Knowledge Sharing Between Higher Educational Institutions: Evaluation of a Transfer Platform

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Abstract: The paper presents a platform for knowledge and technology transfer processes and relevant information for higher educational institutions (HEIs). Nowadays knowledge transfer or third-mission activities are daily business for universities. Nevertheless, they often lack internal standardized processes and procedures. Every HEI tends to establish their own way of efficiently handling transfer activities, without sharing their knowledge with other HEIs. The presented platform outlines standardized processes with knowledge from several HEIs, presented in digitized form. The processes and the platform were evaluated with use cases and a standardized user experience questionnaire (UEQ). The results presented in this contribution indicate a high need for and positive perception of the processes and the platform.

1 INTRODUCTION

Transfer of knowledge and technology from and to higher educational institutions (HEIs) is a key driver for innovation and change. This idea is often summarized by the terms *third-mission* or *transfer* (Zomer and Benneworth, 2011), which are described by many different models with a lot of different characteristics. Throughout this paper, the term transfer is used for the idea of knowledge and/or technology transfer. In a concrete transfer situation, the transfer object is the actual knowledge, new theory or a newly developed technology. This includes, among other things, the communication of research-based knowledge, scientific consulting, and the application of knowledge and technologies derived from research to solve real challenges faced by the economy or society. Knowledge in this context refers to the totality of scientifically developed findings (Wissenschaftsrat, 2016). In this process, knowledge is represented declaratively by concepts, statements, or models as well as procedurally by research methods and process skills (Zack, 1999). Technology transfer refers to methods, procedures and courses of action that range from scientific and technical work to social or artistic techniques (Santoro and Gopalakrishnan, 2000). Lately, there has been a shift in universities to move from 'just' teaching and performing research to interact with and contribute more intensely to society (Urdari et al., 2017). These activities are often associated with the term *third mission*, which describes a deeper exchange of HEIs with society (Compagnucci and Spigarelli, 2020). This, of course, has presented HEIs with new internal challenges. In addition to the tasks that the administration previously had to perform only for the operation of teaching and research, activities for the processing of *third mission* projects are now added on top. Every HEI tends to establish their own way of efficiently handling transfer activities, without sharing their knowledge with other HEIs.

As administrations are slowly starting digitalization initiatives and the complexity of administrative tasks rises, the idea of sharing knowledge about all necessary procedures between HEIs emerges (Doering et al., 2021). The objective of this paper is to evaluate a tool for the efficient handling of knowledge and technology transfer activities of HEIs, developed by the authors, which is the *Transfer Platform* (TP). The suggested processes and procedures are developed on basis of shared knowledge by six German universities. These universities have established a network for transfer, called TRIO (Transfer and Innovation in

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Eastern-Bavaria), with the aim to expand and actively shape their knowledge and technology transfer.

1.1 Transfer Platforms in HEIs

To examine the current state of platforms or tools for the handling of transfer activities in HEIs, a systematic literature review (SLR) was conducted. Following the guidelines of PRISMA (Moher et al., 2010)[1], the literature search and analysis was structured accordingly. In the process of selection by title, abstract and paper content, a total of 13 papers were found for further review, which indicates a comparatively limited theory and analysis on how knowledge is shared between universities (Doering et al., 2022). This has then led to the design of an own concept, which is evaluated within the scope of this publication. The platforms and tools, which were found in this review are dedicated to collaboration and knowledge sharing for mainly educational purposes, like e-learning or the assessment of learning processes. Only limited theory and analysis on how universities, who collaborate with each other, could share their knowledge with each other was found. As a result of the fact that the literature review did not reveal any transfer platforms or equivalent models, the authors recognize a research gap, which may be closed with the proposed TP. The structure of the paper is as follows: a brief overview on how the TP was built will be given in the next section, followed by the evaluation methodology and study design. Next, an in-depth evaluation of the tool and its contents (applicability, usability, and user experience) is outlined. The most important evaluation results are then presented in the following section. In the discussion, the authors conclude on the obtained results from the evaluation and analyze the contribution of this research, its limitations and possible future research issues.

