TEACHING AN OLD WORK SYSTEM NEW TRICKS: TOWARDS AN INTEGRATED METHOD FOR WORK SYSTEM TRANSFORMATION IN TIMES OF DIGITALIZATION

Research paper

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Abstract

Organizational transformation is a topic of increased interest for academics and practitioners alike, especially in light of the various socio-technical developments associated with digitalization. Large-scale transformation initiatives often do not lead to the desired outcomes and fall short of their full potential primarily due to their inherent complexity. Intending to provide guidance for transformation projects, we set out to extend the work system theory – an established theory for representing and analyzing the design and evolution of organizational systems. In the framework of elaborated action design research, we performed a literature search before leveraging an extensive project database and conducting a series of interviews to develop and iteratively improve the research artifact. The resulting work system transformation method builds on the work system theory as well as the work system method and provides guidance in structuring and conducting work system transformation initiatives. Our results include a set of work system transformation principles backed by exemplary good practices and tools. Our work extends the existing literature on work systems and provides a holistic method to structure and perform large-scale transformation initiatives.

Keywords: Work System, Transformation, Digitalization, Action Design Research.

1 Introduction

Driven by the rapid adoption of digital technologies, digitalization is a complex socio-technical phenomenon profoundly affecting individuals, organizations, and society at large (Bockshecker et al., 2018; Gimpel et al., 2018; Legner et al., 2017; Sebastian et al., 2017). It enables the design of new business models and processes leading to a volatile, uncertain, complex, and ambiguous environment (Kohli and Melville, 2019; Kutzner et al., 2018; Bennett and Lemoine, 2014). Exploring and exploiting the opportunities presented by digitalization, organizations may initiate complex redesigns of products, processes, services as well as organizational structures, business models, and management concepts (Alter, 2020; Fuchs and Hess, 2018; Dery et al., 2017; Sebastian et al., 2017; Matt et al., 2015). Related transformation initiatives are viewed as part of organizations' digital strategy accounted for by a Chief Digital Officer

and/or a Digital Transformation Officer and are of paramount importance for organizations in sustaining their competitive advantage (Singh and Hess, 2017). However, there are several challenges related to the (successful) completion of such transformation initiatives. Importantly, they are often set up from a purely technological perspective ignoring crucial outside factors such as organizational strategy and culture (Tabri et al., 2019). Barthel and Hess (2019) claim that knowledge about digital transformation is still insufficient and point out that respective initiatives require cross-functional teams with both the business and digital technology perspective being crucial for their successful implementation. In addition, Gothelf and Seiden (2017) emphasize that digital transformation projects' outputs often differ from the goals of regular information technology (IT) projects. Even from a purely technological perspective, transformation initiatives have been recognized for their ambitious goals and scope as well as unclear success criteria (Alami, 2016). Current methods and techniques related to digital transformation undoubtedly offer valuable support, but do not necessarily account for the outlined challenges (Alt, 2019). Consequently, the success rate of digital transformation initiatives remains alarmingly low (Baculard et al., 2017) indicating the need for more guidance with regard to their setup and implementation (Bordeleau and Felden, 2019). We propose that one possible way to deal with the presented challenges and enable a holistic perspective on digital transformation could be rooted in the work system (WS) theory. It is a well-established theory in the information systems (IS) field and questions the narrow premise that IT artifacts should be viewed as the core subject matter of the IS field (Alter, 2013, 2003). Instead of IT artifacts, WS theory considers socio-technical WS as the core unit of analysis in organizations (Alter, 2003). The WS theory includes the WS framework as well as the WS life cycle model, which represent the static and dynamic views of WS, respectively. Due to WS theory's broad scope and holistic approach, we deem it is well suited to tackle the above-mentioned challenges of digital transformation initiatives. To the best of our knowledge present literature does not cover implementing WS theory to provide guidance for digital transformation. Therefore, we set out to explore how WS theory can provide utility in digital transformation initiatives. Our research question is:

How can work system theory be extended to guide digital transformation initiatives?

We approach the research question by following the elaborated action design research (eADR) paradigm of Mullarkey and Hevner (2019) in order to create an artifact aimed at providing guidance in digital transformation. Thus, we perform a literature search as well as a series of interviews to enhance our understanding of the underlying problem and identify the specific goals that the artifact needs to fulfill. We then proceed to iteratively enhance the artifact by evaluating a database of 99 digitalization projects and conducting qualitative interviews with scholars and practitioners involved in digital transformation initiatives. Our artifact – the WS transformation method – depicts the three phases of digital transformation initiatives. Additionally, it includes seven WS transformation principles of prescriptive character that are enriched by exemplary good practices and tools contributing to the operationalization of the principles. The rest of the paper is structured as follows: Section 2 provides a detailed background on WS theory. In section 3 we outline the research process as well as the method development and evolution. Section 4 presents the artifact resulting from our research – the WS transformation method. Finally, in section 5 we discuss the main insights, limitations, and avenues for further research.

2 Theoretical Background

In this section, we present an overview of WS theory including related extensions and applications. WS theory focuses on social-technical systems as the main unit of analysis in organizations and comprises a definition of a WS, the WS framework, and the WS life cycle model (Alter and Bork, 2019). Alter (2018b, p. 8) defines a WS as "a system in which human participants and/or machines perform work (processes and activities) using information, technology, and other resources to produce specific products/services for specific internal and/or external customers". In practice WS are usually socio-technical constructs but the definition also allows for identifying both entirely social as well as entirely IT-reliant WS (Alter and Recker, 2017).

