# Process Model for Digital Transformation of University Knowledge Transfer

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Abstract: The digital transformation is still a volatile concept with different understandings between researchers and practitioners. Nevertheless, digital technologies and concepts are finding their way into all areas of life, be it private or professional life. Even universities are not spared from digital transformation. They need to incorporate innovations not only within their curricula, but also in their inner structures and administration to ensure up to date research and transfer. Therefore, a structured model for the digital transformation of transfer in universities was created. The main purpose of this paper is to provide practical support and break down barriers in the digital transformation of knowledge transfer in and out of universities.

## 1 INTRODUCTION

Economy, society and research are currently experiencing a global surge in digitization, which is partly due to the pandemic, or at least reinforced by it. Processes, procedures and production steps are being digitized, just as meetings, schooling and studying.

At the same time, the importance of knowledge transfer is continuously increasing due to various stakeholder groups. Companies, society, universities and other research institutions, as well as politicians, are recognizing this importance and are promoting transfer and calling for it to be intensified. For example, in Germany, a Higher Education Innovation Act is planned, which is expected to be passed this year or next year and which emphasizes a central role of transfer (Bavarian Ministry of Science and Art, 2021). Knowledge and Technology Transfer, is one of the central tasks of universities, like research and teaching (Bavarian Ministry of Science and Art, 2021).

Digitization in the context of universities affects all areas of higher education institutions. Research is already in the transformation process through an increasing establishment of research information systems, and teaching is also in the process of this transformation. In addition to pandemic online teaching, MOOCs (massive open online courses) have already gained attention for themselves in recent years. These are online courses, mostly free of charge or accessible for small fees, which students from all over the world can use to educate themselves in a wide variety of topics.

However, the knowledge and technology transfer of universities has not yet been sufficiently digitized (Doering and Timinger, 2020).

Transfer often takes place "via heads", which means that people spread knowledge and technology, for example as part of a student's thesis in a company (Liyanage et al., 2009). Such knowledge is called tacit knowledge, which is non-codified knowledge that is acquired through informal behavior and procedures (Howells, 1996). In this case, knowledge from academia is brought into the company, but on the other hand, practical application cases are also brought from the company via the student into the university (Roessler, 2015). Other types of transfer include cooperation projects between companies and universities, patents, or presentations and workshops. For successful tacit knowledge transfer, universities

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need to address the human, social and organizational culture factors (Joia and Lemos, 2010).

In order to intensify the transfer between companies and universities, target group-specific information is needed. Target groups are in this case, collaborating partners from society and industry, but also employees of universities, in knowledge transfer departments. Furthermore, studies have shown that the geographical proximity between companies and universities influences the intensity of transfer (Arundel and Geuna, 2001; Laursen et al., 2011). If project consortia are made up of various specialists from different sectors of the economy, it can be assumed that the physical distance between these specialists and the universities is large. In most cases, the distances are not limited to individual regions or countries; in many cases, the parties are even distributed globally. The proximity needed for satisfactory knowledge transfer is missing. In order to establish this, a way often chosen is the digitization of the transfer process in all its facets. In this context the term digitization means the transformation of a process from analogous to digital data, whereas digitalization is to use digital technologies to transform business processes and business models and create new revenue and value opportunities. It is the process of using digital technologies and information to transform business operations. The often used term digital transformation refers to a strategic transformation that requires both, organizational change, and the implementation of digital technologies.

By means of this digitalization, continuous dissemination of research results – and thus, transfer of knowledge and technology – is possible. The advantage of digital transfer is that dissemination can take place globally and continuously.

Universities must use digitalization in order to be able to exploit the digital transformation for their own benefit. Many universities are active in the area of teaching and research in the subject area of digitization, although some internal procedures and processes are not digitized. Digitalization is being taught by universities but not applied in their own structures and processes (Doering and Timinger, 2020).

In order to give universities an impulse for digitalization, a generic process model is necessary which describes the various steps and stages of the digitalization of a transfer process. Digital platforms for knowledge transfer can be considered as an enabler for innovation and problem solving within transfer projects (Hossain and Lassen, 2017).

Therefore, this paper proposes an approach for a process model for digital transformation of university transfer processes in order to qualitatively and quantitatively increase knowledge transfer with the economy and society.

**RQ1.** How can the process of the digitalization of university transfer processes be displayed in a structured process model?