2 TRANSFER-PLATFORM: CONCEPT AND IMPLEMENTATION

Given the need for a digital and standardized representation of transfer processes and procedures in HEIs, a TP has been conceived to support the ease of the transfer activities. The transfer-platform is a web-based tool meant to provide assistance regarding all activities around the life-cycle of a transfer activity - starting with the initiation, the handling and finally the completion of a transfer activity. The tool provides a set of functionalities for choosing the best fitting processes and relevant documents. The TP is based exclusively on HTML and CSS. For the reuse of single HTML-elements JavaScript was used. All presented processes were developed and evaluated iteratively, using the Design Science Research (DSR) paradigm by Hevner (Hevner and Chatterjee, 2010). In a four-loop approach, the processes were created and evaluated in a user-centered approach, following the recommendations of the ISO 9241-210:2010 (Ergonomics of human-system interaction — Part 210: Human-centred design for interactive systems) (International Organization for Standardization, 2023). The first two creation and evaluation loops are based on expert interviews and their feedback. Hereby, in a first step, expert interviews were conducted to gather relevant process steps and information. Expert interviews were chosen as they are a typical research method in DSR (Offermann et al., 2009) and appear to be adequate given our project context in which there is only a fairly small number of possible interviewees with transfer-related knowledge. The results were then integrated in a first version of the process model, which was then re-evaluated, again by expert interviews. In this first version, the main core, support and management processes were gathered and incorporated into a regulatory framework of our reference model.

This second evaluation has then led to a revised version of the reference model. To evaluate the modified version of the model, relevant use cases were determined and modelled into the core processes of the framework. With this method, the revised version has been evaluated, which has led to the final set of processes and documents within the reference model.

For better usage and an improved understanding, the whole model was then integrated into the software-based TP (see Figure 1). The TP shows on its landing page on the right side the different core, support and management processes of transfer projects. The user can then choose a process in which he/she has interest in and by clicking on it, a detail view of the respective process opens up (see Figure 2). There, the user can find a textual description of the process and the possibility to download it as a Business Process Model and Notation (BPMN) model. In addition, a fact sheet gives a short overview of the process, its main actors, and its results.

To evaluate the TP (e.g. its design, usage and efficiency), it was then assessed using the standardized method User Experience Questionnaire (UEQ) (Schrepp, 2020), as this is a fairly easy to handle and brief questionnaire. This UX questionnaire was ex-

[1]"Preferred Reporting Items for Systematic Reviews and Meta-Analyses". https://prisma-statement.org [Accessed: 25.05.2023]

plicitly chosen from the various number of different UX questionnaires, as it considers usability and the hedonic quality of a system or product to be of equal value, which is not represented in for example the SUS or UMUX-LITE questionnaires (Schrepp et al., 2023). This parameter is particularly important in this evaluation, as the users need to like using the TP, because otherwise it must be assumed that the TP would not be used.

3 METHODOLOGY

Any research should follow an appropriate research paradigm to demonstrate robustness. To meet this requirement, the research results presented in this contribution were evaluated based on the reference modeling research of Fettke and Loos (Fettke and Loos, 2003). According to them, a variety of different evaluation methods for reference models exist. One possible way is to use case studies (Yin, 2018). Other evaluation methods include for example surveys, fields studies and laboratory experiments (see (Fettke and Loos, 2003)). Case studies examine a reference model situation at a specific point in time within the concerned context. They are often found where other research methods are not possible due to the complexity or scope of the context. Case studies involve a user, who is solving a practical and representative problem with the reference model (Turnbull et al., 2021). A case study therefore describes a real problem, possible solutions and results. The advantage in the use of case studies is that the creator of the model can obtain important information, e.g. on the application of the processes, directly from the model user. Normally, the model creator and the model user sit together and go through the model together and check it for inconsistencies or for potential improvement. However, case studies are often not representative and cannot be generalized, which can lead to subjective reference models. Nevertheless, this approach was chosen, as this made it possible to obtain a comprehensive survey of the problem and possible solutions directly from the concerned users. This is also the great advantage of using case studies over use cases. Here, a tried and tested solution can be used, while a use case would only cover possible solutions for the handling of transfer. As, during the creation of the reference model and its processes, all single steps were evaluated over and over again, an evaluation with before tested and used processes was possible. Since the case studies were carried out at several universities and the results were subsequently consolidated, it can be assumed that they are at least partially generalizable. Also, it is often suggested that problems in the usage should be identified as early as possible in the development and modeling of new systems, which is possible with the usage of case studies as evaluation method (Hornbæk et al., 2007). For this evaluation, two specific use cases for the processes and the TP were chosen, as they both incorporate the main steps in the initiation and handling of transfer activities and therefore provide a good overview of all the important aspects.

