with them for lunch, and quite often that is not planned at all, to be honest, it just happens […] The A&O is the conversation, it's just talking to each other" (Manager 6 of a TTO in the Federal State of Brandenburg, 2019).

> "It is also a matter of trust, um, when a scientist talks about his research projects and the scout has already heard of them, they are on the same wavelength" (Manager of a private transfer agency in the Federal State of Brandenburg, 2019).

They highlight the creation of mutual trust based on personal relationships as well as on positively valued collaborations, potentially facilitating the coupling of actors from heterogeneous systems to enable an open exchange. A manager (2) of a TTO in the Federal State of Brandenburg also described the position of intermediaries as "a job that clearly depends on people".

> "Quite clearly, it depends on the person, um, a transfer scout can do a lot, but also do nothing if the personality does not match" (Scout 5, 2018).

> "Having a relationship, um, to the professor, on a personal level, I think that's very important" (Scout 7, 2019).

Against the background of their experience, almost all transfer intermediaries describe the importance of the "chemistry" between the partners.

> "If it turns out that the chemistry is not right, it will be difficult" (Manager 3 of a TTO in the Federal State of Brandenburg, 2019).

> "It is better to have a 90 percent partner where it fits on an interpersonal level, than one that fits 100 percent professionally, but uh, where one says, no, I can't do that. It doesn't work" (Scout 5, 2018).

Even before the pandemic, however, transfer intermediaries were confronted with the usage of digital tools and their potential to replace personal components and face-to-face interactions in university-industry-relations (Schmauder 2012). The observed transfer scouts dedicated a large part of their communicative exchange to the search for suitable digital tools, e.g. for internal project communication or presenting the HEI's latest technological developments and to selecting a suitable customer-relationship-management (CRM) system. Transfer scouts also experimented with manifold software tools to secure ideas from brainstorming processes or to create an indicator that measures the time used for the scouts' diverse activities. The scouts also sought digital support with the help of VR tours through university laboratories or digital innovation radars, which cluster the exploitation and market potential of various technologies in a sector-specific manner. Although the literature refers to the positive effects of these developments – reduced costs (Czarnitzki et al. 2001: 41), quick and efficient information (Czarnitzki et al. 2001: 48), the existing knowledge can be stored, found and used by all partners at any time (Schmauder 2011: 62) – transfer intermediaries rarely consider it possible to improve the efficiency of KTT by digital tools alone.

While one scout is chasing the vision that "hopefully at some point it would be best for us to make ourselves redundant" (Scout 3, 2018), the majority of the intermediaries anticipate a different development and strongly emphasise the permanent need for intermediaries in person and face-to-face interactions in order for trustful relationships to develop in KTT processes:

> "Somehow I don't think that such a portal will someday replace the work of such a scout, because people, because people would have to somehow completely pour their problems into such a portal […] a digital platform can help with specific cases, e.g. looking for a specific device or technology, but cannot help with diffuse problems with an open solution. In this case, direct communication is necessary" (Scout 1, 2018).

> It is "[…] not a platform, but people that think along and are able to create connections. Digitalised queries work poorly because they are often poorly maintained" (Manager of a private transfer agency in Hamburg, 2019).

> KTT "is still based on personal trust, personal conversations and personal acceptance, I think. […] Otherwise, I think that platforms of this kind simply don't do much in general, because that's just a personal business. It is the same with the cooperation partners. We are talking about things that can be stolen when we talk

about IP and those things. There must be trust" (Transfer manager of a TTO in Berlin, 2019).

The following *Data Table 1* summarises the transfer intermediaries' assessments (relevant codes) of the interplay between face-to-face interactions and mutual trust in university-industry-relations before the pandemic.

