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Towards a Critical Realist Understanding of Digital Transformation: Results of a Structured Literature Review

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Completed Research

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Abstract

While digital transformation as a research phenomenon per se gains acceptance in both practice and academia, its precise conceptualization and theoretical underpinnings are discussed. To address these gaps, we propose a critical realist view on Digital Transformation. Building on a literature review on generative mechanisms in digital transformation studies, we show how the concept of generative mechanisms is used and what types of generative mechanisms are adopted. Based on our findings, we propose a research agenda that encourages further studies on digital transformation, taking a critical realist stance. Thus, we put forward ways of applying critical realism to digital transformation studies and show how critical realism can advance research through its ability for multi-level analysis and its unique understanding of change and transformation.

Keywords

Digital Innovation, Digital Transformation, Critical Realism, Generative Mechanism, Literature Review

Introduction

The phenomenon of digital transformation (DT) has gained increasing attention over the past years in academia (Vial 2019) and practice (Forth et al. 2020). However, while definitions of DT as a process have been proposed (Hinings et al. 2018; Vial 2019) and numerous case studies of organizations DT journeys have been published (Gimpel et al. 2018; Sebastian et al. 2017), the concept of DT still bears the risk to remain a buzzword in practice and research (Baiyere et al. 2017). Recently, a stream of research emerged that discusses conceptualizations of DT and intents to achieve greater clarity on its type of transformation and theoretical underpinnings (Drechsler et al. 2020; Vial 2019; Wessel et al. 2020). In particular, it is argued that DT is reasoned as a consequence of Digital Innovation (Vial 2019; Wessel et al. 2020). Digital Innovation has been attributed to fundamentally challenge existing theories in information systems (IS) and management as Digital Innovation presents a less bounded and predefined phenomenon (Nambisan et al. 2017). Nevertheless, current conceptualizations of DT reflect the implications of DI only to a very limited extent (Wessel et al. 2020). Wessel et al. (2020) for example, point out "that the material properties of digital technologies call for reconsidering classical models of transformation" (p. 41). Furthermore, to distinguish the notion of DT clearly from existing concepts of information systems, such as (IS)-enabled transformation, a more nuanced understanding of DT is necessary. In particular, they suggest overcoming the dominant macro views looking at organizations as a whole and to move toward multiple levels of analysis (e.g., micro, meso, and macro-level). Thus, we can develop theory on DT that accounts for the multi-faceted phenomenon of DT. Furthermore, a recent review by Hanelt et al. (2020) states that the

phenomenon of DT exceeds established theoretical models, thus offering a chance to generate new theory on DT that considers the move towards more malleable organizational setups. This call for a new understanding of the organization has also been raised by Majchrzak et al. (2016). They stress the importance of recognizing the inherent tensions organizations deal with as part of and potentially due to their DT endeavors. As a consequence, they suggest to use concepts such as emergence and different layers of embeddedness for studying DT. Additionally, Vega and Chiasson (2019) argue to develop a more nuanced understanding for the role of agency in contexts in which digital innovation is used and implemented. To summarize, current theoretical understandings of the concept DT fall short to reflect the multiple organizational changes triggered by digital innovations. This need for new ways of theorizing on DT has also been encouraged through the recent call for papers on "Envisioning Digital Transformation: Advancing Theoretical Diversity" by the prestigious Journal of the Association for Information Systems (JAIS) (Markus and Rowe 2020).

To address the introduced shortcomings, scholars have argued for using critical realism as an underpinning philosophy of science to study DT (Vega and Chiasson 2019). Critical realism is deemed to be found most beneficial in "blue ocean theorising", that is "theory that taps into truly new concepts or relationships and presents new ways of applying existing theory or theoretical concepts" (Williams and Wynn 2018, p. 320). Having this ability and deploying critical realism can thus help to contribute for enhancing our understanding of DT. In particular its sophisticated stance on agency and its stratified ontology might contribute to the introduced calls made in the context of DT (Majchrzak et al. 2016; Vega and Chiasson 2019). A vital element in critical realist studies are generative mechanisms which have been defined as "causal forces that would have to exist in order to explain a given phenomenon" (Williams and Wynn 2018, p. 318). These generative mechanisms have the ability to provide causal explanations and can contribute to develop mid-range theories (Mingers and Standing 2017). While critical realist studies receive growing attention in IS research (Rowe 2018; Vega and Chiasson 2019; Wynn and Williams 2020), a recent analysis of empirical critical realist studies revealed that the use of generative mechanisms remains inconsistent, as no standardized format of mechanisms is used and their understanding is ambiguous (Wynn and Williams 2020). While recent papers (Bygstad et al. 2016) have proposed ways to identify generative mechanisms, Wynn and Williams (2020) point out that "bringing greater conceptual and practical clarity to what mechanisms really are and how they should be described has become a fundamental challenge to the advancement of Critical Realism-based research in IS" (p. 56). If the concept of generative mechanisms can add value to our theoretical understanding of DT, a coherent understanding on the types of generative mechanisms is necessary. Therefore, we intent to review current literature on generative mechanism in DT studies and pose the following research question:

What types of generative mechanisms are currently used in empirical critical realist studies to explain digital transformation-related change phenomena?