WS theory includes a static view of a WS in its stable state (i.e. the WS framework) as well as a dynamic view of how WS change over time (i.e. the WS life cycle model) (Alter, 2013). The WS framework

includes nine elements necessary for a rudimentary understanding of a WS's form, function, and environment in its stable state. These central elements – *processes and activities*, *participants*, *information*, *technologies*, *customers*, *products and services* – are linked via arrows indicating how they need to be balanced (Alter, 2013). The three remaining elements – *environment*, *infrastructure*, and *strategies* – provide the context, in which the WS operates (Alter, 2013). Adding to the static descriptive view of WS, the WS life cycle model covers a dynamic perspective by representing the "iterative process by which WS evolve over time through a combination of planned change (formal projects) and unplanned (emergent) change that occurs through adaptations and workarounds" (Alter, 2018a, p. 5). The WS life cycle model includes the phases *operation and maintenance*, *initiation*, *development*, and *implementation* (Alter, 2013). Thereby, WS in the operation and maintenance phase can be terminated, continued, or redesigned. In the case of redesign (planned change), WS go through the rest of the phases in a sequential manner allowing for reverting to previous phases. Unplanned change is accounted for in the WS life cycle model by the inclusion of unexpected adaptations and opportunities influencing the four phases. These can stem, for instance, from adopting workarounds (Davison et al., 2019; Alter, 2014). The WS method builds on the WS framework and the WS life cycle model as the central ideas of WS theory and can be used as a tool to analyze and design WS (Alter, 2018b). Additionally, business and IT professionals can apply the WS method to draft system improvements with the WS theory enhancing their collaboration (Alter, 2006, pp. v–vi). While several versions of the WS method exist, they share the same procedure: (1) identify the main opportunities or problems as well as the smallest WS ("as is" WS) that exhibits those; (2) analyze the WS using the WS instruments in the required level of detail; (3) identify possibilities for improvement by recommending a proposed WS ("to be" WS); (4) explain likely performance improvements (Alter, 2013, 2011, 2006, p. 21). In this sequence, a one-page WS snapshot can be used to summarize the most important aspects of the "as is" or "to be" WS in terms of the six central elements of the WS framework (Alter and Bork, 2019).

There are several extensions to the WS theory that address limitations observed in the application of the WS method. The conceptual WS metamodel considers the elements of the WS framework in a more rigorous way and enables an essentially more detailed analysis of a WS (Alter, 2016). In addition, WS design principles and WS axioms provide theory-based prescriptive knowledge facilitating design decisions (Alter, 2018b). Alter (2019) also introduces a WS perspective that combines aspects of the WS method as well as WS theory and helps conceptualize socio-technical systems in a business environment, which has changed greatly over the past decades. By introducing a first version of the WS modeling method, Bork and Alter (2020) comprise many WS-related modeling techniques, which are based on the WS metamodel, for example. Furthermore, WS theory and its extensions have been applied in various different research areas and projects. Wolf et al. (2019) use the WS framework as a lens for digitalization in organizations and introduce four patterns of the digitalization of organizational routines in WS. Pinheiro and Misaghi (2014) present the Framework of Lean Governance and Management of Enterprise IT that builds on the WS framework. Beerepoot and van de Weerd (2018) develop three artifacts that exploit knowledge of workarounds to continuously improve WS. Laumer et al. (2016) investigate individual resistance to newly implemented information systems and use WS theory as a theoretical foundation to distinguish between perceptions of technology and work routines as objects of resistance. Röder et al. (2015) extend the Business Process Modeling Notation on the basis of WS theory and the theory of workarounds to enable workaround aware business process modeling. Mrass et al. (2018) propose measures for the successful management of complex WS as well as a respective model designed for crowd working platforms. Finally, Yadav and Dong (2014) develop a method to asses WS security risk. Such research initiatives indicate that WS theory is versatile enough to be employed in various research domains. Overall, we consider WS theory a suitable lens for structuring transformation initiatives, since it has the potential to address typical shortfalls of transformation initiatives such as those outlined in the introduction (e.g. narrow focus on technology, complex set-ups, interdependencies, or unclear goals).

3 Research Process

3.1 Elaborated Action Design Research

The explorative nature of the posed research question requires a research process that is capable of both integrating various perspectives on the research problem as well as aiding in creating an artifact that covers prescriptive knowledge on digital transformation. Hence, we decided to apply action design research (ADR), which is an established research paradigm that aims to iteratively create innovative IT-related artifacts in an organizational context (Sein et al., 2011). ADR combines action and design research to generate prescriptive design knowledge (Sein et al., 2011). It often results in methods supporting practitioners from various contexts (Bub, 2018; Denner et al., 2018). Generally, methods are built upon a certain number of steps or phases and can be represented by models that help describe the relationships of included concepts and constructs, respectively (March and Smith, 1995). After a *problem formulation* stage, ADR strives to iteratively shape an ensemble IT artifact (Sein et al., 2011). This includes the *building, intervention, and evaluation* stage, which is characterized by the involvement of practitioners or end users (Sein et al., 2011). The continuously conducted *reflection and learning* stage that focuses on receiving feedback is followed by a final *formalization of learning* stage (Sein and Rossi, 2019). Despite the increasingly effective application of ADR, there has been demand for further guidance on key activities included in ADR (Mullarkey and Hevner, 2019). Therefore, we turned to the eADR research process as per Mullarkey and Hevner (2019), which builds on all established ADR principles and provides an updated structure that we deemed our research would profit from. Mullarkey and Hevner (2019) introduce four eADR stages (*diagnosis*, *design*, *implementation,* and *evolution*) each of them consisting of at least one ADR cycle comprising five key activities (*problem formulation / planning*, *artifact creation*, *evaluation*, *reflection*, and *learning*). By defining a separate phase for understanding the problem, by offering multiple entry points, and by allowing that each eADR stage yields a seperate artifact, eADR not only complements existing ADR practices, but also makes their application in different projects more flexible (Ågerfalk, 2019; Mullarkey and Hevner, 2019; Sein and Rossi, 2019). Since digitalization is a complex socio-technical phenomenon, we deemed eADR to be more suitable for addressing the research question and followed the guidelines of Mullarkey and Hevner (2019) in developing a WS transformation method.