Codes	**Representative Quotes/Examples (selection)**
Face-to-face interactions	"So it's just a very, very strong relationship that I have with the professors, so that um, they just talk about what they're doing and just meet with them for lunch, and quite often that is not planned at all, to be honest, it just happens […] The A&O is the conversation, it's just talking to each other" (Manager 6 of a TTO in the Federal State of Brandenburg, 2019).
Mutual trust	"I always think it's such a, well, you need a credit of trust, but mostly, well, if you could rely on the other person, then you always know, ah yes okay, then I can refer to him […] I benefit from the fact that there is already a basic trust and they [researchers] know, yes, that I just understand what problems they have at the moment" (Scout 2, 2018). "To the majority of people, we have an absolute relationship of trust. […] We know the corporate landscape relatively well here in the region." (Manager 1 of a TTO in the Federal State of Brandenburg, 2019). "It is also a matter of trust, um, when a scientist talks about his research projects and the scout has already heard of them, they are on the same wavelength" (Manager of a private transfer agency in the Federal State of Brandenburg, 2019). KTT "is still based on personal trust, personal conversations and personal acceptance, I think. […] Otherwise, I think that platforms of this kind simply don't do much in general, because that's just a personal business. It is the same with the cooperation partners. We are talking about things that can be stolen when we talk about IP and those things. There must be trust" (Transfer manager of a TTO in Berlin, 2019).
Digital means of communication	"Somehow I don't think that such a portal will someday replace the work of such a scout, because people, because people would have to somehow completely pour their problems into such a portal […] a digital platform can help with specific cases, e.g. looking for a specific device or technology, but cannot help with diffuse problems with an open solution. In this case, direct communication is necessary" (Scout 1, 2018). It is "[…] not a platform, but people that think along and are able to create connections. Digitalised queries work poorly because they are often poorly maintained" (Manager of a private transfer agency in Hamburg, 2019). "In any case, I think you also have to get to know each other in the digital age" (Manager 7 of a TTO in the Federal State of Brandenburg, 2019). KTT "is still based on personal trust, personal conversations and personal acceptance, I think. […] Otherwise, I think that platforms of this kind simply don't do much in general, because that's just a personal business. It is the same with the cooperation partners. We are talking about things that can be stolen when we talk about IP and those things. There must be trust" (Transfer manager of a TTO in Berlin, 2019).

Data Table 1: Transfer intermediaries' assessments of the interplay between face-to-face interactions and mutual trust before the pandemic: codes and representative quotes.

Face-to-face interactions and personal encounters play a major role in the assessments of the transfer intermediaries with regard to the development of trust and cooperative arrangements in university-industry-relations before the pandemic, as *Data Table 1* summarises. Whereas longstanding personal relationships and strong ties between partners (Hemmert et al. 2014) based on intensive and recurring face-to-face interactions and reputation (Kloke and Krücken 2010: 39; Pollard 2006: 166; Rauter 2013: 140) are of great general importance in their assessments, transfer intermediaries remain sceptical about the possibilities of match-making via digitally mediated communications.

4.2 Transfer intermediaries and their experiences with digitally mediated communications during Covid-19

The paper now examines how intermediaries build trust and mediate partnerships in the online environment without – at least temporarily – having the possibility of meeting face-to-face. Observations during digital transfer scout and project meetings (26 meetings), as well as digital matching events organised by the scouts in cooperation with other transfer intermediaries (10 meetings) between March 2020 and April 2021, form the data basis.

4.2.1 The role of trust, extended networks and geographical proximity

In the data, two competing assessments of the situation by transfer intermediaries collide, namely that virtual communication is narrowing university-industry-relations to existing contacts and, on the other hand, that it even facilitates contact with new partners and the creation of broader networks.

> "Transfer only works when I have the person face-to-face, it's not the same via a video conference. The side conversations are where the contacts are actually made and ideas develop" (Former project manager, September 2020).

> "Building trust depends mainly on personal contacts. So, during the Covid-19-phase, it was only possible to sustain existing relationships via phone or video conference, but not to establish new relations" (Manager of a transfer project in the Free State of Saxony, June 2020).

> "I was surprised how easy it was to create a community online, connecting with people, using design thinking methods and tools; giving tips on how remote working works; we really recommend this" (Representative of a TTO at a Finnish University, June 2020).

> "What is lost is that I cannot give a person a meaningful look, e.g. a colleague, I can't use these little signals, at most via private chat. A personal meeting is different, but just because we can't do this, it doesn't mean we can't do something equally good" (Industry Liaison Manager of a private transfer agency in the Free State of Bavaria, May 2020).