**RQ2.** What are possible challenges in the digital transformation in universities and in which ways can digitalization of university transfer processes be initiated?

This article is divided in the following sections: at first, the relevant research design is summarized. The framework for digital transformation is then outlined in the following section to answer RQ1. The next sections cover RQ2 and outlines several challenges in the digital transformation within universities.

An overview of the evaluation of the results with a theoretical case study and an outlook completes this contribution.

## 2 RESEARCH DESIGN

A comprehensive research method is needed to ensure a high degree of quality of research. Therefore, Design Science Research according to HEVNER and CHATTERJEE is used within the scope of this research (Hevner and Chatterjee, 2010). They describe two approaches, the Design Science and the Behavioural Science. Whereas the latter aims at the construction and validation of hypothesis, Design Science Research focuses on the creation and evaluation of IT-artefacts, which are build and evaluated in alternating and iterative phases. In this context the presented model is the artefact of research. HEVNER and CHATTERJEE present seven guidelines for the rigorous research.

As this research method aims at solving an essential business problems, a systematic literature review according to the guidelines of VOM BROCKE was conducted to prove the relevance and fulfil the request for rigorousness and support the research as a search process (Vom Brocke et al., 2009). To disseminate the information and the related model as well as to fulfil the seventh guideline of HEVNER and CHATTERJEE, it will be published in this conference and in an accompanying doctoral thesis.

To evaluate the process model for digital transformation, expert interviews were conducted. All expert interviews were executed as semi-structured interviews according to the principles of
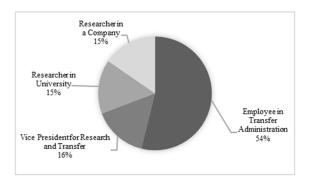
Figure 1: Overview of Roles of Experts.

MEUSER AND NAGEL (Meuser and Nagel, 2009). According to these guidelines an expert is a person with special knowledge which is accepted by society as relevant expert knowledge. In order to be able to select the experts on the basis of specific criteria, the guidelines of MEUSER and NAGEL were applied (Meuser and Nagel, 2009). According to these guidelines, an expert is a person with specialized knowledge, which can often have been acquired through the specific position in the company or in the university. In total 13 experts, all situated in Germany, were surveyed with a length of at least 30 minutes up to 90 minutes. They were carried out in 2021 using the online platform Zoom. The first questions dealt with the experience and the background of the experts (Figure 1). More than half of the experts, namely seven, are employed in transfer administrations of higher education institutions. Two are researchers in universities, and two experts are researchers in a company. Two of the experts are Vice Presidents of Research and Transfer of a university. The types of higher educational institutions, in which the experts are employed, ranges from universities, universities of applied sciences and technical universities. Furthermore quality criteria according to MAYER were considered (Mayer, 2013). The objectivity of the interviews is ensured by the independence of the experts. The data acquisition was conducted under equal conditions, with concrete specifications for the provision, evaluation and interpretation of the interviews. Reliability guarantees that the same results appear at the end of the research, if it was conducted under the same conditions. This quality criterion was ensured through the conduction of pre-interviews. Validity ensures that a suitable research design was chosen according to the specific research questions. As the results of the interviews can be generalized for knowledge transfer situations for all kinds of transfer possibilities, the validity of the interviews is ensured.

## 3 PROCESS MODEL FOR DIGITAL TRANSFORMATION IN UNIVERSITIES

The model consists of four phases, three of them consisting of several views each. The phases are shown in ascending order of the maturity level to the right; the different views symbolize that there are several potential processes or possibilities in these phases (Figure 3).

The first phase is to elicit the current status in relation to the existing analogous and digital structures and data. This is exemplified by the Design Thinking process, but the other views also indicate other possible variations of the elicitation. The following phase is the Enabling Phase, in which the data is already available digitally, but is not linked to each other. Furthermore, the processes are not modeled or captured. Here, too, different views are possible. The initiation of process changes or general changes in the course of digitization can take place in different ways, also represented by different views (cf. **RQ2**). The Development & Implementation Phase is the first phase in which steps backward, i.e., iterations, are possible. First, the structures and data are available digitally, which means that processes have already been differentiated, process owners have been selected and named, and digital process management is already in place. This means that the Development and Implementation Phase is therefore firstly characterized by a basic digitization level. Within departments process management systems can be used, but there are no service-oriented or cloud-based approaches for cross-department tasks within transfer activities.