3.2 Work System Transformation Method Development

We conducted four complete ADR cycles, consisting of one exhaustive diagnosis and three design cycles in accordance with the eADR process model by Mullarkey and Hevner (2019). Thereby, the implementation and evolution eADR stages are beyond the scope of our research. Figure 1 summarizes our research process, which is comparable to other completed ADR projects (Mullarkey and Hevner, 2019, pp. 19–20).

In the first diagnosis cycle (diagnosis), we aimed at thoroughly defining and exploring the research problem. This involved three activities: (1) we confirmed WS theory as a suitable design theory to obtain a holistic perspective on IT- and organization-related problems by performing a non-structured broad literature search on transformation-related literature. As a first step of the literature search, we used the search query "('work system' OR 'work system theory') AND ('improvement' OR 'transformation' OR 'redesign')" in ACM Digital Library, Google Scholar, and IEEE Xplore Digital Library to verify that at the moment of the search no extensions of WS theory to guide digital transformation initiatives existed. We then proceeded by searching for established project management standards and guidelines (e.g. PRINCE2 and ADKAR) including related concepts and extended the results through backward and forward search. By further including practical studies, (2) we determined a first set of socio-technical tools (e.g. DevOps, design thinking, and process modeling) employed in transformation initiatives. Given this literature-induced knowledge, (3) we identified specific goals for our research project by conducting five interviews with interview partners having participated or participating in digital transformation initiatives at the time of this research. During the ideation interviews, the interview partners agreed that WS theory is tangible and comprehensive. All of them pointed out that, in general, digital transformation

is a complex undertaking requiring proper guidance including socio-technical tools. Thus, we were able to refine the set of socio-technical tools and together with the interview partners identified 35 tasks conducted in digital transformation initiatives. After thoroughly reviewing WS theory as well as the results in this cycle we concluded these tools provided a strong foundation for understanding the problem domain. Therefore, we were able not only to corroborate the demand for holistic methodological guidance regarding digital transformation, but also to gather innovative and practice-induced ideas at an early stage of the research process. This allowed us to proceed to the first design cycle.

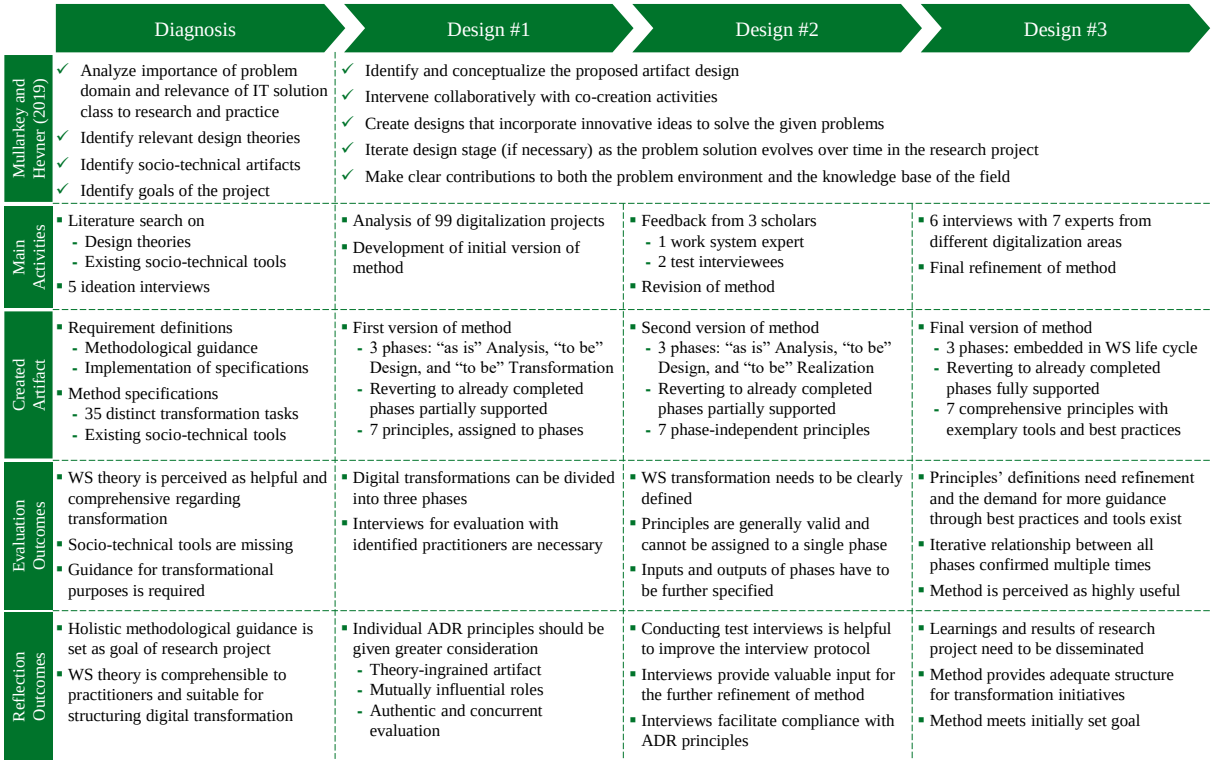

Figure 1. Research process based on Mullarkey and Hevner (2019)