Some transfer intermediaries emphasise the need for face-to-face contacts to build trust as a basis for university-industry-linkages, whereas others reported that trust-building between heterogeneous partners is also possible through virtual communicative exchange with limited access to multiple communication channels (language, gestures, facial expressions) in order to immediately assess associated moods (Piller et al. 2013: 57). They illustrate the possibilities of digital match-making with regard to the (spatial) expansion of the network.

> "Networking at this level may be much better and people who didn't travel as much before are now in the loop again […] Spatial distances become less important" (Industry Liaison Manager of a private transfer agency in the Free State of Bavaria, May 2020).

The findings also indicate that geographical proximity as a key aspect of KTT's success diminishes in relevance during the course of digital partnering processes. On the other hand, it is precisely the lack of spatial proximity and contact opportunities in a mutually shared context that is viewed as a barrier to relationship building and maintenance.

> "When we think of transfer, we also think of short distances, we think of the SMEs that are located in the vicinity of the universities, where we maintain direct contact and therefore also facilitate the regional aspect" (Former project manager, September 2020).

Here, geographical proximity is assessed as facilitating communication processes between heterogeneous partners, reducing collaboration barriers and promoting the exchange of tacit (Villani et al. 2017) and non-codified knowledge (Sapsed et al. 2005), with face-to-face contacts referred to as the "most fundamental aspect of proximity" (Storper and Venables 2004: 352).

4.2.2 Durable commitment and creative exchange processes in the digital environment

As virtual communication could be a challenge to using the advantages of geographical proximity and trust-building, transfer intermediaries also emphasised, several times, that they have to create incentive schemes in order to guarantee participation, despite a certain anonymity. It seems that the assessments of transfer intermediaries with respect to the

challenge of motivating participants to put sufficient effort into collaboration (Porter and Smith 1970) via digitally mediated cooperation opportunities are becoming increasingly critical during the course of the pandemic. This is the case, for example, with the former project coordinator and Scout 2, who rated the possibilities of digital networking in June 2020 more positively than after a total of eight digital events in September 2020.

> "Where you can really invite personally, that just works better. You have a different commitment" (Project coordinator, October 2020).

> "Before corona, I thought everything was more binding and they also encouraged each other to take part, and that has subsided at the digital meetings. They switch off and are no longer really involved […] Short conversations are more effective face-to-face. I found digital things to be of moderate use, you don't have to drive, it was easy to prepare, but there was less effective participation" (Scout 2, September 2020).

While the transfer intermediaries describe the level of participation and commitment primarily as a challenge, they emphasise the possibilities of brainstorming and creative exchange processes via digital means of communication. The intermediaries have a variety of communicative tools for knowledge sharing at their disposal. In contrast, social group dynamics must be consciously produced with great effort.

> "Digitisation has a lot of creative potential for interaction, participation and co-creation. The creation of emotional connections and community experience [however] must be moderated, because the social group dynamics cannot arise spontaneously in the digital setting." (Manager of a TTO in Saxony-Anhalt, March 2021).

> "In these digital times, I don't want us to be lone warriors, but develop a sense of togetherness and move forward together" (Scout 6, November 2020).

In their role as moderators and initiators of digital partnering events, transfer intermediaries are important figures in motivating participants to engage in mutual exchange, as well as making a strong commitment to participation and cooperation.

4.2.3 Simultaneous inclusion and exclusion via digitally mediated transfer processes

An aspect of digital matching processes that was assessed as being beneficial by transfer intermediaries was the increasing degree of social inclusion, and with it, the potential reduction of "power differences" (Bower et al. 2001) that usually inhibit equal participation. An Industry Liaison Manager from a private transfer agency in the Free State

of Bavaria emphasised this when stating that virtual match-making processes enable cheaper access to international trade fairs and conferences. This would increase the proportion of smaller companies taking part in those events due to the elimination of travel expenses.

> "The event was actually planned as a live event, but you can see from the number of participants that we couldn't have accommodated that many" (Scout 8, June 2020).