To answer this question, a systematic critical literature review was conducted with a sample of 43 empirical studies. We perform a critical assessment of the identified generative mechanisms, discuss patterns, identify shortcomings and propose research avenues to study DT while relying on critical realism. By showing how generative mechanisms can be used more consistently for studying DT, we hope to inform future IS research how different types of mechanisms can be used.

Theoretical Foundations: Digital Transformation and Critical Realism

Digital Transformation

We follow Hinings et al. (2018), who understand DT as the "combined effects of several digital innovations bringing about novel actors (and actor constellations), structures, practices, values, and beliefs that change, threaten, replace or complement existing rules of the game within organizations, ecosystems, industries or fields" (p. 53). Compliant with other recent understandings and conceptualizations, DT is often discussed as a consequence of Digital Innovation (Vial 2019). Digital Innovation has been defined as "the carrying out of new combinations of digital and physical components to produce novel products" (Yoo et al. 2010, p. 725). In this context, DT refers to a procedural understanding of the term digital innovation (Hinings et al. 2018; Vial 2019; Yoo et al. 2010). This process of developing digital innovations is shaped by more distributed collaborations of actors in which agency is less predefined and more dispersed (Nambisan et al. 2017; Yoo et al. 2010). These characteristics require companies to engage in the process of DT, which

intends beyond others to adjust the current technologies in place, the existing organizational structure, strategy and product portfolio (Drechsler et al. 2020). The final goal of the adjustment is to exploit existing resources more efficiently and to explore new opportunities effectively to realize the generative potential and recombinational opportunities of digital innovations (Drechsler et al. 2020; Vega and Chiasson 2019).

Current theoretical and practical shortcomings are evident on multiple dimensions. From a theoretical perspective, current conceptualizations of DT are hard to distinguish from related concepts such as IS-enabled transformation (Wessel et al. 2020). Additionally, the meaning of the term "transformation" is often ambiguous (Markus and Rowe 2021). Some authors have started to argue for DT as deep-structure change, while others have developed different notions of DT (Drechsler et al. 2020; Hanelt et al. 2020) matching either more episodic or more continuous modes of change. Current research has approached DT from lenses such as dynamic capabilities (Pappas et al. 2018). However, the understanding of how DT actually unfolds remains an open question (Vial 2019). From a practice lens, organizations have engaged in the "process" of DT and adjusted their current organizational structure and culture, processes and business models to strengthen their digital capabilities (Drechsler et al. 2020). As part of these endeavors, many organizations experience substantial organizational inertia (Schmid 2019; Vial 2019).

Critical Realism and Generative Mechanism

In critical realism studies, the concept of generative mechanisms plays a foundational role. As a philosophy of science, critical realism believes that reality is stratified into the three pivotal domains (see Figure 1) of the empirical, the actual and the real (Bhaskar 2013).

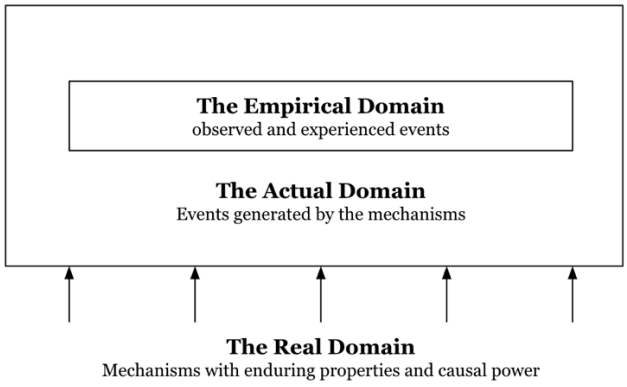

Figure 1. Three Domains of Critical Realism based on Archer (1995)

The empirical relates to our experiences that scientists can investigate. The domain of the actual relates to the events that humans intentionally or unintentionally experience. And the domain of the real refers to the underlying generative mechanisms that cause events and have an explanatory power (Bhaskar 2013; Mingers and Standing 2017). Critical realism studies rely on a contingent understanding of causality, meaning that the realization of a mechanism always depends on specific contextual conditions (Mingers and Standing 2017; Williams and Wynn 2018). In critical realist studies, these contextual conditions and their effects are often described using the Context, Mechanism, Output model (Pawson and Tilley 1997) or Archer's morphogenetic approach (Archer 1995). Both models use the concept of structure which denotes the "relational, material conditions that stand ontologically apart from both behavioral interaction [agency] and culture" (Porpora 2015). Besides structure as a concept, critical realism builds on a reflective understanding of human agency (Archer 1995). Critical realism recognizes that humans are embedded into structural conditions that they interact with intentionally or unintentionally. As a result, they either reproduce existing structures (called morphostasis which means stability) or they change their environment and new structures emerge (called morphogenesis or transformation) (Archer 1995).