In the first design cycle (design #1), we developed an initial version of the WS transformation method including relevant principles for WS transformation by following the assembly-based approach of situational method engineering as proposed by Henderson-Sellers and Ralyté (2010). To that end, we built on the set of the 35 digital transformation tasks and their descriptions. We also drew on the set of tools from the diagnosis cycle as well as a database with an overview and description of 99 completed and ongoing digitalization projects. Access to this database was provided by an organization having participated or participating in each of the projects at the time of this research. The project database comprises project summaries as well as detailed project plans. Thereby, the (projected) duration of the digitalization projects ranged from a few months to several years and the respective organizations stemmed from various industries with a focus on manufacturing and financial services. When reviewing the projects, each member of the research team focused on three aspects: 1) the transformational tasks performed in a project, 2) the tools and methods used, and 3) the WS framework elements primarily affected by the transformation. We then compared and discussed our results in the research team to identify commonalities (generic phases) of transformation projects as well as typical tasks and tools within each phase. In terms of intervention, we were able to transitively gain valuable input from the transformation projects through the database and create an initial version of the WS transformation method. This version consisted of the three phases similar to the ones in the final version of the artifact (refer to section 4) with a single iterative relationship that allowed to revert from the third to the second phase. With one exception, each of the initial WS transformation principles was assigned to a single phase. When eval-

uating the artifact, we identified the need for interactive feedback through in-depth interviews and contacted multiple project owners listed in the project database as well as additional experts on digital transformation. At this point, the WS transformation method was rather descriptive and, therefore, did not meet the goal of providing guidance in transformation initiatives. This necessitated an additional design cycle. Reflecting on the design #1 cycle, we recognized the need for improvement in the implementation of certain ADR principles (i.e. theory-ingrained artifact, mutually influential roles, and authentic and concurrent evaluation) (Sein et al., 2011).

In the second design cycle (design #2) we obtained feedback on the integration of the WS transformation method in WS theory and its extensions. As a first step, we discussed the general structure of the WS transformation method and the version resulting from the design #1 cycle with one prominent WS scholar. In line with the feedback from the WS scholar we further specified the context, in which the method is to be implemented by providing a corresponding definition of WS transformation, and also explicitly integrated the scholar's considerations regarding the adoption of workarounds. We further conducted two semi-structured in-depth interviews with members of the research team to obtain additional feedback on the WS transformation method and improve our interview procedure. In light of the information in the project database, we also established that the WS transformation principles represent ideas that transgressed the scope of any single phase in the method and could rather be useful in providing guidance throughout the entire transformation. Reflecting on the design #2 cycle, we were able to refine the WS transformation method especially regarding its integration in WS theory. We recognized the value of test interviews as a tool for ameliorating the design artifact as well as the interview procedure itself to comply with the established ADR principles. Nevertheless, due to the received feedback, we concluded that another design cycle was necessary.

In the last design cycle (design #3), we focused on improving the prescriptive character of the artifact. We employed the enhanced interview procedure to conduct six semi-structured interviews with seven experts selected for their knowledge on and experience in digital transformation initiatives. We leveraged our professional networks as well as the project database to select and contact suitable interview partners. Table 1 specifies the nature of the transformation initiatives the experts were involved in as well as their corresponding roles. Each interview lasted between 50 and 75 minutes, was recorded, and was attended by at least two members of the research team. The only exceptions were interview 6, which was conducted by only one researcher due to the interview's distant location, and interview 5, which we were not allowed to record. We informed the interview partners in advance about the research topic and the role, for which they were chosen. The semi-structured interviews started with a short introduction to WS theory and a presentation of the WS transformation method. Thereafter, each interview was centered around the specific transformation initiative(s), in which the interview partners were or had been involved, allowing them to provide specific feedback based on their corresponding experience (Schultze and Avital, 2011; Myers and Newman, 2007). However, we also encouraged the interview partners to share their experience gained in the context of other transformation initiatives in case they deemed it was valuable for further developing the WS transformation method. We iteratively adapted and refined the WS transformation method after each interview. All interview partners approved the general structure of the method (i.e. the input, output, and the three phases) as well as its contents. The lack of the possibility to revert from the second to the first phase of the WS transformation method was criticized in the first interviews. Therefore, we decided to allow for transitions between any two of the phases, which was approved in the following interviews. Further, some interview partners pointed out that the trigger and the initiation of the transformation initiative had not been incorporated satisfactorily in the method. We addressed this feedback in the artifact by referring to the role of internal and/or external stimuli regarding the context, in which the method is to be implemented. In addition, we also refined the principles and their definitions and gathered good practices and tools in conjunction with the feedback that the interview partners gave. In summary, the WS transformation method was highly appreciated for its methodological guidance and its ability to provide a structure for digital transformation initiatives. The interview partners deemed the resulting version of the WS transformation method suitable for providing guidance in transformation initiatives. To align all practical and theoretical insights, we conducted a final reflective refinement of the WS transformation method within the research team. Since

we achieved the initially set goal of creating an artifact that helps set up and conduct digital transformation, we concluded that the experts' feedback had converged and refrained from initiating additional design cycles. As mentioned, we also did not initiate the implementation and evolution eADR stages since the practical implementation and validation of the artifact are beyond the study's scope and a matter for future research.