The experience that the number of participants increases in digital match-making events is described by almost all transfer intermediaries, and is mainly due to the time and cost saving effects of these events. Conversely, inclusion effects due to resource efficiency can result in social exclusions of those who are not familiar with the necessary digitisation skills.

> "The digital skills of speakers run in parallel to their technical expertise and are decisive for the implementation of […] co-creation" (Manager of a TTO in Saxony-Anhalt, March 2021).

Those potential exclusions go hand in hand with integration tasks, that are primarily performed by the transfer intermediaries, which repeatedly offer the participants of digital match-making events technical support in processes of information and data transference. This interface function, however, does not seem to solve the structural problems and dependencies of the intermediary agents.

> "Despite the digital tools, we are all incredibly busy and we are all fighting for the attention of the makers" (Manager 1 of a TTO in the Federal State of Brandenburg, June 2020).

> "The university side always complains that they do not have enough company contacts, but during our online match-making events they were not strongly represented" (Scout 6, June 2020).

This also becomes relevant with regard to the role dependency of transfer intermediaries. Their success requires a continual willingness to initiate cooperation on behalf of science and industry. In addition to the promotion of transfer activities and the corresponding (time) resources, this is not least a question of the appropriate incentive mechanisms and individual/organisational reputations, which up to now have hardly been based on KTT, especially within science. Here, the potential influence of transfer intermediaries on KTT decreases, and the dependency of their role becomes obvious.

Data Table 2 summarises the experiences of transfer intermediaries with digitally mediated communications during the Covid-19 pandemic (from March 2020 to March 2021).

Codes	**Representative Quotes/Examples (selection)**
Mutual trust	"Building trust depends mainly on personal contacts. So, during the Covid-19-phase, it was only possible to sustain existing relationships via phone or video conference, but not to establish new relations" (Manager of a transfer project in the Free State of Saxony, June 2020). "Purely digital doesn't work either. Transfer only works when I have the person face-to-face, it's not the same via a video conference. The side conversations are where the contacts are actually made and ideas develop" (Former project manager, September 2020). "What is lost is that I cannot give a person a meaningful look, e.g. a colleague, I can't use these little signals, at most via private chat. A personal meeting is different, but just because we can't do this, it doesn't mean we can't do something equally good" (Industry Liaison Manager of a private transfer agency in the Free State of Bavaria).
Extended networks	"Well, let me say, in human terms you can even realise it on the phone, is that okay or is it not possible at all? And I'll say, the video conferencing made it a little easier because you can see the other person and don't just have to imagine what he might look like or how he could be, but otherwise the dynamics are the same. So far, it's okay, we still don't have any problems entering into new partnerships" (Scout 9, August 2020). "I was surprised how easy it was to create a community online, connecting with people, using design thinking methods and tools; giving tips on how remote working works; we really recommend this" (Representative of a TTO at a Finnish University, June 2020). "Consortia have already found each other digitally in order to initiate projects with companies that are not yet known […] Although the very first personal impression is missing, we have had very, very positive experiences" (Project coordinator, June 2020). "Of course we would prefer the combination of physical meetings and digital formats, but one or the other idea came to fruition and the first networking took place" (Scout 6, June 2020).
Geographical proximity	"Networking at this level may be much better and people who didn't travel as much before are now in the loop again […] Spatial distances become less important" (Industry Liaison Manager of a private transfer agency in the Free State of Bavaria, May 2020). "When we think of transfer, we also think of short distances, we think of the SMEs that are located in the vicinity of the universities, where we maintain direct contact and therefore also facilitate the regional aspect" (Former project manager, September 2020). "The problem is, it just has to be close. You have to sit together. We can see how difficult this has been since Corona. So you have to be close." (Professor of a University in the Federal State of Brandenburg, September 2020).
Durable commitment	"Before corona, I thought everything was more binding and they also encouraged each other to take part, and that has subsided at the digital meetings. They switch off and are no longer really involved […] Short conversations are more effective face to face. I found digital things to be of moderate use, you don't have to drive, it was easy to prepare, but there was less effective participation" (Scout 2, September 2020).