3.1 Expert Interviews with Case Studies

Working together with experts is particularly suitable in a context where the content is still comparatively new and unpredictable. This is especially true when emphasis is placed on real-time interaction and bringing together different perspectives (Hornbæk et al., 2007). Therefore, specific case studies were generated and discussed together with the experts. In this context, an expert is a person with specific expertise and knowledge that can be acquired, for example, through a specific job in a company or organization.

Table 1: Overview of experts and their background.

Number	Experience	Position
Expert 1	7 years	Department Head
Expert 2	3 years	Employee
Expert 3	21 years	Employee
Expert 4	11 years	Department Head
Expert 5	8 years	Vice President
Expert 6	2 years	Employee
Expert 7	6 years	Employee
Expert 8	10 years	Department Head
Expert 9	12 years	Vice President
Expert 10	8 years	Department Head
Expert 11	7 years	Employee

Criteria for the selection of experts include a minimum of three years of experience and professional experience in the conduction of transfer activities and a current job position in the direct area of knowledge and/or technology transfer. They all have a special view on the topic of transfer processes and bring different perspectives to the discussion. All of the experts work at HEIs, but at the same time they have a large knowledge base from the other transfer side, for example, because they themselves have worked in companies in a transfer position or support companies that want to cooperate with HEIs in their current position. Table 1 provides an overview of the professional background and experience of the participants. All experts are employees at a German HEI, where they work for example as Department Head of a Transfer