Industry	Transformation Initiative	Role of Interviewee in Transformation
(1) Finance and IT Consulting	Establishment of a multi-site collaboration platform	Business and Information Systems Engineering Manager
(2) Semiconductor Production	Introduction of financial ratio forecasting	Data Scientist and Digital Business Model Expert
(3) Financial Services	Restructuring of company-wide IT landscape	Lead IT Consultant
(4) Software Development	Offering SaaS as a substitute of on-premise solutions	Senior Enterprise Architecture Manager
		Junior Enterprise Architecture Manager
(5) Software Development	Multiple transformation initiatives in the public sector	Member of Project Steering Committees
(6) Glassware Production	Implementation of ERP Software	Project and Change Manager

Table 1. Overview of expert interviews conducted in the design #3 cycle

4 Work System Transformation Method

4.1 Method Context and Overview

In this subsection, we elaborate on the context and settings, in which our method can be applied and provide a short overview of the research artifact. We begin by defining WS transformation:

> *Work system transformation refers to a planned change of an existing "as is" work system into a designed "to be" work system, in which the value for customers is fundamentally different and/or is created differently requiring an essential shift in the way work is performed.*

The definition implies that a planned change initiative has to be of major significance for internal and/or external stakeholders and highlights the necessary impact or scope of the WS's transformation. Importantly, our artifact assumes the existence of an initial WS to be transformed. The WS transformation can be triggered by internal or external stimuli such as changes in the environment (e.g. organizational, cultural, regulatory, competitive), strategies (e.g. enterprise, department, WS strategy), and/or infrastructure (e.g. human, informational, technical) (Alter, 2013). In line with the existing WS literature, our method requires that the boundaries and scope of the WS under consideration are clearly defined either prior to or in the course of the transformation initiative. Further, we acknowledge that there may be a pre-existing overarching vision, which guides the general outcome that the transformation aims to achieve and may, therefore, be out of the control of the involved participants (e.g. organizational strategy). Nevertheless, the vision may also be conceived and refined as part of the transformation itself and can be operationalized by means of concrete goals that the WS transformation needs to follow. The main outcome of the transformation initiative is a transformed WS.

The WS transformation method consists of three phases, namely "as is" analysis, "to be" design, and "to be" realization. An existing "as is" WS is transformed into the target state – the "to be" WS. In the "as is" analysis phase the WS subject to transformation is analyzed and described. The "to be" design phase serves to develop and justify a new design for a proposed "to be" WS. Finally, in the "to be"

realization phase the "as is" WS is operationally transformed based on the chosen design of the second phase. When applying the transformation method, stakeholders of transformation initiatives can decide to revert to already completed phases as necessary. Figure 2 represents the process of WS transformation as well as the relationship between WS transformation and the existing WS life cycle model.

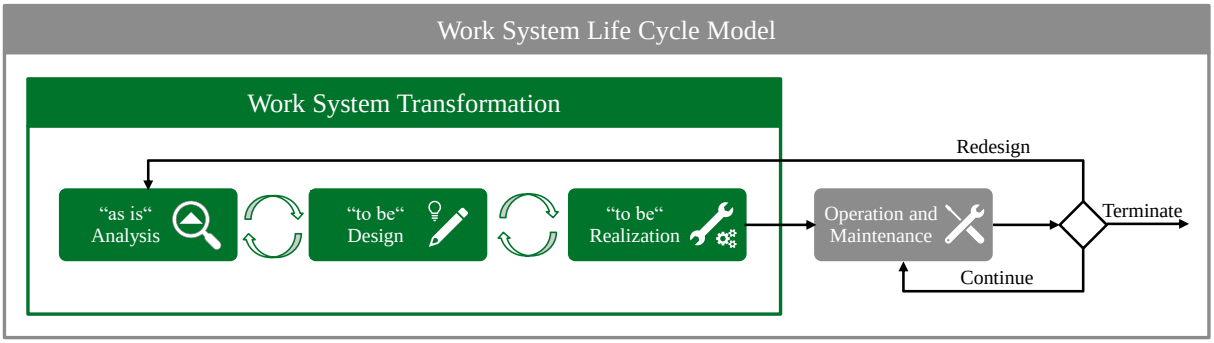

Figure 2. Work system transformation and its integration in the work system life cycle model

4.2 Method Description

In this subsection, we provide details on the phases of the WS transformation method, the relationships among them as well as the WS transformation principles, exemplary good practices, and tools. Figure 3 complements the three phases of the WS transformation method outlined in the previous subsection by including possible relevant inputs, activities, and outputs in each phase. The WS transformation principles constitute prescriptive statements regarding all transformation-related activities across the three phases. The flow of information is represented by arrows. An activity receives static input, consists of various tasks, and finally produces a static output that serves as input for the subsequent phases.

Phase 1: "as is" Analysis. During the first phase, the "as is" WS is analyzed, described, and assessed. This provides the necessary understanding regarding the WS's current state, its relation to its environment, and is, thus, necessary for the design of the "to be" WS as well as the realization of the WS transformation. Existing documentation such as process models as well as the WS's participants' and customers' experience may prove useful for gathering insights. Depending on the size and complexity of the WS, the assessment of outside individuals may be required in this phase. Further, the scope of the "as is" WS is to be determined in the "as is" analysis phase, if this has not already been done. The established concepts of WS theory such as the WS method provide valuable input for analyzing the WS under consideration (Alter, 2013, 2006, p. 28). Especially the first two steps of the WS method (identify the system and opportunities, analyze the system and identify possibilities) may prove useful at this phase of the WS transformation. Further, the WS framework and the more detailed WS metamodel may facilitate structuring the documentation of results in this phase. Particularly, the WS snapshot is a suitable tool in this phase (Alter, 2006, pp. 16–18). Of course, there are additional instruments outside of the WS theory that may be helpful when analyzing the "as is" WS such as process modeling languages for documenting essential processes and activities.

