Factors Influencing the Usage Behavior of Digitalized Innovation Environments in Companies: A Qualitative in-Depth Analysis

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Abstract: Digital Innovation Environments (DIE) as an umbrella term for facilities such as FabLabs, Makerspaces and Innovation Laboratories are already well known in the private and academic sectors. We focus on exploring the business aspects of DIEs and their role in digital transformation and creation of new opportunities for companies to increase their knowledge transfer and innovation capabilities. This research is dedicated to factors influencing the usage behavior of company employees of a DIE. From seven guided interviews, a total of 27 influencing factors in seven topics were identified through successive in-depth analysis and criterion-guided interpretation. These factors show the complexity of DIEs and at the same time lay the foundation for further research. In addition, they are a valuable insight for practice, as they can be used as a basis for developing new integration and cooperation structures.

1 INTRODUCTION

Digital transformation is an irreversible process that has now infiltrated all areas of our lives and is challenging existing structures and processes (Vial, 2019). This affects both private and business perspectives, so it is not surprising that this phenomenon is a much-discussed field both in scientific research (Bharadwaj et al., 2013; Piccinini et al., 2015) and in practice (Fitzgerald et al., 2014; Westerman et al., 2011). Since digital transformation affects all areas of life and has many facets, it is also the subject of research in a variety of research disciplines and is viewed from a wide range of perspectives.

In this paper, we focus on the business perspective and explore the basis on which digital transformation and DIEs create new opportunities for companies to increase their knowledge transfer and innovation capabilities. The nature of innovation has changed fundamentally over the past decades. From the former Schumpeterian model of a single inventor who has an idea and commercializes it (Schumpeter, 1943), innovation has become a complex process involving a variety of different actors (Hippel, 2007; Tidd & Bessant, 2016). Thus, two different developments can be observed: On the one hand, innovation processes are increasingly opening up and integrating external actors to get new stimuli, which leads to interdisciplinary innovation teams. This development is a well-known innovation approach under the term of Open Innovation (Chesbrough, 2003) and is a permanent object of the research landscape. Another striking development is Digital Innovation, which supports innovations through the use of digital technologies and methods or leads to digital products (Iansiti & Lakhani, 2014; Nambisan et al., 2017). Due to their scalability, these digital products and services enable enormous growth potential, so that many of the world's most valuable companies are based on these digital innovations (e.g. Amazon, Apple, Microsoft, Alphabet, Alibaba and Facebook (Kantar Millward Brown, 2020)). Comparatively low

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investment costs also enable smaller companies to act as innovation drivers. Thus, potentially disruptive innovations are no longer reserved for large and established companies but can also be realized by flexible start-ups or small enterprises. The pressure to innovate has grown steadily due to the new developments and companies are in a constant competition for innovation leadership. Faster iteration cycles are required to keep pace with progress, otherwise there is a risk of missing important market trends. The basis of these two innovation approaches is an efficient transfer of knowledge between all the players involved.

Based on the mechanisms of open innovation and digital innovation, innovation environments have developed in recent years in the private and university context, which are characterized by their interdisciplinary users and the use of digital technologies to implement ideas (Cutcher-Gershenfeld et al., 2018). There are various names for comparable facilities such as Makerspaces, FabLab, Coworkingspace, living Labs, innovation hubs and innovations laboratory (Capdevila, 2013). In this paper, we will summarize these facilities under the umbrella term of Digitalized Innovation Environments (DIE), as they are all characterized by the use of digital technologies and methods to support innovation while providing open access to a wide range of players (Capdevila, 2018). It is this combination that leads to faster iteration cycles through the faster realization of initial prototypes through the use of digital manufacturing technologies such as 3D printing and CNC milling (Wolf et al., 2014). The interdisciplinary exchange between users on a non-hierarchical ground also supports creativity in the solution approaches. In the private context, these environments are used by hobbyists and do-it-yourself users, the so-called makers, to realize personal ideas (Dougherty, 2012; Hartmann et al., 2016). In the academic context, these environments are often used for hands-on teaching of digital competencies using concrete examples of implementation (Konopek et al., 2018).