To conceptually dissect the concept of generative mechanisms and derive the generative mechanisms that trigger events in the actual domain, a macro-micro-macro typology of mechanisms (Coleman 1990; Hedström and Ylikoski 2010) is often used in critical realist research (Wynn and Williams 2020). As displayed in Figure 2, the model assumes that change does not happen through a direct macro-level association.

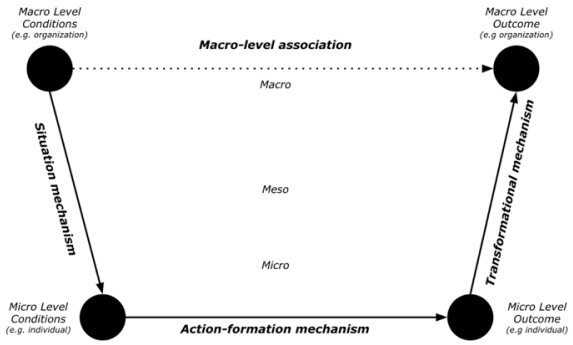

Figure 2. Typology of mechanisms based on Hedström and Ylikoski (2010)

Instead, it unfolds from the macro-level to the micro-level where actions take place. These actions affect the macro-level again (Hedström and Ylikoski 2010). In detail, Hedström and Ylikoski (2010) distinguish between 1) situational mechanisms by which macro structures constrain or enable individuals' activities on the micro-level, 2) action formation mechanisms which link individuals' desires and beliefs to their actions on the micro-level, and 3) transformation mechanisms by which individuals, through their actions and interactions, generate various intended and unintended social outcomes. Notably, the term generative mechanism is used in the critical realist context to refer to mechanisms in the real domain that "generate" events in the actual domain. The term itself does not provide any information in which context (micro, meso, macro). This is why often the typology from Hedström and Ylikowski is used for a more sophisticated analysis. Thus, each type (situational, action formation, transformational) describes a mechanism in the real domain that triggers events in the actual domain on the recurring level.

Methodology: Critical Literature Review

To answer our research question, a critical review of the literature at the intersection of critical realism and DT was conducted. The intention of a critical review is to "critically analyze the extant literature on a broad topic to reveal weaknesses, contradictions, controversies, or inconsistencies" (Paré et al. 2015, p. 189). We purposefully chose a critical review to identify thematic gaps and weaknesses in the discourse that require further research attention and provide future research directions (Paré et al. 2015). A critical review compares existing studies against a set of criteria, in our case the mechanisms' typology. In doing so, a critical review "can constructively inform other scholars and strengthen knowledge development by giving a focus and direction to studies for further improvement" (Paré et al. 2015, p. 189). In contrast to a systematic review that would seek to integrate exiting work, our review compares the findings against a set of criteria (types of mechanisms) (Paré et al. 2015). Furthermore, our sample of papers does not cover all relevant literature but focusses on a representative set of articles (Paré et al. 2015). Following vom Brocke et al. (2009) and Webster and Watson (2002), the review's search process consisted out of four steps shown in Figure 3. To identify relevant literature for DT, we used the keywords "digital" and "technology" which have been used for reviews on DT (Hanelt et al. 2020). We purposefully used these broad terms to avoid limiting the search scope to much. From the lens of critical realism, we used the terms "critical real*" and "generative mechanism*". The term "generative mechanism" was chosen as it builds a core element in critical realism (Mingers and Standing 2017; Wynn and Williams 2020).

To search for representative papers a database search covering multiple journals and conferences was chosen. Reflecting the fast pace in which digital technology has developed and considering the time for the review process of journals, also conference proceedings were considered. As DT is a transdisciplinary topic, we decided to use databases from information systems, business innovation and management literature: Web of Science Core Collection (WoS), the Business Source Ultimate (BSU), Scopus (Scop), AISeLibrary (AIS), ABInform ProQuest (ABI) and ScienceDirect (SD). Each search string was inserted into the database for a search in the title, abstract and keywords. Databases revealed a total of 1131 hits. All hits were subject to initial screening of the title, abstract and keywords and their connection to DT and critical realism. Furthermore, only literature in the English language was included, which led to 106 relevant papers. A following full-text screening of the papers resulted in 80 papers relevant from the keyword search. We followed vom Brocke et al. (2009) and Webster and Watson (2002) and conducted a forward/backward search that added 3 papers from the forward search and 3 papers from the backward search.