Input: The "as is" WS itself as well as related descriptive documentation (e.g. process models) serve as the input in the first phase of the WS transformation method. However, existing descriptive documentation of the WS has to be validated.

Output: The output of the "as is" analysis phase comprises the concrete scope of the WS as well as the WS snapshot. An overview of the main problems and possibilities for improvement of the "as is" WS is an additional deliverable.

Phase 2: "to be" Design. Whereas the previous phase of the WS transformation method is concerned with analyzing the status quo, the "to be" design phase focuses on creating a new design for the WS. This phase demands creativity and innovation due to the substantial design space that is usually available as well as the abundance of internal and external requirements that possible designs need to consider. Successful transformation initiatives from similar and/or completely different sectors may prove to be valuable in creating new designs. In this phase, the overarching vision should be refined and broken down into concrete design specifications in order to match the output of the previous phase in terms of level of detail and scope. There are a number of important guidelines that need to be abided by in this phase. For example, designs need to be realistic and take into account human behavior as well as the occurrence of workarounds (Alter, 2014). All design-related decisions need to be assessed in terms of their feasibility. It is important to include WS stakeholders that are affected by the changes as customers and/or participants of the WS. Various (and in many cases contrary) design ideas of different stakeholders have to be harmonized, compared, and eventually integrated into a shortlist of WS designs. Clear and comprehensive design evaluation criteria need to be set up for selecting the most valuable proposal. Just as in the previous phase, existing instruments and tools related to the WS theory such as WS principles, design spaces, and axioms can facilitate the design of the "to be" WS (Alter, 2013). Reverting back to the previous phase may be necessary in case there is a need for a more thorough "as is" analysis.

Input: The first iteration of the "to be" design phase follows the first "as is" analysis phase. Hence, the output of the preceding phase fundamentally influences the development of the "to be" design. The input of this phase may exhibit different degrees of formalization (e.g. reference models versus organizational good practices). Other input factors that have a major impact on the "to be" design are enablers, capabilities, and suggestions. Enablers comprise available (future) resources that facilitate the design process (e.g. simulation software). Capabilities represent specific organizational competencies contributing to coming up with superior WS designs. Naturally, important suggestions regarding the WS design may be derived from outside the WS.

Output: The most essential output of the "to be" design phase is at least one validated "to be" WS design selected out of multiple candidates. Depending on the transformation initiative's size and approach the "right" level of detail for the design may vary. Nevertheless, its representation should be similar to the output of the first phase to facilitate the comparison between the output of the first and the second phase. The design must be validated and justified as outlined above. In addition, the output of this phase includes further artifacts such as formulated recommendations and requirements that extend and clarify the design itself.

Phase 3: "to be" Realization. Based on the previous two phases, the "to be" realization phase is concerned with the operational transformation of the existing "as is" WS into the designed "to be" WS. Thereby, the design can be broken down into feasible tasks that constitute its implementation. Various approaches for setting up and conducting projects may be selected depending on the transformation's characteristics. Thus, this phase entails choosing and setting up organizational resources as well as establishing suitable structures. Again, established tools such as Gantt and burn down charts can be used to monitor the progress in this phase (Sharon and Dori, 2017). Just as in the previous phase, reverting back to the "to be" design phase is allowed as necessary.

Input: The output derived from the previous phase is essential since it is used to establish the difference between the "as is" and the "to be" WS. A large transformation initiative goes hand in hand with many expectations regarding scope, quality, time, and budget. Various restrictions and dependencies (e.g. related to other organizational initiatives) are factors that influence the "to be" realization. Valuable resources may be shared with other organizational entities and initially allocated resources may be assigned alternatively influencing the implementation of this phase.

Output: The output of the "to be" realization phase is a transformed WS. Its realization may differ from the chosen design in the second phase depending on the presence of the aforementioned restrictions and dependencies that influence the "to be" realization phase. However, the transformed WS is not the only output. In the course of the transformation various documentations, best practices, and knowledge are

established, which may serve as a reference and/or directly influence future transformation initiatives in or outside the WS under consideration.