In the meantime, companies have also become aware of the potential of such digitalized innovation environments and are trying to integrate them into their own innovation processes (Zakoth & Mauroner, 2020). Large companies are taking the path of setting up their own innovation environments, but these are usually reserved for the research and development department, so that they cannot benefit from the interdisciplinary knowledge transfer and the innovation potential of their other employees (Lo, 2014). Cooperation between such DIEs and companies has been underrepresented in the research landscape to date, although initial studies at the meta-level have shown promising approaches. The already hypothetically identified potentials, which result from a cooperation, could not be retrieved in a structured way so far (Ruberto, 2015b; Suire, 2016). It has not yet been possible to unlock the potential known from the private and academic context and make it fully usable for companies, although these approaches are seen as promising drivers of innovation capacity (Bergner, 2017). This is partly due to the very small number of companies that have tested interdepartmental cooperation, so that the empirical material is very limited.

Against this background, this paper first empirically examines the basis on which such cooperation can operate and which factors influence the integration of DIEs. In our paper, we thus start from the basic assumption that extended use of DIEs in companies is a prerequisite for exploiting the innovation potentials that are already known from other contexts. This results in the following research question:

Which factors influence employees´ usage behavior of Digitized Innovation Environments in companies?

This explorative approach attempts to form an empirical basis for subsequent research regarding the integration of such DIEs in companies by identifying the underlying conditions. The so far only sporadic use of the potentials known in other contexts suggests that obstacles and barriers arise here, which must first be overcome. At this point, the study makes a far-reaching contribution to the Information Systems (IS) research landscape by empirically identifying relevant factors moderating the usage behavior of a DIE in a company. These results are useful for further research as a starting point for the development of suitable cooperation models, as well as for practitioners for a more targeted integration of DIEs into their innovation processes. The findings are to be used as a basis for future theories that have the potential to take into account the “New Logics of Theorizing About Digitization of Innovation” by (Nambisan et al., 2017, p. 227). DIEs, with their complex interplay of diverse actors and extensive digital technologies, address all four logics indexed by Nambisan et al. (2017) and can provide a platform on which the postulated research questions can be addressed.

2 DIGITALIZED INNOVATION ENVIRONMENTS

Environments in which targeted innovations are to be supported and which offer a platform for sharing knowledge and equipment are already known instruments, especially in the private and academic context (Boutillier et al., 2020; Suire, 2016). However, the first comparable approaches can also be observed in the commercial sector in the form of coworking spaces and LivingLabs (Capdevila, 2014). LivingLabs and their underlying innovation methods have already been identified as element of user innovation, which is characterized by its real-life environment and the user as co-creator (Almirall et al., 2012). Particularly in the private and academic contexts, a new way of innovating has developed in recent years through the integration of a wide variety of digital components and tools. For example, 3D printers and CNC milling machines paired with in-house electronics development enable the short-term implementation of functional prototypes without comprehensive craftsmanship (Gershenfeld, 2012). This allows new user groups to participate in the innovation process and to be involved by means of digital communication channels. Based on the new opportunities made possible by these technologies, a wide range of different innovation environments have developed under various names. Fablabs, Makerspaces, InnovationLabs, Hackerspace or Cocreation Laboratory are some examples. These environments have emerged in different contexts and differ in individual areas with regard to their focus, orientation and user groups. However, differentiation by naming is not possible because there is no uniform understanding of the terms. There is only a Fab Charter that defines some very generic requirements of a FabLab (*The Fab Charter*, 2015). Initial approaches to differentiate the individual approaches from one another have produced only insufficient selectivity and have excluded the digital aspect (cf. Aryan et al., 2020; Capdevila, 2017). Each innovation environment is adapted to its specific context and makes use of a wide variety of elements from the different streams. In order to respect this richness of facets, the term "Digitized Innovation Environment" will be introduced as an umbrella term for these facilities. These environments are physical spaces that use a variety of different digital technologies to support innovation, but are not themselves digital. They are therefore Digitalized Innovation Environments rather than digital/digitized innovation environments such as virtual-reality environments would be, which convert analog material into a digital format. We use the following definition of "Digitalized Innovation Environments":

Digitalized Innovation Environments are physical spaces that provide both traditional and digital tools and state of the art technologies to support collaborative and interdisciplinary innovation and knowledge transfer.