The next step, but still in this third phase, is process automation, which involves, for example, the rollout of automated workflow. When moving on to a process automation approach cross-department digitization can occur, when process are implemented in e.g. a research information system.

The last phase is the Sustaining & Systematic Change Phase, which contains new business models. In this case, this means that new areas and ideas can be addressed and dealt with. A digital transfer process has therefore been achieved and a new business model or a new strategy can be implemented. Phase two, three and four are underpinned by a foundation, it is the Research Information System, starting partly integrated in the Enabling Phase.

The roof is filled with different gears implying different initiation ways of the digital transformation. Depending on the current circumstances, the gears

rotate around the Organizational Culture gear and digitization processes are initiated via different participants – symbolized by the different gears.

The gears act as a unified and closed system. Some of these areas have an influence on areas outside the university. At the same time, these areas also have an influence on the university. In collaborations with the economy, the areas influence each other, and the digital transformation can take place from the university to the economy or vice versa. Organizational culture is presented as the largest gear in the middle and connects all others. In this aspect, culture refers exclusively to the culture within the organization and not to country-specific cultures. It is a key position that can be both, an obstacle, and an enabler of digital transformation. However, the organizational culture gear is always at the center, and the others are moving around, which determines the translation and thus, the power transmission of the changes. If the organizational culture is very entrepreneurial and focused on quickly changing processes, it acts as an accelerator of change. If the internal culture is focused on maintaining the status quo, it can act as an inhibitor.

The whole process model embodies the idea on continuous learning and adapting. Therefore, not only the steps backward are included, but also the whole

digital transformation process maintains the idea of a PDCA-cycle (Figure 2). PDCA stands for Plan-Do-Check-Act and illustrates that the process of digital transformation will never finalize. Not only technical solution and processes will always develop over time and need to be evaluated over again, but also new ideas or even business models can change the whole previous process steps.
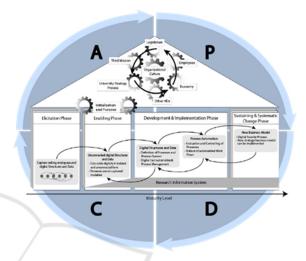


Figure 2: Continuous improvement process of the digital transformation process.
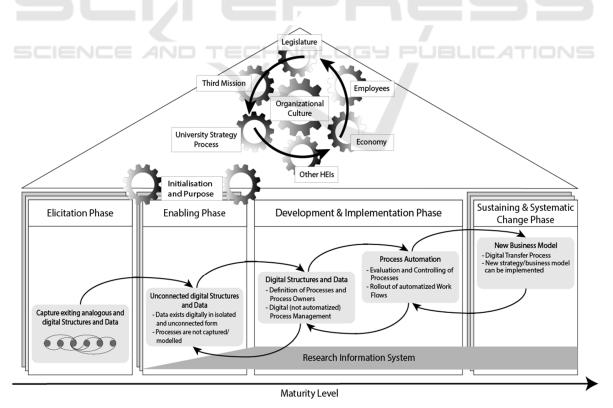


Figure 3: Process Model for Digital Transformation in Universities (cf. **RQ1**).

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# 4 CHALLENGES IN DIGITAL TRANSFORMATION IN UNIVERSITIES

The implementation of a process model for digital transformation in universities faces some limitations and challenges, which were assessed through the expert interviews (**RQ2**). Having presented our definition of digital transformation and a brief description of the process model, the experts were asked to name challenges, which they emphasized with digital transformation. In the following, the most commonly named challenges are presented (Figure 4).

## 4.1 Lack of Long-term Strategy

All the interviewees agree that digital transformation is a strategic issue for universities. As stated by the experts, often only short-term digital initiatives, like the implementation of new software, are conducted without establishing or communicating a long-term strategy.

The strategic impetus for this change should come from the university management and its governance, which should not only advocate digitization, but also be an example for it. This is seen as the only way to promote an openness to change the way of working, according to all experts.

## 4.2 Lack of Resources

The lack of resources as a limitation for digital trans-transformation relates, according to the experts, mainly to lack of resources in the IT departments of universities. These departments are often understaffed and are not able to support a digital transformation besides their daily business.

## 4.3 Investment Costs

Investment costs for passing through the process of digital transformation were not seen as a major challenge. Process modelling tools or research information systems are normally totally free of charge or quite cheap. For example the Camunda Modeler, where users can model processes in BPMN 2.0 or create decision-tables in DMN, is free of charge (Camunda, 2019).