	"It is just a web conference. Because many of them tend to be more passive there, it was perfectly fine, it is normal [...] They are thrown together, they sometimes don't know each other [...] it's always difficult, you can always explain things better if you do it personally" (Scout 2, June 2020). "Where you can really invite personally, that just works better. You have a different commitment" (Project coordinator, October 2020). "I myself always feel the need for us to use these participatory formats [opinion polls, breakout rooms], that is not that easy, but I still don't have the feeling that this can be brought to the high level of participation as in face-to-face meetings" (Transfer Manager of a TTO in Baden-Wuerttemberg, March 2021). "If you like to take a look at the tool, there are a lot of profiles with needs, a real digital pin board, search, offer […] The tool looks great, but the question arises how can we get the participants to use the thing?" (Project coordinator, October 2020).
Creative exchange	"Digitisation has a lot of creative potential for interaction, participation and co-creation" (Manager of a TTO in Saxony-Anhalt, March 2021). During the virtual scout meetings "only information is exchanged, it is actually always just the transfer of information and it is not much more [...] I miss a bit of personal exchange, and that we develop new ideas" (Scout 6, October 2020).
Social inclusion	"Then it has to be said that this digitalisation actually means that many more people have time to talk to you. Well, we have a lot more requests for digital conversations than we used to have requests for face-to-face meetings. This certainly also has something to do with the fact that driving is eliminated, and you can still see the other person, at least virtually. Because of that, it's been accepted relatively well (Scout 9, August 2020). "The event was actually planned as a live event, but you can see from the number of participants that we couldn't have accommodated that many" (Scout 8, June 2020). "The creation of emotional connections and community experience [however] must be moderated, because the social group dynamics cannot arise spontaneously in the digital setting" (Manager of a TTO in Saxony-Anhalt, March 2021). "In these digital times, I don't want us to be lone warriors, but develop a sense of togetherness and move forward together" (Scout 6, November 2020).
Social exclusion	"What is kind of a challenge, especially for smaller companies, is creating the digital conditions" (Scout 9, August 2020). "The digital skills of speakers run parallel to their technical expertise and are decisive for the implementation of […] co-creation" (Manager of a TTO in Saxony-Anhalt, March 2021).

Data Table 2: Transfer intermediaries and their experiences with digitally mediated communications during Covid-19: codes and representative quotes.

4.3 The role of transfer intermediaries in digitally mediated knowledge and technology transfer

With regard to Canhoto et al. (2016), this paper analyses different, partly contradicting experiences with regard to the potential of digitally mediated communications to facilitate mutual trust, commitment and cooperation in KTT processes. Although a certain section of

the transfer intermediaries assesses virtual communication to be effective for creating new and spatially distant university-industry-relations, their experiences with regard to participation, durable commitment and the development of mutual trust has become more critical, especially as the pandemic continues. Here, face-to-face contacts remain essential in the assessments, whereas digital means of communication are at best a supplement to reach more participants, extend the network, use multiple communication tools for creative exchange processes or save travel times and costs. In times of limited opportunities for face-to-face contacts, however, actors and organisations with bridging functions like transfer intermediaries are even more important. Transfer intermediaries organise regular communicative exchange between potential partners, which, according to Hong et al. (2010) as well as Lee (2011), is more important than the communication channel for developing a shared understanding and mutual trust, but also for initiating new contacts that otherwise would have failed as many face-to-face events have had to be cancelled. They also take on integration tasks with respect to establishing university-industry-relations, starting from offering technical support and encouraging participation and cooperation, through to fostering social group dynamics and social cohesion.

5. Discussion

It is not only since Covid-19 that the importance of digitalisation has increased in knowledge and technology transfer. However, the pandemic has accelerated this process. Transfer scouts as professional boundary spanners and co-creators of KTT have become vital within these processes: with their competence to organise a regular communicative exchange between researchers and entrepreneurs based on a variety of communication channels, but also with regard to their professional usage of digital tools and means of communication.