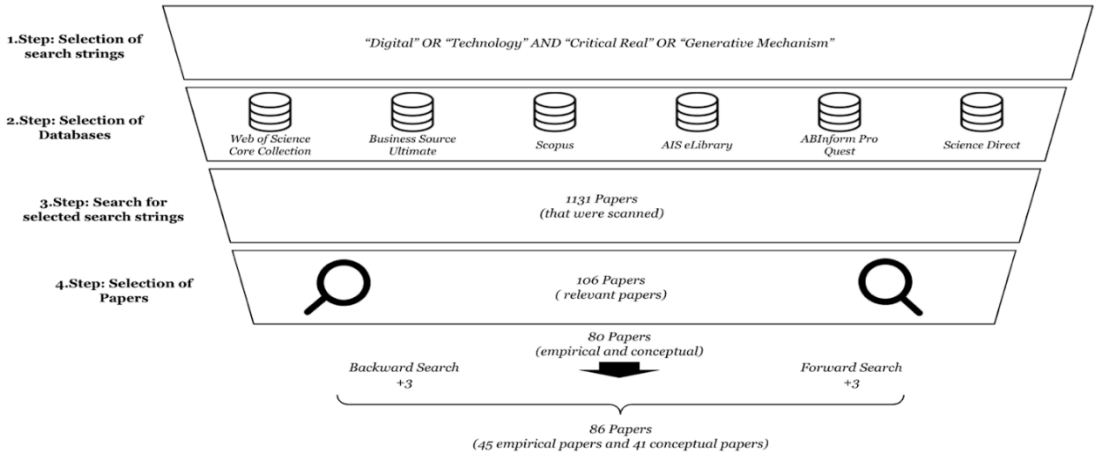

Figure 3. Process of Systematic Literature Review (adapted from Engel and Ebel 2019)

Thus, in total 86 papers were subject to our analysis. For this study, we intended to only look at only empirical studies, which resulted in 45 papers, of which three groups of papers emerged. Firstly, a stream looking at the IT artifact itself (17), another one looking at the specific impact of IT (16) and a third stream looking at organizational change and DT (12). Focusing on the research question and what type of generative mechanisms were used to explain change in DT on the organizational level, we focused on the last stream of research. As part of our concept matrix (Webster and Watson 2002), we analyzed the research design, research question, understanding of DT, the generative mechanisms, their activating or constraining factors and we categorized each mechanism found in the articles by using the typology of Hedström and Ylikoski (2010).

Results

Our analysis of studies revealed insights on the amount and nature of mechanisms that authors proposed and how they were embedded in describing organizational transformation triggered by digital innovation. In all studies part of the sample, the understanding of transformation and change required an underlying theoretical approach (Besson and Rowe 2012). Beyond taking a critical realist stance, papers within the sample adopt Archer's Morphogenetic Approach (e.g. Gebre-Mariam and Bygstad 2019; Mihailescu et al., 2015), discourse analysis (Ovrelid and Bygstad 2019), IS-enabled organizational transformation (Coombs 2015), the concept of transformative change (Bemgal and Haggerty 2019), systems theory (Törmer 2018), a socio-technical approach (Crick and Chew 2020) and an institutional approach to change and transformation (Essen and Varlander 2019).

Types of Mechanisms in CR Studies on Digital Transformation

Looking at the adoption of different types of mechanisms used, Figure 4 shows that only two studies (Gebre-Mariam and Bygstad 2019; Ovrelid and Bygstad 2019) provide mechanisms along with the entire macro-micro-macro framework. Seven studies identify at least transformational mechanisms that describe and explain a macro-level outcome. Respectively four studies mention situational mechanisms, and five identify action mechanisms. We discuss the adoption of each mechanism in detail.

Situational Mechanisms: Situational mechanisms explain how macro-level contextual factors constrain or influence individuals' actions on the micro-level in a transformational context. In terms of existing macro-level factors, our analysis revealed factors related to the characteristics of digital technology (Gebre-Mariam and Bygstad 2019; Törmer 2018). For example, Törmers (2018) mechanism of modular upgradability refers to the deployment of single elements of the digital plattfrom by specifc user groups. Thus, a feature of the digital solution allows for a specific use case. Furthermore, a match between the task that is supposed to be solved and the technology in use aswell as a shared understanding of technology by emplyoees has been mentioned as relevant situational factors by Crick and Chew (2020).