Some companies have already recognized the potential of such DIEs and have made various efforts to integrate them into their innovation processes (Zakoth & Mauroner, 2020). However, collaboration has so far mostly been limited to supporting the research and development departments (Ruberto, 2015a). Some large concerns have gone the way of making their own DIEs available to their development teams, but even these have so far mostly been reserved for a very limited user group and therefore neglect to exploit the potentials of interdisciplinary exchange known from the private and academic context (Lo, 2014). Based on these findings, potentials and functions that a DIE could assume within a company has already been identified (Hellwig et al.), but there is still a lack of knowledge on how to implement them. As a result, the empirical data on full-scale collaboration between DIEs and companies is very limited, which means that only very generic findings have been obtained so far. There is a precise concept of use, instruction, communication, and networking necessary (Bergner, 2017). Before such a concept can be developed, it is first necessary to define the framework conditions that influence the use of a DIE offering. Only if the usability is ensured empirical data on the impact on the innovation capacity of companies can be collected. In the next step, this can lead to inductive theory building, which is a far-reaching contribution to the IS research landscape as well as to practice.

So far, there are only superficial findings regarding the factors that influence the involvement of DIEs in the innovation processes of companies. This is because cooperation across all departments of a company with a DIE has so far been a rare approach to increasing knowledge transfer and innovation capacity. Thus, the potential cases which allowed an empirical investigation are very limited.

3 METHOD

Due to the limited prior knowledge in this research area, an explorative approach was chosen to build a data base for further investigations. For this purpose, a qualitative in-depth analysis of an exemplary case

was to be conducted and findings were to be formed by means of inductive theory building (Gregor, 2006). In the context of information systems research, a case study is an inquiry into single or multiple instances of observable complex phenomena with the aim of identifying discrete units of analysis (Turnbull et al., 2021). In our study, we explore a range of influencing factors that impact DIE usage. As a methodological approach, expert interviews (Kaiser, 2014) were conducted with employees from various departments of a company which, at the time of the survey, had its own FabLab on its own premises for a year and which was freely accessible to all employees. The guidelines for the interviews are based on established theories and models from comparable application areas, which were identified through a literature search (Webster & Watson, 2002). The employees are in a position to report on their own experiences and, due to their various departmental affiliations, reflect a wide range of perspectives and motives for use. In the following evaluation and data analysis, we structured the answers, identified influence factors and derived initial recommendations for practice (Mayring, 2002). The detailed methodological steps are explained in detail below.

3.1 Case Description

For the case study, we aimed at a company with broad experiences to capture the broadest possible range of experiences. For this purpose, we recruited a company with a long-term cooperation of a company with a DIE, which was made accessible to all employees. This is the only way to ensure that the interviewees can base their statements on experience and that the greatest possible variance in perspectives can be taken into account. Since this type of cooperation is extremely rare, the search for suitable research cases was limited. It was possible to recruit a company in Germany for the study, which had been operating its own FabLab for a year at the time of the survey. This FabLab meets the definition of a Digitalized Innovation Environment and houses a variety of different digital tools and technologies. The company is part of an international group, but forms an autonomous unit at the location under consideration with all the usual organizational units for medium-sized companies. It is a manufacturing mechanical engineering company with around 350 employees at the location of the DIE. The employees are divided equally between the administration, production and research and development departments. All employees were free to access and use the possibilities within the FabLab. At the beginning, all employees were offered information events and workshops on how to use individual technologies. Over time, various concepts were tested to simplify the integration of the FabLab into daily business. Finally, one part of the development department was permanently located in the FabLab and serves as a contact person for other employees. This must be taken into account in the upcoming data evaluation.

In order to identify the widest possible range of factors influencing usage behavior, employees were also recruited at different hierarchical levels and from different departments for an expert interview. A total of seven stakeholders were identified, all of whom had gained experience in the DIE but used its opportunities to varying degrees. Two employees each from Research & Development (R), Production (P) and Marketing (M) as well as one employee from Administration (A) were interviewed. Thus, the sample represents a heterogeneous cross-section of a medium-sized manufacturing company.

3.2 Expert Interviews

To ensure a balance between unbiased expression of opinion and a minimum of structure, the expert interviews were organized with the help of predetermined interview guidelines. The employees were asked to comment on pre-identified dimensions relating to their usage behavior and were also given the opportunity to comment on entirely new aspects (Döring & Bortz, 2016). The interview could be divided into three parts. In the first part, the demographic information of the interviewees was asked to be able to evaluate the subsequent statements. Then questions regarding usage, motivation, expectation, and cooperation were asked to be able to identify first indirect influencing factors and to gain a broader understanding of the interviewees' context. he questions were derived from the dimensions of customer orientation (CO) (Handlbauer & Renzl, 2009), as this model has already proven itself in comparable research approaches and the employees have a customer relationship with the DIE. In the third phase, questions were also asked about specific factors influencing usage behavior. To ensure a basic structure, the dimensions to be considered were derived from adjacent theoretical models. The technology acceptance model (TAM3) (Venkatesh & Bala, 2008) and the Innovation Diffusion Theory (IDT) of Rogers (1983) were used as underlying theories, as these are both established models and

Table 1: Dimensions and Guiding Questions within guided Expert Interviews.