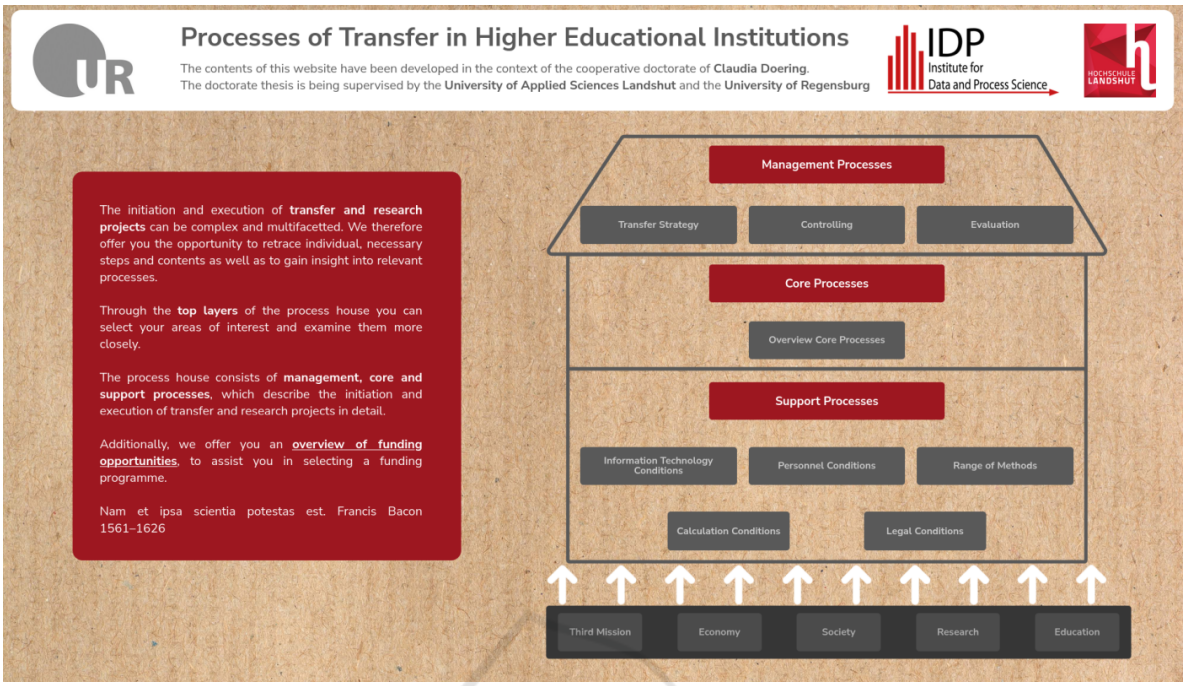

Figure 1: Landing page of transfer-platform.

and Collaboration Department or are Vice Presidents for Knowledge and Technology Transfer. In total, experts from six German (research) universities as well as universities of applied science were consulted. In this evaluation loop eleven interviews were conducted (one interview with each expert).

Based on the requirements analysis carried out and considering the conceptual requirements identified in advance, the system architecture was designed successively. The result is described below with the help of corresponding UML diagrams. Each case study was described according to a scheme based on Rupp (Rupp, 2009). It contains the component's name, a brief description, actors, results, and essential process steps. Based on the functional requirements, use cases were defined and formulated.

Case Study 1:

The problem domain of case study 1 is **contract research** done by HEIs. Figure 3 shows the corresponding use case diagram. In general, contract research is scientific research commissioned by a private-sector or public-sector funder (= client). The process regulates the application and implementation of non-public industry projects at universities. The goal of the research is specified by the client, and the rights to the research results are in most cases reserved for the client. The content of the contract is defined in a research and development contract concluded between the client and the HEI. When all parties have agreed on the project content and the contract is signed by both parties, the project can be carried out.

Fact Sheet of Process:

- Name: Contract Research
- Brief description: the use case describes which actions are necessary to initiate and execute a contract research project
- Actors: client, researcher, research consultant, employee of a HEI administration
- Results: knowledge or technology development and transfer
- Essential process steps: communicate project idea; re-conciliate project idea; agree on project content; set up project profile and contract; execute administration; carry out industrial project

Case Study 2:

The problem domain of case study 2 is **third-party research** done by HEIs (see Fig.3). Third-party funding is defined as financial resources that flow to HEIs from third parties in addition to the current funds provided by the funding bodies (basic funding). As a rule, they are made available for a limited period of time for specific projects, for example research projects. Research funding can be provided by both national and international funding agencies. According to the German federal ministry for education,