## 4.4 Lack of or Insufficient Know-how

The lack of sufficient know-how within the university administration was assessed as the other main challenge of digitalization besides the lack of a long-term strategy. Employees in the university administration are often not involved or enabled in processual, tool or strategic changes, which can result in a lack of understanding. For example, modelling tools can be quite hard to understand in first place, without any explanation. Three experts mentioned that digitalization needs tools and processes, which are usable without being an IT-expert.

Therefore, the employees might see problems in the transformation, because they were not explained target-group oriented to them.

Figure 4: Challenges in Digital Transformation in Universities (cf. **RQ2**).

## 4.5 Lack of Acceptance

The lack of acceptance of this change relates also to the lack of or insufficient know-how of the employees in university administrations. According to the experts, the fear of change or the fear of losing the personal impact are major challenges, which need to be addressed by a university management.

## 4.6 Uncertainty of Data Security/Legal Issues

The experts mentioned, that there are often reservations with the implementation of new tools/processes concerning data security or legal issues concerning cyber security. But all these reservations can be disproved, as the changes are conducted internally within a university and can be solved with legal support.

## 4.7 Availability of Solutions

The availability of suitable solutions for digitalization was not considered as a major obstacle by the experts. One expert even stated that this point is only used as an "*excuse for not changing anything*".

Another expert suggested the usage of internal expertise by the researchers, as they often have a very deep understanding of the processes and possibilities of digitalization. Nevertheless, a lack of networking possibilities for all university departments, in current solutions, was assessed as a possible limitation in digitalization.

## 5 EVALUATION

The digital transformation of the field of transfer and the underlying processes at universities primarily addresses internal university processes and structures, as well as those of some experts from other fields. In order to adequately capture this situation, expert interviews were conducted, on the one hand with experts within universities and on the other hand with experts from external, for example from a company, which conducts transfer projects (e.g. research projects and thesis from students) on a regular basis with universities (Figure 1).

## 5.1 Evaluation Design

The evaluation includes a case study in which the digitalization of a single process is explained as an example. The process is the "application of funded research and development projects". In order to illustrate this, the various phases of the Process Model will be stepped through in the context of the digitization of this university transfer process.

## 5.2 Case Study

The target of this case study is to demonstrate the capability of the process model for its application in the digital transformation of a transfer process in a university. To this end, the process of the application of funded research and development projects is considered exemplarily and theoretically.

This process is initiated through the different gears (Figure 3). For example, it can be initiate as a result of the fact that public funding agencies require a purely digital submission of the application, which requires a digital application instead of an analog application, for example in paper form. This gear (external funding agencies) thus drives the "Organizational Culture" gear and thus, "Initiation and Purpose".

The Elicitation Phase concerns a survey of the current status in all departments involved and affected by this process. This includes the identification of all relevant stakeholders within the university. The design thinking methodology can be used to capture all data necessary for this process and form a joint vision of this transformation process.

In the Enabling Phase all processes (digital and analogous) are brought together from their isolated form (from for example research information systems).

When moving from Enabling to the Development & Implementation Phase, this process is modelled, for example with the BPMN2.0 modelling language. This is a formal modelling language maintained by the Object Management Group (Object Management Group, 2010). This modelling language has its benefits in its syntactic clarity and its prevalence. The modelling involves all concerned departments, so that they are integrated as a whole.

In the Development & Implementation Phase, the interfaces between the departments are implemented by the research information system. It is also possible to automate parts of the process, in this case for example the pre-filling or partially automated filling in of applications. Keywords can also be marked in tender texts or parts can be transferred to the corresponding application.

The last phase describes a final, digital and automated process. The capacities of employees that are freed up by automation and digitization can be

used for other activities, such as in a deeper support in the initiation of other transfer projects. This means that more work can be done with the same utilization of resources and capacities. This new process can serve as a starting point for the redesign of other and similar processes such as the application of non-public research and development projects.

# 6 CONCLUSION AND OUTLOOK

Digitalization and the provision of digital processes and platforms have been seen as an enabler for knowledge transfer, as they offer innovative possibilities for collaboration and further development of organizations (Hossain and Lassen, 2017).