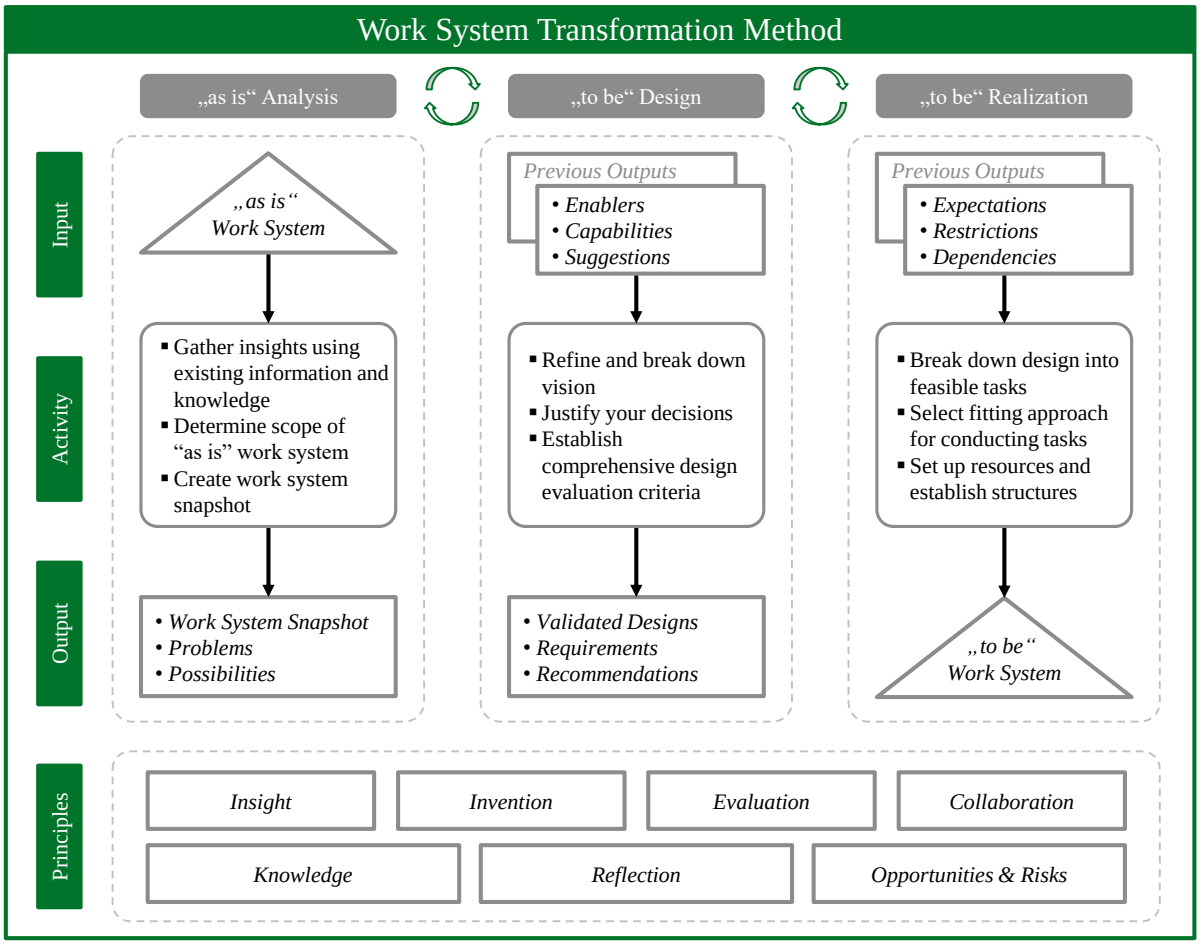

Figure 3. The three phases and seven principles of the work system transformation method

Work System Transformation Principles. The WS transformation method is supported by seven WS transformation principles. These represent prescriptive statements providing further guidance regarding the method. They consist of a definition, a set of exemplary good practices, and exemplary tools. The exemplary good practices and tools help operationalize the WS transformation principles. They were developed in the course of the research process and offer a similar level of abstraction as the WS principles (Alter, 2010). We could not identify any fixed relationships between the WS transformation principles and the phases of the WS transformation method. Rather, the WS transformation principles could be seen as orthogonal to the phases of the WS transformation method. Table 2 comprises the seven WS transformation principles, their definitions as well as the exemplary good practices and tools. In a practical setting the principles act as guiding statements across all three transformation phases simultaneously. They can be implemented through a variety of organizational practices and further enhanced by employing corresponding socio-technical tools. As an example, instituting regular project meetings in a team concerned with conducting (a part of) the transformation initiative is a practice that helps operationalize the principle of *collaboration* amongst others. Similarly, the same principle could be further supported by introducing a specific collaboration tool to help conduct project meetings. Thus, transformation managers need to evaluate both organizational practices as well as tools to adequately account for the transformation principles.

Insight	
Definition: Understand and reflect on the mechanics of the current work system and its organizational context (e.g. interacting work systems).	
Exemplary Good Practices: • Acquire data, information, and knowledge in a structured manner • Gain a holistic understanding of the work system's past, present, and future • Identify contextual factors such as enablers, capabilities, and restrictions influencing the work system's transformation	*Exemplary Tools:* • Process mining • Customer and expert interview • Use case diagram
Invention	
Definition: Create, structure, explore, and refine ideas contributing to a possible work system design and/or the related work system transformation.	
Exemplary Good Practices: • Explore and exploit the potential of different ideation and design methods • Build upon insights gained when creating possible work system designs • Establish a culture fostering diverse perspectives and suggestions	*Exemplary Tools:* • Crowdsourcing • Design thinking • Lean startup
Evaluation	
Definition: Assess and justify artifacts related to the work system transformation and incorporate corresponding results into subsequent activities.	
Exemplary Good Practices: • Continuously involve work system stakeholders when evaluating potential designs • Harmonize and prioritize design proposals in a structured manner • Define metrics and incorporate feasibility aspects to compare work system designs	*Exemplary Tools:* • SWOT analysis • Delphi study • Concept test
Collaboration	
Definition: Enable effective and efficient interaction among individuals and teams by establishing suitable structures considering the work system environment.	
Exemplary Good Practices: • Foster collaboration among interdisciplinary teams • Assign roles based on individual strengths and weaknesses • Maintain a clear structure for communicating information to stakeholders and participants	*Exemplary Tools:* • Project meeting • Six thinking hats • DevOps
Knowledge	
Definition: Gather relevant tacit and explicit knowledge, establish a common knowledge base, and share it among individuals and teams.	
Exemplary Good Practices: • Foster a culture of knowledge sharing • Decide how to retain and transfer knowledge depending on its type • Find appropriate solutions for establishing a common knowledge base	*Exemplary Tools:* • Business model canvas • Process modeling • UML class diagram

Reflection	
Definition: Assess, review, and scrutinize the transformation approach and collaboration to derive learnings for the current and future transformation initiatives.	
Exemplary Good Practices: • Encourage all participants to adopt an open feedback culture • Reflect regularly on whether the transformation's progress is aligned with the overarching vision and goals • Use reflected learnings to refine current transformational practices	*Exemplary Tools:* • Retrospective feedback • Sprint review (agile methods) • Project log review
Opportunities & Risks	
Definition: Continuously identify and evaluate potential deviations to control and monitor relevant ones aiming to foster positive and tackle negative effects.	
Exemplary Good Practices: • Establish holistic categories for classifying opportunities and risks • Asses and prepare for potential showstoppers • Evaluate the trade-off between opportunities and risks regularly	*Exemplary Tools:* • Maturity model • Scenario analysis • Risk matrix