Nevertheless, most of the intermediaries assess the role of digitally mediated communications to be merely complementary to personal face-to-face contacts, although the database suggests that cooperation agreements and university-industry-relations also come about through the digital networking initiatives of transfer intermediaries. “Relative to electronically-mediated exchange, the structure of face-to-face interaction offers an unusual capacity for interruption, repair, feedback, and learning […] face-to-face interaction is so quick that it is virtually instantaneous” (Nohria and Eccles 1992: 292). It also enables humans to pick up non-verbal messages referring to emotions, cooperation and trustworthiness from one another (Storper and Venables 2004: 355). This is why face-to-face is able to promote the development of mutual trust (Schmidt et al. 2018) and informal relationships, helping to overcome the diversity of systems, participating actors and their information asymmetries (Debackere and Veugelers 2005; Siegel et al. 2004). Trust-building between heterogeneous actors is also necessary in terms of creating an open and creative exchange about knowledge and technologies (Schmauder 2012: 32). Although

these brainstorming and creative exchange processes do not seem to be limited by virtual communication, this is the case for the commitment of participants to put sufficient effort into the collaboration (Porter and Smith 1970) during online partnering events, which is described as being a challenge for transfer intermediaries. Face-to-face interactions, in contrast, help to overcome incentive problems in efficient partnering and increase the motivation of the participating parties (Storper and Venables 2004: 358).

Despite the ongoing relevance of face-to-face contacts, digitally mediated communications overcome spatial distances and potentially enable new combinations of knowledge and actors, which can be a prerequisite for innovation (Ibert and Müller 2015) as well as for greater social inclusion. To what extent this social inclusion only benefits those organisations that have already promoted a high degree of digitisation is also a question that generally arises in discourses around digitisation, and cannot be answered clearly at the moment. Digitally initiated and spatially detached networks, however, question the relevance of geographical proximity for a regional innovation system (Schmidt et al. 2018). On the other hand, some transfer intermediaries also report that it is more difficult to acquire new contacts via digitally mediated communication, and that the communicative exchange is primarily limited to the existing contact network. This leads to the assumption that in practice the multitude of digital contact options are rarely updated. Nevertheless, industries clustered within regions interact more intensely with co-located university-based scientists – and will probably continue to do so in future – than with those in other regions (Canhoto et al. 2016), resulting in higher rates of commercialisation than at longer distances (Storper and Venables 2004: 365). Thus, geographical proximity will continue to play a major role, despite a higher level of virtual communication processes within KTT. The following *Table 3* summarises the opportunities observed here, as well as the challenges of digitally mediated communications in processes of knowledge and technology transfer:

Opportunities of Digitally Mediated Communications in KTT	**Challenges of Digitally Mediated Communications in KTT**
multiple communication tools for knowledge sharing	development of mutual trust
wider networks of university-industry-relations	advantages of geographical proximity harder to use
brainstorming and creative exchange processes	durable commitment of participants
social inclusion (more participants and SME's)	exclusion of participants with low digitalization skills
resource-saving (time, costs)	social group dynamics, social cohesion
	legal frameworks (data protection compliance)
⇩	
transfer intermediaries enable a *regular communicative exchange* and take on *integration tasks* ▪ **technical support** ▪ **enabling participation and cooperation** ▪ **fostering social group dynamics and social cohesion**	

Table 3: Opportunities and challenges of digitally mediated communications in processes of knowledge and technology transfer.

Whereas digitally mediated communications potentially accompany multiple communication tools for knowledge sharing, fostering wider university-industry networks, creative exchange processes and social inclusion and save travel times and costs, they prove challenging for the development of mutual trust, geographical proximity, social group dynamics and the durable commitment of participants. Here, actors with bridging functions like transfer scouts are vital in enabling a regular communicative exchange to create commitment, social cohesion and cooperation in digital contexts. All the more so as the new levels of digitalisation recently seen in the KTT intermediation process do not point to a fundamental change in structural context factors. Nevertheless, transfer intermediaries are confronted with ongoing structural dependencies, such as the dependency of their role on the continual willingness of science and industry to cooperate. In our observations, this especially applies to the incentive schemes of researchers (Friedman and Silberman 2003) that are still not favourable to transfer activities (especially compared to basic research), taking into account their scientific reputation and limited time capacities.