In this article, the two research questions RQ1 and RQ2 have been answered. The first question dealt with the design of a structured process model to display the reality of the digitalization of university transfer processes adequately. The target of research was to design an adaptive process model, which displays possible ways and methods of a digital transformation within a university. When using the process model, the users may customize the model and only use the processes or methods, which are relevant to them. With its iterative approach the model supports the concept of a learning organization and allows for setback to continuously improve itself. Also, the various possibilities to initiate a digitalization of university transfer processes are displayed through different views and gears in the process model (cf. RQ2).

To evaluate if the process models is suitable for the digital transformation in universities, in-depth expert interviews were conducted. It was found that multiple challenges and limitations exits in the digital transformation in universities (cf. RQ2). The experts assigned the "Lack of long-term strategy" and "Lack of or insufficient know-how" as the most challenging aspects.

The use of automatized or even a whole digital transformation has multiple benefits for universities, e.g. a faster and enhanced availability of internal services or an improved external image of universities (Doering and Timinger, 2020).

The individual components of the process model will be further evaluated in an international perspective, as the current solution was only evaluated within the scope of German universities.

Furthermore, aspects from other types of higher educational institutions need to be taken into account to evaluate whether the model is also suitable for all types of universities, for example for private universities, vocational academies or teacher training colleges.

## REFERENCES

Arundel, A. and Geuna, A. (2001), "Does proximity matter for knowledge transfer from public institutes and universities to firms?", Available at: https://www.researchgate.net/publication/24132185_d oes_proximity_matter_for_knowledge_transfer_from_ public_institutes_and_universities_to_firms (accessed 16 june 2021).

Bavarian Ministry of Science and Art (2021), "Hochschulreform - Bayerisches Hochschulinnovationsgesetz", available at: https://www.stmwk.bayern.de/ministerium/hochschule -und-forschung/hochschulreform.html (accessed 16 February 2021).

Camunda (2019), "Web-based tooling for BPMN, DMN and CMMN | bpmn.io", available at: http://bpmn.io/ (accessed 13 December 2019).

Doering, C. and Timinger, H. (2020), "Industry-oriented Digital Transformation in Universities to Facilitate Knowledge Transfer", in *International Joint Conference on Knowledge Discovery, Knowledge Engineering and Knowledge Management*, pp. 212–218.

Hevner, A.R. and Chatterjee, S. (2010), "Design Research in Information Systems Theory and Practice", *Integrated Series in Information Systems Volume 22*.

Hossain, M. and Lassen, A.H. (2017), *How Do Digital Platforms for Ideas, Technologies, and Knowledge Transfer Act as Enablers for Digital Transformation?*

Howells, J. (1996), "Tacit knowledge", *Technology Analysis & Strategic Management*, Vol. 8 No. 2, pp. 91–106.

Joia, L.A. and Lemos, B. (2010), "Relevant factors for tacit knowledge transfer within organisations", *Journal of Knowledge Management*, Vol. 14 No. 3, pp. 410–427.

Laursen, K., Reichstein, T. and Salter, A. (2011), "Exploring the Effect of Geographical Proximity and University Quality on University–Industry Collaboration in the United Kingdom", *Regional Studies*, Vol. 45 No. 4, pp. 507–523.

Liyanage, C., Elhag, T., Ballal, T. and Li, Q. (2009), "Knowledge communication and translation – a knowledge transfer model", *Journal of Knowledge Management*, Vol. 13 No. 3, pp. 118–131.

Mayer, H.O. (2013), *Interview und schriftliche Befragung: Grundlagen und Methoden empirischer Sozialforschung, Sozialwissenschaften 10-2012,* 6., überarb. Aufl., Oldenbourg, München.

Meuser, M. and Nagel, U. (2009), "The Expert Interview and Changes in Knowledge Production", in Bogner, A., Littig, B. and Menz, W. (Eds.), *Interviewing Experts*, Palgrave Macmillan UK, London, pp. 17–42.

Object Management Group (2010), "About the Business Process Model and Notation Specification Version 2.0", available at: https://www.omg.org/spec/BPMN/2.0/About-BPMN/ (accessed 17 June 2021).

Roessler, I. (2015), "Third Mission. Die ergänzende Mission neben Lehre und Forschung", *wissenschaftsmanagement No.* 2, pp. 46–47.

Vom Brocke, J., Simons, A., Niehaves, B., Niehaves, B., Reimer, K., Plattfaut, R. and Cleven, A. (2009), "Reconstructing the giant. On the importance of rigour in documenting the literature search process", *ECIS 2009 Proceedings*.