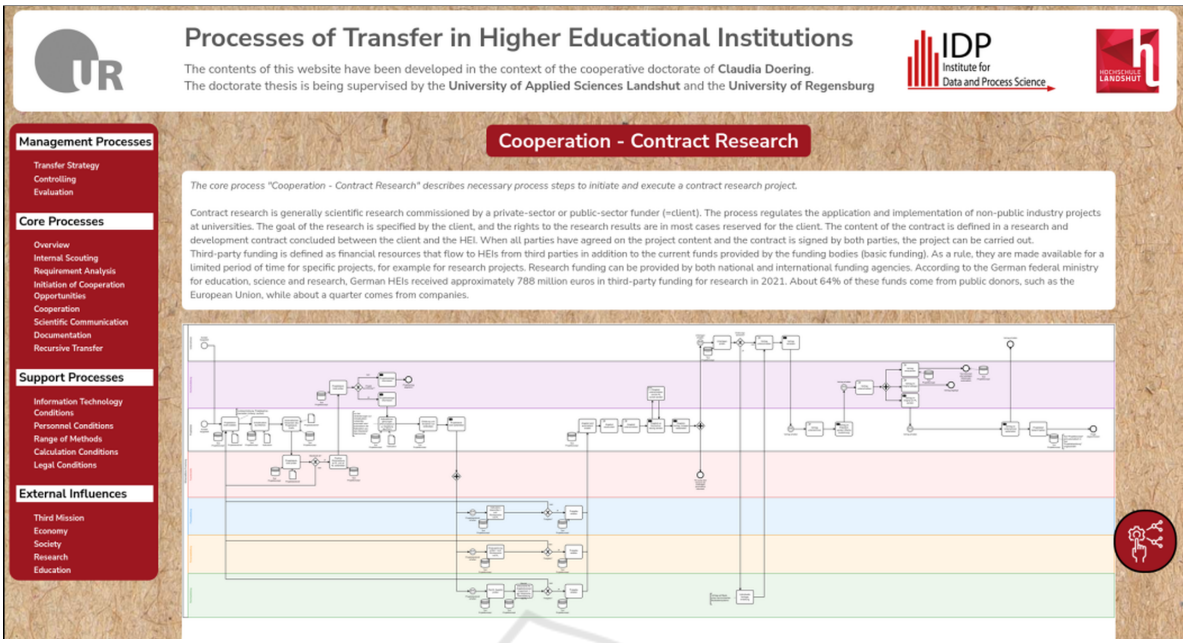

Figure 2: Overview of the process cooperation in contract research.

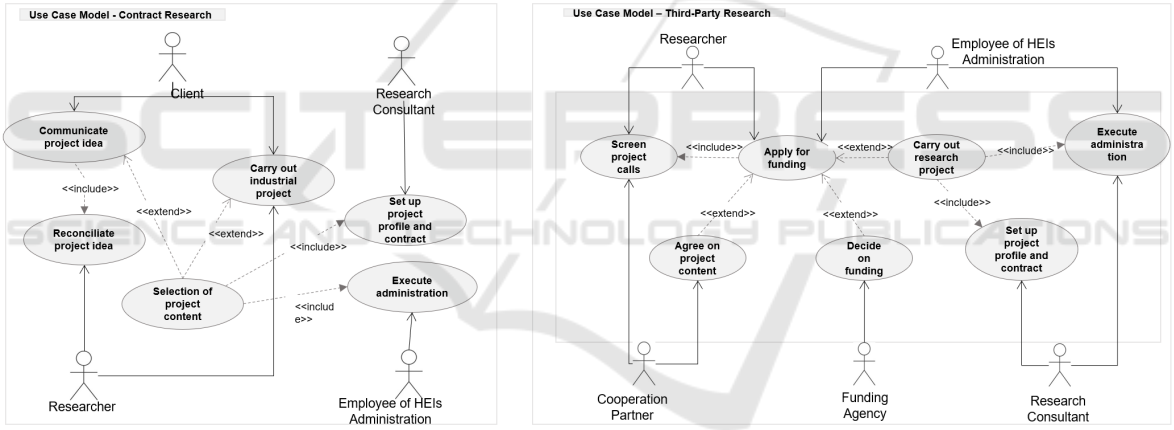

Figure 3: Use Case Diagram of Case Study 1 (Contract Research) and Case Study 2 (Third-Party Research).

science and research, German HEIs received approximately 788 million euros in third-party funding for research in 2021 (Bundesministerium für Bildung und Forschung and (Federal miniatry of Education, Science and Research), 2023). About 64% of these funds come from public donors, such as the European Union, while about a quarter is funded by companies. In contrast to contract research, which is generally referred to as the traditional transfer, it is a bit more difficult with third-party funded research. This type of research is often associated with the goal of developing new technologies, products or processes and aims to bring scientific knowledge and technologies from academia into practical applications. The results of such projects can take the form of patents, licenses or prototypes, for example, and find their way into industry or the market. New ideas and concepts are developed to address existing problems and open up new opportunities. This innovation process is an important aspect and clarifies third-party research as a transfer activity.