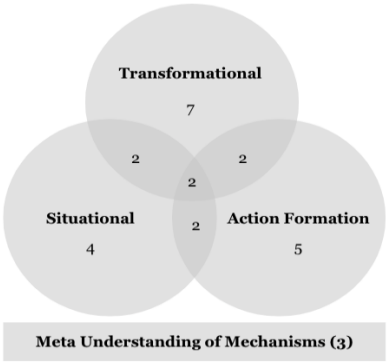

Figure 4. Overlap of mechanisms in papers

Another factor is the existence of processes within the transformational setup (Crick and Chew 2020; Gebre-Mariam and Bygstad 2019). Process and role clarity as well as decentralized organizational structures played a major role in the activation of the situational mechanism in both studies. Across studies, using discourse theory, the way how stakeholders frame and talk about the implementation of technology gains is mentioned as decisive for the activation of the mechanism (Bemgal and Haggerty 2019; Crick and Chew 2020; Gebre-Mariam and Bygstad 2019; Ovrelid and Bygstad 2019). For example in Gebre-Miriam's study (2019), the dominant discourse around project-based work and the effects of this discussion are a factor for the activation of their projectification mechanism. Furthermore, the role of a governing agency and the acknowledgement of the problem relevance aswell as proper funding within the project context is a relevant factor that ensures legitimacy among stakeholders (Gebre-Mariam and Bygstad 2019; Ovrelid and Bygstad 2019). To summarize, relevant contextual factors have been identified on the charateristics of the available digital technology, its relationship to important project stakeholders (e.g. discourse of employees and managers) and predefined organizational factors (e.g. processes, skills, existing capabilites).

Action Mechanisms: Action mechanisms are causal explanations that describe a relationship between an individual and their action linking the individuals' desires and beliefs to what people are doing on the micro-level. The use of digital technology in this case offers new opportunities for action. To realize these actions on the individual level, two main dimensions can be identified. Firstly, a setup in which actors are incentivized to take action. One example is the Embedded Inscription mechanism in which strategically embedded actors pursue opportunistic modes of interaction (Gebre-Mariam and Bygstad 2019). And second, an individual decision in which actors decide to make use of the implemented digital technology. This is for example the case through the identified standardization mechanism in which some actors decide to replace paper-based work practices with digital solutions and others not (Mihailescu et al. 2015). Additionally, often elements of decentralization are mentioned as triggers for the activation of such mechanisms. For example, Essen and Varlander (2019) explain that employees have control over local practices which drives the ongoing transformation. Also, Bemgal and Haggerty (2019) are an example as in their case employees became more peripheral decision-makers as part of the transformation. Furthermore, often signals such as the framing or forming of specific intentions or goals trigger individual action if activated (Bemgal and Haggerty 2019).

Transformational Mechanisms: Transformational Mechanisms refer to actions on the micro-level that impact the macro level. Within our sample of papers, it was possible to identify the transformational mechanisms related to the digital technology in use and how this mechanism is supported through actions on the micro level that translate into a macro-outcome. For example the mechanism of scaling was mentioned multiple times (Gebre-Mariam and Bygstad 2019; Henfridsson and Bygstad 2013; Ovrelid and Bygstad 2019) and refers for example to a *"self-reinforcing process by which an infrastructure expands by proposing a configured solution to common challenges*" (Ovrelid and Bygstad 2019). Gebre-Mariam and Bygstad (2019) as well as Henfridsson and Bygstad (2013) refer to a similar mechanism which explains how the digital artifact expands its use based on a macro level. This also refers to the malleability of the digital artifact. The mechanism of scaling for example is often embedded into an existing ecosystem, that means the use of the digital technology supported by new partners enables this scaling of the digital solution (Ovrelid and Bygstad 2019). Furthermore, a clear strategy of the executing organization (Gebre-Mariam

and Bygstad 2019) and management support (Ovrelid and Bygstad 2019) are mentioned as factors triggering the mechanism. Beyond scaling effects of the digital solution, often mechanisms such as transformation (Ovrelid and Bygstad 2019) or convergence (Mihailescu et al. 2015) are mentioned. As such, both mechanisms refer to processes in which the technology is embedded and supported through organizational members.

Research Agenda: A Critical Realist Lens on Digital Transformation

Critical realism with its three-layer stratification of reality allows researchers to take a realist stance on investigating phenomena while recognizing that our access to the world surrounding us is mediated through our perception and ways of seeing (Mingers et al. 2013). It agrees that knowledge is always local and distinguishes between the different types of knowledge in its physical, social and conceptual idea. Thus, it builds a bridge between the empiricist view of science and an idealist view of science, which is expressed through constructivism and interpretivism (Mingers et al. 2013). Furthermore, with its stratified worldview and its distinction of structure and agency (Archer 1995), critical realist based models of social change and transformation such as Archers Morphogenetic Approach (Archer 1995) or the related Transformational Model of Social Activity (Faulkner and Runde 2013) have made value contribution in delivering explanatory theoretical contributions in IS (Mingers et al. 2013; Mutch 2010). Yet, IS research on DT is dominated by a constructivist or postpositivist worldview (Kutzner et al. 2018). This is confirmed by our comparatively small number of studies within our review. For critical realist studies, the use of generative mechanism – centerpiece of our review – has indicated how critical realism can help to advance our theoretical understanding on DT (Mingers and Standing 2017). Generative mechanism and their contingent understand of causality may help to offer a promising position on the question discussed how digital technology may change our thinking of causality (Markus and Rowe 2018). DT as a concept that embodies the implementation of digital technology in our social world can serve as an area in which scholars can use the epistemological tools provided by critical realism. This can clarify conceptual uncertainties (Wessel et al. 2020) and can also help build new theory that rejects the claim of DT serving as a buzzword (Baiyere et al. 2017).