No	Dimension (Reference)	Guiding Question
1	Demographic context	
2	Utilization (CO)	How have you used the FabLab so far?
3	Motivation (CO)	What incentives are there for FabLab use?
4	Barriers (CO)	What problems are associated with the use of the FabLab?
5	Expectations (IDT & TAM3)	What future possibilities of use do you see in the FabLab?
6	Competencies (IDT & TAM3)	To what extent do your own skills and knowledge support you in implementing your own ideas in the FabLab?
7	Organization (IDT & TAM3)	What influence do the organizational structures in the FabLab and at the company level have on your usage behavior?
8	Social Aspects (IDT & TAM3)	To what extent do social aspects influence your decision to use the FabLab?
9	Marketing (IDT & TAM3)	How is the public presentation of the FabLab?
10	Feedback (IDT & TAM3)	Do you receive feedback on your projects in the FabLab?

cover a wide range of potential influencing factors. Since DIEs represent a complex structure that attempts to integrate a variety of technologies into an existing system, but at the same time can be interpreted as an innovation itself, both the TAM3 and the IDT were used as a basis. Thus, the complexity of DIEs should be considered and as many perspectives as possible should be considered. The influencing factors listed in the reference models were generalized in such a way that they allowed statements to be made regarding FabLab use, while at the same time leaving room for supplementary factors. This resulted in the ten dimensions in table 1 that were addressed in the expert interviews.

In addition to the guiding questions, sub-questions were prepared for each dimension, but these were optional depending on the progress of the interview. As guiding questions were formulated to avoid suggestion, and interviewees were directed only to broad topics. The sequence of the questions was also not predetermined. The interviewees were asked to express themselves as freely as possible and were encouraged during the interview to explain points that were not explicitly asked for. An initial pretest with two volunteers confirmed that the formulated guiding questions were easy to understand without prescribing answers to the interviewees. The actual interviews were conducted in the company itself in an appropriately relaxed atmosphere, alone with the interviewer. This ensured that possible critical factors were also openly communicated. The interviews lasted between 40 and 65 minutes and were recorded.

3.3 Data Evaluation

Our explorative research approach aims at identifying factors that influence the use of the company's internal FabLab by a wide range of employees, a qualitative data analysis approach was chosen. This is suitable for explorative research approaches when a database is to be created first (Döring & Bortz, 2016). Therefore selective protocols were used. When identifying influencing factors, the wording is of secondary importance, which is why selective protocolling according to Mayring (2002) provides sufficiently precise results. Parallel to the creation of the protocols, a category system is to be derived with the help of the object-related theory formation (cf. grounded theory (Glaser, 1978)), which permits an allocation of the statements to differentiated aspects (Urquhart, 2013). This methodology, which is known from sociology, enables the formation of categories already during the data collection or the rehearing of the recordings by summarizing statements on superordinate topics. The categorization could be made inductively, which was further developed in an iterative process during the recording of the various interviews. This methodology already falls in part into the data evaluation and is particularly suitable for explorative studies (Mayring, 2002). In a further step, the statements of the interviews were then assigned to the developed categories. Finally, the statements within the identified categories were generalized into precise statements with the help of a qualitative content analysis (Mayring, 2002). In this way, it was possible to successively reduce the complex statements of the interviewees to individual influencing factors together with their impact on usage behavior. The evaluation is done in four analysis steps: paraphrasing, generalization to a defined abstraction level, first reduction and second reduction (Mayring, 2002). The results of the data analysis are presented below.

Table 2: Identified Categories of Influence Factors of DIE Usage of Employees.