6. Conclusions

As a result of the corona pandemic, working environments and processes have had to change from one day to the next and adapt to the new situation. This also places high demands on transfer intermediaries at universities or HEIs engaging in KTT who primarily build on recurring face-to-face interactions and trust-based personal relationships (Kloke and Krücken 2010; Pollard 2006; Siegel et al. 2003; Rauter 2013) to evoke regional economic development (Hassink 1996) through innovation. They are now confronted with digitally mediated communications temporarily replacing or supplementing face-to-face interactions. Although this was an issue before, the pandemic has accelerated the digitisation process for transfer intermediaries. Accordingly, face-to-face contacts on the one hand, and the growing importance of digitally mediated communications with respect to the development of mutual trust and commitment in university-industry-relations on the other, constitute a new field of tension that has opened up a research agenda in the context of KTT, but probably also beyond this.

This paper is already limited as a result of the exploratory character of the research which offers a situational picture after one year of digital matching experiences under the corona pandemic. However, it has been possible to supplement this ethnographic data set by observing the practices of transfer scouts and their use of digital means of communication since September 2018, and thus at least one and a half years before the pandemic. The experiences, nevertheless, generally refer to the Eastern German context and would profit from more international and comparative research, all the more from further research on the following questions: How do digitisation processes change the practices of intermediaries over a longer period of time? To what extent do digitalised practices in KTT influence the form, the course, and the outcome of transfer processes? Are there differences

with regard to the organisational embeddedness, path dependency and plasticity of different types of intermediary organisations (e.g. between TTOs at universities and Higher Education Institutes for Applied Sciences)? How do the institutional and structural factors of nationally or sectorally diverse university-industry-linkages impact on digitalized KTT practices? To what extent does the digital exchange of knowledge and technologies change the forms and orders of knowledge and knowledge regimes? Who is received as a digital expert, and how does this possibly change the relations of domination and power?

This paper intends to encourage other researchers interested in the relations between face-to-face interactions and digitally mediates communications in KTT processes to extend and refine the analysis presented here, e.g. by including survey data to generalise the ethnographic research. The majority of transfer intermediaries agree that digitally mediated communication processes enhance knowledge and technology transfer, that is primarily based on face-to-face interactions, via wider networks of university-industry-relations, social inclusion, more effective group discussion and decision making, resource-saving (time, costs) and the usage of multiple communication tools for knowledge sharing. However, transfer intermediaries do not consider this form of communication as capable of fully replacing face-to-face interactions. This can be supported by the research of Polanyi, elucidating the notion of tacit knowledge. “We can know more than we can tell” (Polanyi 1967: 4), which refers to the point that knowledge is neither reducible to rules nor to algorithms: “There is, in addition, know-how or skills which are difficult to articulate” (Yusuf 2008: 1170). Furthermore, with new kinds of innovation, new complex activities evolve that nurture recurring face-to-face contacts (Hameri 1996: 53) and co-location in shared spatial contexts based on geographical proximity (Storper and Venables 2004: 368). “New technologies may facilitate dispersion of production, but they also destabilize activities, creating uncertainty, research questions, and unknown opportunities. This is an environment in which information is rapidly changing and knowledge is tacit” (Storper and Venables 2004: 368).

For transfer intermediaries this means that in a time of pandemics, when they almost exclusively rely on digitally mediated communications, they also have to deal with the associated challenges – from the development of mutual trust and the enabling of durable commitment and social cohesion between university and industry partners through to compliance with legal frameworks, especially with regard to data protection. Thus, transfer intermediaries as professional boundary spanners, with their competence in organising a regular communicative exchange between researchers and entrepreneurs via a variety of communication channels and digital tools, become vital within these processes. In the future, transfer intermediaries will primarily be concerned with creating a balance between digitally mediated communications and face-to-face interactions in order to use the advantages and mitigate the challenges of the former through the simultaneous use of face-to-face contacts in commonly shared physical spaces.

This speaks neither for the dispensability of the human factor, nor for face-to-face interactions that enable trust-based processes in KTT. This is at least one reason why KTT will probably never be completely conducted under digital conditions and will continue to include an important mix of activities, involving intermediating professionals, face-to-face contacts and co-location, which will still continue to play a major role in the KTT of the future.

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