Fact Sheet of Process:

- Name: Third-Party Research
- Brief description: the use case describes which actions are necessary to initiate and execute a third-party research project
- Actors: researcher, research consultant, employee of a HEI administration, cooperation partner, funding agency (e.g. project sponsor)

- Results: knowledge or technology development and transfer
- Essential process steps: screen project calls; agree on project content; apply for funding; decide on funding; set up project profile and contract; carry out research project

The two cases studies were chosen for evaluation as they cover the majority of processes within the reference model and therefore enable an extensive evaluation of the model. Furthermore, these two use cases serve as a major source of funding for research for HEIs. Generally said, funding originates either from companies or from government (and a small amount from charitable foundations, private persons, etc.). Therefore, these two case studies represent two of the most important transfer scenarios for HEIs.

3.2 User Experience Questionnaire

The user experience questionnaire (UEQ) is a standardized questionnaire to survey the user experience of products (Schrepp et al., 2023). User experience can be defined as the ”user’s perceptions and responses that result from the use and/or anticipated use of a system, product or service” (International Organization for Standardization, 2023). Accordingly, user experience (UX) comprises the factors of emotion, comprehensiveness and usability of a product before, during and after use (Hinderks et al., 2019). One possible metric to measure UX is the usage of the UEQ. It consists of 26 items that are grouped into six scales (attractiveness, perspicuity, efficiency, dependability, stimulation and novelty). All items are presented in the form of a semantic differential, which means that each item is represented by two terms with opposite meanings.

4 FINDINGS OF EVALUATION

The purpose in evaluating reference models is to test them for their value and usefulness. In this way, the suitability of the reference model to a certain situation, in this case the transfer of knowledge into and out of HEIs or university networks, is analyzed and evaluated.

Findings From Case Study Evaluation:

- The chosen case studies and their representation as core processes of transfer correctly display the experiences of the experts.
- The single process steps in the two chosen case studies show the respective scenarios in great detail, which was perceived as positive. However, this makes it difficult for HEIs that already have their own process ideas to find points of reference. Hence, it was requested whether it could be possible to upload own processes and then receive automatic feedback for potential process improvements.
- The opportunity to obtain further information via links and the overview of funding possibilities are perceived positively by the experts.
- A discussion forum or an other way to exchange information about the different transfer scenarios was also suggested by the experts. In this way, they could easily interact with corresponding persons in other HEIs.
- Processes are only available to download in the modeling language BPMN 2.0. This format cannot be integrated in all different process administration software used by HEIs and can be difficult to understand without any previous modeling knowledge.

Findings from UEQ:

In total, 12 questionnaires could be analyzed, which were sent in advance by e-mail to the selected participants. The participants are directly related to the initiation and execution of transfer project in HEIs. For this reason, the responses to the questionnaires constitute a representative opinion. It may happen that individuals misinterpret the individual items. An exemplary scenario for this is the item ”safe/unsafe”. This item is intended to consider or depict the following aspect: *To what extent is the interaction by the user to be classified as safe and controllable?* However, the respondents could also interpret this item as follows: *Is the protection of my data guaranteed?* This may result in an inconsistent evaluation.

The results of the UEQ can be interpreted by the means of scales. They range from -3 (horribly bad) to +3 (extremely good). The findings from the evaluation with the UEQ are shown in the following by their means:

- Attractiveness: 2,056 (TP makes an overall good impression and the users seem to like it)
- Perspicuity: 1,792 (TP seems to be reasonably easy to learn and to get familiar with)
- Efficiency: 2,146 (TP supports the users in solving their tasks without unnecessary effort)
- Dependability: 1,729 (The users feel somewhat in control of the TP)
- Stimulation: 1,667 (The use of TP is moderately motivating and somewhat exciting)

- Novelty: 0,917 (TP is regarded as a not very creative or innovative software and therefore does not catch the interest of users)
- After the UEQ evaluation, all of the experts also gave some additional comments about the TP in general.
  - The design of the TP was assessed very differently by them. Some liked it very much, others found it too playful.
  - All of the experts found that the usage of the TP is very easy to learn and that it is easy to navigate through the pages.
  - In general, the TP does meet the expectations of the experts, but some thought that it could replace an own process portal, which is interconnected with all relevant administrative departments.