No	Category by object-related theory building	Interviewees
1	Personal motivation	M1, M2, P1, P2, R1, R2, A
2	Relevance for daily business	M1, M2, P1, P2, R1, R2, A
3	Integration into the daily business	M1, M2, P2, R1, A
4	Previous competencies	M1, M2, P1, P2, R1, R2, A
5	Workshops	M1, M2, P1, R1, R2, A
6	Trainings according to needs	M1, M2, P1, P2, R2, A
7	Software	M1, M2, P2, R2, A
8	Guided projects	M1, M2, P1, R1
9	Challenges	M1, M2, P1, P2, R1
10	Equipment	M1, M2, P1, R1, R2
11	Usage solicitation	M1, M2, P1, P2, R1, A
12	Acceptance of the manager	M1, M2, P1, P2, R1,
13	Communication with other users	M1, M2, P1, P2, R1, R2, A
14	Reputation of the FabLab	M1, M2, R1, R2, A
15	Presentation of project results	M1, M2, P1, P2, R1, R2, A
16	External presentation	M1, M2, P1, P2, R1, R2, A
17	Improvement recommendation system	M1, P1, P2, A
18	Availability of contact persons	M1, M2, P1, P2, R1, R2, A
19	Time flexibility	M1, M2, P1, P2, R1, R2, A
20	Requirements of use	M2, P1, R1, R2, A
21	DIE Premises	M2, R2
22	Personality of contact persons	M1, M2, R1, A
23	Restructuring	P1, R1
24	Permanent staff in the Fablab	M1, P1, P2, R1, R2, A

4 FINDINGS

Through the iterative process of object-related theory building (Glaser & Strauss, 1979), a total of 24 categories could be identified from the seven interviews. Some of the categories can be assigned to the dimensions previously derived through theoretical considerations, which formed the basis of the guiding questions of the interview, but some also go beyond these. Thus, the method of guided interviews in combination with the inductive category building is confirmed as appropriate for such an explorative study. In table 2, the 24 categories will be presented, and an assignment of the interviewees will be made.

The identified categories show the multifaceted nature of the perspectives of the influencing factors. Some, like "Personality of contact persons," can be clearly assigned to a previously assumed dimension (social aspects). Other categories such as "relevance for daily business", on the other hand, cannot be clearly assigned and go beyond existing theories in terms of both content and level of detail. It can therefore be deduced from the categories identified that DIEs should not be viewed solely as technologies, but rather represent significantly more complex systems with more multi-faceted factors influencing usage behavior. Single categories such as "Permanent staff in the FabLab" appear to be a company-specific category, since at the time of the interviews the company had some employees from the development department permanently located in the FabLab. These company-specific categories, which cannot provide generalizable factors, were not considered further for the analysis.

In the next step, the interviewees' propositions were extracted from the individual interview protocols and assigned to the categories. Here, the statements were successively brought to a uniform level of abstraction with the help of qualitative content analysis in the steps of paraphrasing, generalization and reduction in order to identify the final influencing factors (Mayring, 2002). In doing so, the interrelationships as well as the impact (positive or negative factor) had to be considered. In the following, the 27 identified influencing factors will be presented and explained. Individual factors were inverted to present a uniformly positive influence. Table 3 is already reasonably sorted for a further generalization loop.

Some of the 27 identified impact factors derive directly from the previously elaborated categories, while others only revealed themselves through the content analysis. In addition to the factors, the in-depth analysis also made it possible to identify their effects. For example, the equipment within the DIE was identified as an influencing factor. However, without in-depth analysis and description, it would not be possible to assess how this factor affects usage

Table 3: Identified Influence Factors and Description.

No	Influence Factor	Description
1	Self-Realization	Employees can contribute their own ideas and implement them.
2	Fun	Employees experience fun in using the DIE.
3	User Competencies	Employees have basic skills in handling the equipment.
4	Communication	Exchange among employees from different departments and areas of expertise is possible.
5	Promotion	Employees are aware of the benefits of using the DIE.
6	Encouragement	Employees are regularly encouraged to use the DIE.
7	Image	The DIE has a consistent, professional, and positive image among its employees.
8	Outcome Presentation	The results and added values are communicated consistently and positively.
9	Workshop	There is a changing offer of workshops.
10	Training	Individual training on skills acquisition is provided.
11	Projects	Guided projects are offered.
12	Competitions	Competitions with a business orientation are offered within the DIE.
13	Relevance	The work in the DIE is related to the daily business of the employees.
14	Backup	Supervisors support employees in using the DIE.
15	Hierarchies	There are no hierarchies within the DIE.
16	Terms of use	Employees can use the DIE independently of other players
17	Bureaucratic	The bureaucratic hurdles for DIE access are low.
18	Access	There are uniform regulations on the time of access of the DIE.
19	Structural Inclusion	The DIE is part of the company innovation process (e.g. the improvement proposal system).
20	Concept	There is a uniform and transparent concept of the DIE.
21	Contact person Personality	The contact person within the DIE is helpful, independent, and friendly.
22	Contact Person Availability	A contact person is available on a flexible basis.
23	Contact Person Competency	The contact person has all the necessary competencies to support the implementation of ideas.
24	Equipment	The available equipment enables the realization of products with a company connection.
25	Appearance	The DIE has a welcoming and visible appearance.
26	Premises	The premises are inviting and friendly in a central location.
27	Software	The required software is intuitive and user-friendly.