Avenue I: Situational Mechanisms of Digital Transformation

Why do some DT activities of organizations succeed while other fail? Under which conditions are certain DT activities of organizations successful and why? Answering these kinds of questions, the concept of situational mechanisms can add value. As part of organizations' DT journey, many organizations trigger initiatives and projects intended to develop new digital innovations and adjust the current organizational structures and processes (Drechsler et al. 2020). For example, organizations have engaged in setting up dedicated organizational units, referred to as Digital Innovations Units or have initiated large scale organizational transformation efforts to strengthen their digital innovation capability (Soto Setzke et al. 2020). Looking at these kinds of DT activities scholars should investigate the situational mechanisms at play on the macro-level that enable or constrain DT. Using in-depth case studies to investigate the events and ultimately, situational mechanisms may advance our knowledge of how DT unfolds on a macro-micro level (Vial 2019) and shed light on the trajectory's organizations follow (Drechsler et al. 2020).

Avenue II: Action Formation Mechanisms of Digital Transformation

DT fosters new constellations of actors, collectives, and the ability for collective actions in more dispersed and malleable organizational settings (Hanelt et al. 2020; Nambisan et al. 2017; Young et al. 2019). Our review also reveals some mechanisms regarding the role of decentralized action for turning DT into success. However, our understanding of the underlying relationship between new action potentials generated by DT and the circumstances which lead to the release of these action potentials is currently limited (Hanelt et al. 2020; Vial 2019). Thus, the concept of action formation mechanisms can be a potential tool that allows us to better understand the why individual actors get engaged in these setups.

Avenue III: Transformational Mechanisms of Digital Transformation

The intention of DT is often mentioned as deep-structure change (Hinings et al. 2018; Vial 2019), which is triggered by organizational members that aim to transform the organization on a macro level through

various DT activities (Drechsler et al. 2020). Current studies as our review shows have investigated the mechanisms of scaling to describe the recurring process of how the digital solution attracts new user and increases its value. While this field offers much potential for further research (Faulkner and Runde 2019; Yoo et al. 2010) it could also be interesting to investigate transformational mechanisms aiming for illuminating the socio-technical configurations within the process of DT. This could shed light on the trajectories of DT within organizations pursuing the DT journey (Vial 2019).

Avenue IV: Nature of Transformation and Inertia in Digital Transformation

Research on DT currently discusses the nature of transformation (Drechsler et al. 2020; Hanelt et al. 2020) triggered by digital technology. Using the critical realist philosophy of science and affiliated understandings of change and transformation (Archers Morphogenetic Approach or the Transformational Model of Social Activity) could act as a refreshing theoretical lens. This could help to identify path dependencies in DT journeys (Vial 2019) with its replication or transformation approach. Furthermore, the morphogenetic approach's application over time to analyze organizations' DT activities and initiatives provide a fruitful ground to shed light on causal relationships that may better explain how DT unfolds and evolves (Vial 2019). Thus, it might be worthwhile to combine for example Archer's approach with a socio-technical model of change (Lyytinen and Newman 2008). This could allow for a more sophisticated and fine-grained analysis of specific transformation activities, such as the establishment of new organizational forms and structures or the development of specific digital products and services (Drechsler et al. 2020). Additionally, DT goes along with inertia of existing structures within organizations (Schmid 2019). Recent scholars have asked to investigate DT from the lens of structural inertia and recurring capabilities to deal with inertia (Drechsler et al. 2020). While recent papers on the study of inertia have started to investigate mechanisms, still our theoretical understanding of inertia in DT is limited (Besson and Rowe 2012; Schmid 2019). Further investigating the situational, action mechanism that afford inertia in organizations and also identifying the mechanisms and capabilities to overcome inertia could add value to current discussions.

Conclusion

To summarize, our research question on what kind of generative mechanisms are used in critical realist studies explaining DT points out several different ways and interpretations of the situational, action-formation and transformational mechanisms in place. By describing how different mechanisms are applied, we show strengths and shortcomings in the current discussion. Furthermore, we propose four avenues of future research that put forward the notion of a critical realist understanding of DT. Our study contributes as it sheds light on the use of mechanisms in a particular context (Wynn and Williams 2020) and as we propose potential ways of how critical realism can help to build theory on DT. Regarding limitations, the non-exhaustiveness of our sample, the low conceptual maturity of the concept of DT, and the ambiguous use of the term mechanisms in current research present challenges. Following up on our research avenues thus can help to advance our understanding of DT through explanatory theory which can serve as a basis to turn DT into success.

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REFERENCES

Archer, M. S. 1995. *Realist Social Theory: The Morphogenetic Approach*, Cambridge University Press.

Baiyere, A., Grover, V., Gupta, A., Woerner, S., and Lyytinen, K. J. 2017. "Digital 'x' - A New Tune for IS Research or Old Wine in New Bottles?," in *ICIS 2017 Proceedings*, AIS.