5 DISCUSSION

This research can be seen as a first step to digitalize processes in the transfer administration of HEIs. Although the concept of digitalization is not new, in some areas the administration of HEIs is still at a starting point for this change. The streamlining of processes and the topic of digitalization have already been covered in many publications regarding HEIs, but most of the times with a clear focus on teaching (e.g. massive open online courses), student applications, student mobility digitization (like e.g. the applications ELMO or EMREX) or campus management systems (Bacharach et al., 2021). In the sense of a faster and waste-free completion of administrative activities for transfer, it is the goal of digitalization in HEIs to simplify processes and administrative procedures. In order to achieve this, the present reference model has been developed and evaluated.

The reference model seems plausible and implementable at first glance - but, as recently stated by a big German newspaper in March 2023, many digitalization projects in administrations fail already at the implementation of basic digital procedures (Bernau, 2023). For example, German members of the Bundestag had to fill out a form to declare their sideline activities until January 2022. Now, more than a year later, this information is still not available on the website of the Bundestag, as the form could not be filled out electronically. Members of the Bundestag had to hand in their details on paper and employees of the Bundestag had to type them in and sent them back to the members of the Bundestag for checking. With currently 736 members of the Bundestag and a 20-page form, this results in approximately 15,000 pages of paper. This is just one example for possible digitization approaches and missing or hindering administrative processes. After all, it worked and also knowledge and technology transfer projects in HEIs were carried out with only little digital support and usually with processes adapted depending on the situation.

A possible methodological limitation of this research is the comparatively small number of experts for the evaluation. Therefore, this evaluation can only be seen as a starting point for future research, which needs to incorporate more users from different forms of HEIs from Germany and other countries. Therefore, it is crucial that the administrations of HEIs open up and share their knowledge with each other.

Due to the limitation of this publication, it was also only possible to include two relevant case studies, which restricts of course the possibilities to generate knowledge about the processes and the TP.

Another limitation of this research is that until now only core processes of transfer activities could be evaluated. This is mainly due to the fact that management and support processes for transfer are very heterogeneous and differ strongly between research universities and universities of applied sciences. This in turn is mainly because of different strategic orientations of the HEIs.

6 CONCLUSION AND FUTURE WORK

The streamlining of processes and the avoidance of waste are integral parts of process improvements and therefore also an important starting point for research and practice. This publication and the developed reference model focus on the digital support of knowledge and technology transfer projects and a streamlining of necessary processes and procedures at HEIs.

The current status-quo of the reference model and the transfer-prototype were developed on basis of knowledge about processes and procedures from six universities. This contribution outlines the evaluation process with the remark that it should be evaluated in the future at other universities and possibly also across national borders.

In the evaluation points for improvement were found, which will be integrated into future work. One main remark of the experts in the evaluation was that the process modeling language BPMN 2.0 is hard to understand without any prior modeling knowledge or explanation. Therefore, a process caption will be introduced and the processes are also going to be explained textually in future work. With this approach,

established methods from business informatics (e.g. the modeling language BPMN or process modeling in general) are combined with those from media informatics (e.g. UX, evaluation of functionality and user experience quality, user centric development). This interdisciplinary approach is especially crucial to ensure the sustainable use of the TP.

Another approach to further improving the TP is to enable users to include their own knowledge in the suggested processes and to make suggestions on modelled procedures. This could simplify the activity to keep processes up-to-date, but also comes along with technical challenges and a huge coordination effort. The same also applies to the proposed discussion forum.

A further potential starting point for further developments is the design of the TP. Some experts found it nice and intuitive, whereas others found it too playful and complex. As preferences for design are very personal, the main focus of improvements will be laid on the usability of the TP.

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