behavior. For example, the equipment requirements that have a positive effect on usage are described in more detail in Table 3. All interviewees agreed on the effects. No factor was evaluated in a contradictory way. The large number of influencing factors discussed once again highlights the complexity of the cooperation system. It also becomes clear that a digitized innovation environment cannot be understood purely as a technology, since the influence factors go far beyond those from familiar models such as TAM3 (Venkatesh & Bala, 2008) or IDT (Rogers, 1983). In order to develop a manageable model despite the large number of factors, thematically related influence factors were combined into umbrella terms. Some factors are not completely clear-cut and contain aspects of several topics. In this case, the main focus of the factor was taken as the reference. The factors can be summarized into the following seven influence categories: user (influence factor 1-3), presentation (4-8), offer (9-12), perception (13-15), structure (16-20), contact person (21-23), and environment (24-27). This results in the model of factors influencing the use of DIEs by employees shown in figure 1.

The user himself could be identified as a factor and thus an influencing factor which can only be influenced to a very limited extent. Thus, it is difficult to make changes to the sense of fun, the already given competencies or the striving for self-realization. These factors can presumably be favored by other factors such as an offer that is attractive to the specific employee, but they cannot be addressed directly by changing the form of cooperation.

The contact person was cited by all the interviews as a further exceptional influencing factor. This is special in the sense that in conventional DIEs in the private or academic context such a person rarely exists. In universities, there may well be some kind of workshop manager, but he or she is assigned other functions than those mentioned by the interviewees as being conducive to user behavior. In the private context, the dissolution of all hierarchies means that this position does not usually exist at all.

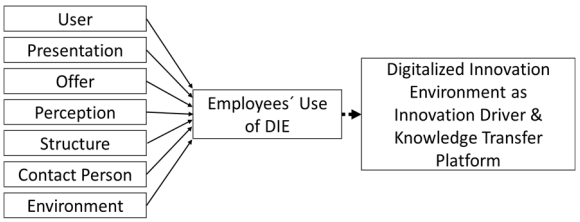

Figure 1: Digitalized Innovation Environment Use Model.

From the interviews with the interviewees from various departments, finally 27 influencing factors were derived in seven influence topics. These are not to be understood as stand-alone linear influences, but also influence each other. These correlations are to be investigated in further studies but were not the subject of this first explorative study. Going further, these factors initially form the basis for enabling the use of the innovation and knowledge transfer capacities of DIEs. Utilization alone will probably not necessarily increase innovative and knowledge transfer capacity and is likely to depend on other factors. However, utilization is a fundamental barrier to entry, without which the potentials known from the private and academic context cannot be accessed. The indicated connection between utilization and the actual function as an innovation driver in figure 1 must be investigated further in future research.

During the in-depth analysis of the interviews, several qualitative and interpretative analysis steps were necessary in order to identify the final influencing factors (Mayring, 2018). In order to exclude misinterpretations and to ensure the robustness of the results, the study was measured against the established quality criteria according to: Truth Value, Applicability, Consistency, Neutrality (Lincoln & Guba, 2007). Truth Value and Applicability are given by the detailed description of the research procedure as well as a detailed description of the underlying context. Consistency could be achieved by the close link to established models and theories and their description. Furthermore, neutrality is ensured by the research design and the successive criterion-guided interpretation. Thus, the most important criteria of credibility of research approaches are met (Schou et al., 2012). In addition, the results were validated communicatively in a final iteration with the interviewees in order to exclude misinterpretations. No errors or inaccuracies were found during the communicative validation.