Table 2. Work system transformation principles, good practices, and tools

5 Discussion and Conclusion

Our research was driven by the perceived need for more guidance when conducting large-scale digital transformation initiatives, which are characterized by a high degree of complexity as well as by their interdisciplinary nature. We turned to the well-established WS theory since it provides a holistic perspective on socio-technical systems such as those subject to digital transformation. Thus, we set out to create a WS-theory-based artifact following the general research process of eADR by Mullarkey and Hevner (2019). Performing one diagnosis and three design cycles, we conducted a literature search, leveraged a project database of digitalization projects, and carried out a series of interviews to develop and improve the research artifact. The resulting WS transformation method is a structured method for setting up and carrying out digital transformation of WS. It comprises three transformation phases as well as a set of principles operationalized by relevant exemplary good practices and tools.

From a theoretical perspective, our research extends WS theory by defining WS transformation as well as providing a method, which includes a set of principles for digital transformation of WS. These elements incorporated in the artifact answer the posed research question of how the existing WS theory can be extended to guide digital transformation initiatives. Thereby, the WS transformation method can be seamlessly integrated into the existing WS theory, since it does not contradict any of its elements. Rather, we see our artifact as a specialization of the WS life cycle model for large-scale transformation, since the latter is a form of planned change (Alter, 2013). Thereby, WS transformation represents a form of planned WS redesign. The corresponding phases of the WS life cycle model – initiation, development, and implementation – have a distinct meaning in the context of transformation initiatives corresponding to the three phases of the WS transformation method. Solely the phase operation and maintenance remains unchanged in the method as represented in Figure 2. Table 3 summarizes the main differences between the WS life cycle model and the WS transformation method. Further, the identified principles enrich the method by providing corresponding prescriptive statements. They feature a similar level of abstraction as the WS principles of Alter (2010). Even though we recognize that certain principles could be more relevant for certain phases, we refrained from a formal mapping thereof due to the principles' generic nature. This was corroborated during the conducted interviews in the third design cycle. In it we received no feedback that such a mapping is necessary or would provide significant utility in transformation initiatives due to their complex, multi-disciplinary, and unpredictable nature. Further, we contend that the principles are not independent (i.e. changing the degree of implementation of one principle

can affect the other ones). Finally, the exemplary good practices and tools, which help operationalize the WS transformation principles, can also serve as an anchor for assessing the degree of their implementation.

Work System Life Cycle Model	Work System Transformation Method
• Represents the phases of WS evolution due to planned and emergent changes • Comprises a generic description of work system evolution independent of the relevant goal, scope, and project type • Provides a descriptive perspective on work system evolution	• Represents a specification of the WS life cycle model for transformation projects as a subset of planned change • Comprises specific input, activities, output as well as principles for all WS transformation phases • Provides prescriptive elements for work system transformation

Table 3. Comparison of work system life cycle model and work system transformation method

From a practical perspective, our results provide guidelines for practitioners aiding in setting up and conducting digital transformation initiatives. The WS transformation method can serve as a blueprint for developing transformation programs and may enhance the understanding regarding the scope and implications of digital transformation across various organizational stakeholders. Further, we believe it also helps communicate objectives in transformation projects. The WS transformation principles as well as the corresponding exemplary good practices and tools can serve as a structure for determining a proper portfolio of project methods that supports the successful implementation of transformation programs. However, we recognize that the principles as well as the exemplary good practices are not equally relevant for all WS transformation setups due to the complexity and variety of the latter. The fact that we were able to find exemplary tools within each principle leads us to hypothesize that, while subject to further development, the existing toolbox for conducting WS transformation initiatives does not feature systematic gaps that need to be urgently addressed.

Our work offers multiple avenues for further research. We refrained from entering the implementation and evolution stages as per the eADR process model by Mullarkey and Hevner (2019). Thus, future studies implementing the WS transformation method in real-life transformation initiatives projects are needed to substantiate and assess the utility and validity of our research artifact. In that respect, it would be beneficial to test the method in the context of digital transformation initiatives (also such that involve multiple organizations) to assess its universality and applicability. Further, our work features several limitations that can be addressed in future studies. First, even though we strove for an exhaustive and parsimonious set of principles, we cannot formally claim they are comprehensive. Second, the aggregation level of the derived principles is comparable to that of the original WS principles. However, we did not validate their usefulness from a practical standpoint beyond the scope of the conducted interviews and literature study as part of the research process. Consequently, future research could specifically look into the practicality of the principles as well as their comprehensiveness and level of abstraction. Third, we strived for operationalizing the principles by deriving exemplary good practices and tools. We cannot exclude the possibility that other constructs convey the essence of the principles in a more meaningful and useful manner that contributes to their practical implementation. Fourth, we assume that measuring the principles' degree of implementation could provide valuable transparency in guiding WS transformation initiatives and respective management actions. Developing corresponding measurement instruments such as maturity models could be beneficial. Fifth, we believe the principles feature reciprocal dependencies, which could be examined and considered in respective measurement instruments. Finally, even though the research artifact supports the digital transformations of WS, we strongly hypothesize that it is fully applicable in other transformation modes. Thus, future research could investigate whether the WS transformation method provides adequate guidance in business-driven transformation initiatives as well as such motivated by other organizational concerns or opportunities.

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