Bemgal, S., and Haggerty, N. 2019. "Generative Mechanisms of Technology Enabled Transformation: A Critical Realist Evaluation of a Hospital Laboratory Unit Transformation," in *ICIS 2019 Proceedings*.

Besson, P., and Rowe, F. 2012. "Strategizing Information Systems-Enabled Organizational Transformation: A Transdisciplinary Review and New Directions," *The Journal of Strategic Information Systems* (21:2), pp. 103–124.

Bhaskar, R. 2013. *A Realist Theory of Science*, Routledge.
vom Brocke, J., Simons, A., Niehaves, Bjoern, Niehaves, Bjorn, Reimer, K., Plattfaut, R., and Cleven, A. 2009. "Reconstructing the Giant: On the Importance of Rigour in Documenting the Literature Search Process," in *Proceedings ECIS 2009*.
Bygstad, B., Munkvold, B. E., and Volkoff, O. 2016. "Identifying Generative Mechanisms through Affordances: A Framework for Critical Realist Data Analysis," *Journal of Information Technology* (31:1), pp. 83–96.
Coleman, J. S. 1990. *Foundations of Social Theory. Cambridge, MA: Belknap Press of Harvard University Press*.
Coombs, C. R. 2015. "When Planned IS/IT Project Benefits Are Not Realized: A Study of Inhibitors and Facilitators to Benefits Realization," *International Journal of Project Management* (33:2), pp. 363–379.
Crick, C., and Chew, E. K. 2020. "Microfoundations of Organizational Agility: A Socio-Technical Perspective," *Communications of the Association for Information Systems* (46:1), p. 12.
Drechsler, K., Gregory, R. W., Wagner, H.-T., and Tumbas, S. 2020. "At the Crossroads between Digital Innovation and Digital Transformation," *Communications of the Association for Information Systems* (47 (1):23).
Engel, C., and Ebel, P. 2019. "Data-Driven Service Innovation: A Systematic Literature Review and Development of a Research Agenda," in *ECIS 2019 Proceedings*, Research Papers.
Faulkner, P., and Runde, J. 2013. "Technological Objects, Social Positions, and the Transformational Model of Social Activity," *Management Information Systems Quarterly* (37:3), pp. 803–818.
Faulkner, P., and Runde, J. 2019. "Theorizing the Digital Object," *Management Information Systems Quarterly* (43:4).
Forth, P., Reichert, T., de Laubier, R., and Chakraborty, S. 2020. "Flipping the Odds of Digital Transformation Success," *BCG*, , October 29. (https://www.bcg.com/de-de/publications/2020/increasing-odds-of-success-in-digital-transformation, accessed February 1, 2021).
Gebre-Mariam, M., and Bygstad, B. 2019. "Digitalization Mechanisms of Health Management Information Systems in Developing Countries," *Information and Organization* (29:1), pp. 1–22.
Gimpel, H., Hosseini, S., Huber, R. X. R., Probst, L., Röglinger, M., and Faisst, U. 2018. "Structuring Digital Transformation: A Framework of Action Fields and Its Application at ZEISS," *J. Inf. Technol. Theory Appl.* (19:1), p. 3.
Hanelt, A., Bohnsack, R., Marz, D., and Antunes Marante, C. 2020. "A Systematic Review of the Literature on Digital Transformation: Insights and Implications for Strategy and Organizational Change," *Journal of Management Studies* (43), p. 39.
Hedström, P., and Ylikoski, P. 2010. "Causal Mechanisms in the Social Sciences," *Annual Review of Sociology* (36:1), Annual Reviews, pp. 49–67.
Henfridsson, O., and Bygstad, B. 2013. "The Generative Mechanisms of Digital Infrastructure Evolution," *Management Information Systems Quarterly* (37:3), p. 907.
Hinings, B., Gegenhuber, T., and Greenwood, R. 2018. "Digital Innovation and Transformation: An Institutional Perspective," *Information and Organization* (28:1), pp. 52–61.
Kutzner, K., Schoormann, T., and Knackstedt, R. 2018. "Digital Transformation in Information Systems Research: A Taxonomy-Based Approach to Structure the Field," in *ECIS 2018 Proceedings*.
Lyytinen, K., and Newman, M. 2008. "Explaining Information Systems Change: A Punctuated Socio-Technical Change Model," *European Journal of Information Systems* (17:6), pp. 589–613.
Majchrzak, A., Markus, M. L., and Wareham, J. 2016. "Designing for Digital Transformation: Lessons for Information Systems Research from the Study of ICT and Societal Challenges," *Management Information Systems Quarterly* (40:2), pp. 267–277.
Markus, M. L., and Rowe, F. 2018. "Is IT Changing the World? Conceptions of Causality for Information Systems Theorizing," *Management Information Systems Quarterly* (42:4), pp. 1255–1280.
Markus, M. L., and Rowe, F. 2020. "Call for Papers: Envisioning Digital Transformation: Advancing Theoretical Diversity," *Journal of the Association for Information Systems*.
Markus, M. L., and Rowe, F. 2021. "Guest Editorial: Theories of Digital Transformation: A Progress Report," *Journal of the Association for Information Systems* (22:2), p. 11.
Mihailescu, M., Mihailescu, D., and Schultze, U. 2015. "The Generative Mechanisms of Healthcare Digitalization," in *ICIS 2015 Proceedings*.
Mingers, J., Mutch, A., and Willcocks, L. 2013. "Critical Realism in Information Systems Research," *Management Information Systems Quarterly* (37:3), pp. 795–802.