In principle, the identified factors appear to represent a realistic picture. Comparable factors to the established acceptance models are found, but further factors are also identified. Since a digitalized innovation environment is not just a technology, but a complex system, the additional factors are conclusive. The complexity of the influencing factors also reflects the different perspectives of the interviewees. For example, it was to be expected that an employee from the development department would focus more on technological factors such as "software" and "equipment", whereas employees with less technical affinity would focus more on factors relating to communication and presentation. The logical validation also confirms the significance of the identified factors.

5 DISCUSSION

The factors identified as influencing the usage behavior of employees of a DIE show a very wide range. It includes aspects of the Innovation Diffusion Theory (IDT) (Rogers, 1983), Technology Acceptance Model 3 (TAM3) (Venkatesh & Bala, 2008) and Customer Orientation (CO) (Handlbauer & Renzl, 2009) identified as potentially relevant in the preliminary work, but also goes beyond them. This confirms the assumption that the introduction of a DIE into a company cannot be understood purely as innovation diffusion or as a new technology, but rather represents a multi-layered challenge. The proximity to the theories and models selected as a basis confirms on the one hand the selection of the scientific foundations, but on the other hand also shows the complexity of the process of integrating a DIE into a company. Individual aspects such as "Relevance" (TAM3: "Job Relevance"), "Outcome Presentation" (TAM3: "Result Demonstrability), "Backup" (IDT: "Extent of Change Agents' Promotion Efforts") or "Promotion" (IDT: "Communication Channels") can already be found similarly in the underlying theories and models. At this point, the findings of the study emphasize the multi-faceted nature of DIEs. They are a complex system whose use is influenced by factors known from technologies (TAM3), innovations (IDT) and customers (CO).

At other points, the in-depth analysis has led to a specification of the generic factors from the established models and theories for the specific use case of DIEs. For example, the factor "Ease of Use" (TAM3) or "Complexity" (IDT) could be differentiated in more detail for the context of DIEs and individual subordinate dimensions could be identified: e.g. "Terms of use", "Bureaucratic", "Access" and "Software". This precision provides

important insights, especially for further research, but can also be a first contribution to practice.

Finally, influencing factors could be identified, which were not considered in previous models and theories and thus consider the special system of DIEs. Thus, a special focus was placed on the contact person and their characteristics. This is interesting because in privately and academically organized DIEs there is no contact person in the sense that is demanded in the corporate context. At this point, there seems to be a stronger emphasis on results and outcomes in companies and the try and error mentality from the maker community is not yet established (Bergner, 2017) These additionally identified influencing factors contribute to the understanding of DIEs and their underlying structures. In addition, they represent a new perspective from which to investigate the phenomenon of DIEs in further research.

In terms of content, the factors range from those that are easy to influence, such as appropriate equipment and a welcoming atmosphere, to those that are much more complex, such as the personality of the contact person. Here, the various interviewees also seem to set different priorities depending on their individual backgrounds. Nevertheless, many factors were addressed by several department representatives. In general, there was agreement on the respective impact of factors among all interviewees. The different focus could come from the different usage perspectives of the employees, but this cannot be validly confirmed on the evidence base. For example, it seems conclusive that an employee from the development department is more interested in the implementation of prototypes and is therefore focused on the equipment, while an employee from the marketing department, would rather use the DIE to acquire competencies and is therefore more interested in an interesting workshop offer.

It can also be deduced from the identified influencing factors that employees have a certain understanding of service from a DIE. A competent and flexibly available contact person within the DIE is a central aspect which is considered important by all department representatives. In a way, this contradicts the original concept of a DIE, which benefits from its intrinsically motivated users and their exchange with each other. In the private and academic context, such permanently available contact persons are not envisaged outside of specific event formats. Rather, the approach relies on the formation of a community in the DIE that develops its own momentum and can therefore operate without an internal structure and hierarchy. Here, the identified influencing factors are an indication that employees have a different interpretation of a DIE than private or academic actors. In the analyzed company, this may be due to the fact that in the year in which the DIE was available, different strategies for integrating it into daily business took place and, in particular, there was no uniform concept at the beginning.

Basically, the multitude of different influence topics also illustrates the complexity of the task of integrating a DIE into an existing company and supporting cooperation. It becomes clear, for example, that a room with many digital technologies without restrictions on use is not sufficient for actual employee use. The influencing factors go far beyond those known from other acceptance models and form a much more complex web. For example, organizational and social factors also play a decisive role. In addition to these quite subjectively perceivable factors, the user himself was also identified as an influencing topic. Also factors were mentioned, on which a company can take influence only indirectly. For example, whether an employee enjoys using digital technologies depends heavily on his or her interests. Here, the company can create a favorable atmosphere through other identified factors but will not achieve this with every employee. Rather, the identified influencing factors form a framework on the basis of which an individual concept can be developed for a specific company.

6 LIMITATIONS, OUTLOOK AND CONTRIBUTION

The present study has a couple of limitations, which are presented below and from which further research needs are to be derived. Due to the very specific condition of deriving the factors from employees' experiences in actually using a DIE, the selection of possible study participants is severely limited. Although a broad spectrum of employees from different departments could be recruited for interviews, the results cannot be generalized without restrictions. It must also be critically reflected that only one company is considered as a case in the study. This is due to the fact that such an integration of a DIE into an existing company is a rare constellation and the recruited company takes a pioneering role. It is also important to point out the many interpretative methodological steps, which, although they were carried out with the greatest care and orientation to quality criteria, cannot completely rule out bias. Finally, it remains to be stated that some of the

identified influencing factors suggest that there is a correlation between them, but this could not be investigated in more detail in the process of this research.

These correlations should be addressed in further research to further expand our understanding. Also, a quantitative evaluation of the influencing factors would be a logical next step. Thus, further weighting of the factors could be undertaken. Building on these findings, it would then be possible to revise existing models of cooperation and integration. The phenomenon of DIEs has already proven to support open innovation and digital innovation (Zakoth & Mauroner, 2020). With the help of the new insights gained it will be possible reach the long perspective goal of unlocking these opportunities for companies as well and thus address some key blind spots of innovation and knowledge management research (Nambisan et al., 2017).

Thus, the findings of this research make a valuable contribution to the IS landscape on several levels. On the one hand, it provides an empirical basis for further research, and on the other hand, it offers valuable insights for practice. DIEs, with their digital technologies and communities, constitute a new phenomenon in the IS discipline and have been little studied to the current point. The first step is to create a basis on which empirical research is possible. At this point, the influencing factors guide a first important step towards integrating such DIEs into corporate contexts. The further research approaches are manifold and can take different perspectives such as DIE technologies, DIEs as competence incubators or DIEs as communication platforms (Hellwig et al.).

Complementary to the scientific contribution, significant added value can also be provided to practice. The integration of DIEs in innovation processes has already been identified as a promising approach (Bergner, 2017), but has so far failed in implementation. At this point, the factors influencing user behavior offer initial insights into the design of efficient integration or cooperation. Thus, the results of this study form a valid basis for a variety of further research approaches to better understand the phenomenon of DIE and, at the same time, to gain an important contribution to practice.

7 CONCLUSION

Digitized innovation environments as an umbrella term for various facilities such as FabLabs, Makerspaces and InnovationLabs are already known from the private context and have already established as competence incubators in the academic environment with their digital technologies. However, integration or cooperation with companies has so far taken place only very partially and to a limited extent. In order to be able to investigate the potentials of this new phenomenon for companies as well, the present work intended to identify factors influencing the usage behavior of employees of a company of DIEs. By conducting extensive guideline-based expert interviews with seven employees from different departments of a company, it was possible to identify these through successive analysis and interpretation. The interview guidelines were based on established theoretical models such as TAM3 (Venkatesh & Bala, 2008) and IDT (Rogers, 1983). A total of 27 influencing factors were identified, which can be assigned to the seven topics: user, presentation, offer, perception, structure, contact person, and environment. These influencing factors go beyond known factors from the underlying models and show the complexity of the phenomenon DIE. It also illustrates that DIEs should not be understood as space with digital technology only, but that many other aspects also influence this construct. A critical reflection of the identified factors on usage behavior suggests that a universal concept for integrating a DIE into a company is a utopian notion and that there must be specific employee-dependent approaches.

The findings provide a basis for further investigation of this still largely unknown phenomenon. Thus, further investigation of usage factors and their correlation with each other is a purposeful next step. In addition to the contribution to the scientific IS landscape, the findings offer added value for practical applications, which is a key claim of IS research (Nambisan et al., 2017). For example, the factors can support companies in the development of suitable concepts for the integration of DIEs, which in turn provide the basis for further empirical research. Thus, the present work contributes to both science and practice and has great potential for connecting research.

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