Mingers, J., and Standing, C. 2017. "Why Things Happen - Developing the Critical Realist View of Causal Mechanisms," *Information and Organization* (27:3), pp. 171–189.
Mutch, A. 2010. "Technology, Organization, and Structure-A Morphogenetic Approach," *Organization Science* (21:2), pp. 507–520.
Nambisan, S., Lyytinen, K., Majchrzak, A., and Song, M. 2017. "Digital Innovation Management: Reinventing Innovation Management Research in a Digital World," *Management Information Systems Quarterly* (41:1), pp. 223–238.
Ovrelid, E., and Bygstad, B. 2019. "The Role of Discourse in Transforming Digital Infrastructures," *Journal of Information Technology Impact* (34:3), pp. 221–242.
Pappas, I. O., Mikalef, P., Giannakos, M. N., Krogstie, J., and Lekakos, G. 2018. "Big Data and Business Analytics Ecosystems: Paving the Way towards Digital Transformation and Sustainable Societies," *Information Systems and E-Business Management* (16:3), pp. 479–491.
Paré, G., Trudel, M.-C., Jaana, M., and Kitsiou, S. 2015. "Synthesizing Information Systems Knowledge: A Typology of Literature Reviews," *Information & Management* (52:2), pp. 183–199.
Pawson, R., and Tilley, N. 1997. *Realistic Evaluation*, SAGE.
Porpora, D. V. 2015. *Reconstructing Sociology: The Critical Realist Approach*, Cambridge University Press.
Rowe, F. 2018. "Being Critical Is Good, but Better with Philosophy! From Digital Transformation and Values to the Future of IS Research," *European Journal of Information Systems* (27:3), pp. 380–393.
Schmid, A. M. 2019. "Beyond Resistance: Toward a Multilevel Perspective on Socio-Technical Inertia in Digital Transformation," in *Proceedings of the 27th European Conference on Information Systems*.
Sebastian, I., Ross, J., Beath, C., Mocker, M., Moloney, K., and Fonstad, N. 2017. "How Big Old Companies Navigate Digital Transformation," *MIS Quarterly Executive*.
Soto Setzke, D., Opderbeck, L., and Riasanow, T. 2020. "Toward a Taxonomy of Digital Transformation Initiatives," in *Proceedings of the 28th European Conference on Information Systems*.
Törmer, R. L. 2018. "Internal Digital Platforms and Generative Mechanisms of Digital Innovation," in *Proceedings of the 39th International Conference on Information Systems (ICIS)*.
Vega, A., and Chiasson, M. 2019. "A Comprehensive Framework to Research Digital Innovation: The Joint Use of the Systems of Innovation and Critical Realism," *The Journal of Strategic Information Systems* (28:3), pp. 242–256.
Vial, G. 2019. "Understanding Digital Transformation: A Review and a Research Agenda," *The Journal of Strategic Information Systems* (28:2), pp. 118–144.
Webster, J., and Watson, R. T. 2002. "Analyzing the Past to Prepare for the Future: Writing a Literature Review," *The Mississippi Quarterly* (26:2).
Wessel, L., Baiyere, A., Ologeanu-Taddei, R., Cha, J., and Jensen, T. 2020. "Unpacking the Difference between Digital Transformation and IT-Enabled Organizational Transformation," *Journal of Association of Information Systems*.
Williams, C. K., and Wynn, D. E. 2018. "A Critical Realist Script for Creative Theorising in Information Systems," *European Journal of Information Systems* (27:3), pp. 315–325.
Wynn, D. E., Jr, and Williams, C. K. 2020. "Recent Advances and Opportunities for Improving Critical Realism-Based Case Study Research in IS," *Journal of the Association for Information Systems* (21:1), p. 8.
Yoo, Y., Henfridsson, O., and Lyytinen, K. 2010. "Research Commentary—The New Organizing Logic of Digital Innovation: An Agenda for Information Systems Research," *Information Systems Research* (21:4), pp. 724–735.
Young, A., Selander, L., and Vaast, E. 2019. "Digital Organizing for Social Impact: Current Insights and Future Research Avenues on Collective Action, Social Movements, and Digital Technologies," *Information and Organization* (29:3), p. 100257.