

Dec 12th, 12:00 AM

How CIOs Influence Digital Transformation Success. Evidence from a Large-scale, Multi-national Survey

Rainer Wittmann
Ludwig-Maximilians Universität, rainer.wittmann@lmu.de

Johann Kranz
Ludwig-Maximilians-University Munich, kranz@lmu.de

Follow this and additional works at: <https://aisel.aisnet.org/icis2022>

Recommended Citation

Wittmann, Rainer and Kranz, Johann, "How CIOs Influence Digital Transformation Success. Evidence from a Large-scale, Multi-national Survey" (2022). *ICIS 2022 Proceedings*. 10.
https://aisel.aisnet.org/icis2022/governance_is/governance_is/10

This material is brought to you by the International Conference on Information Systems (ICIS) at AIS Electronic Library (AISeL). It has been accepted for inclusion in ICIS 2022 Proceedings by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.

How CIOs Influence Digital Transformation Success. Evidence from a Large-scale, Multi-national Survey

Completed Research Paper

Rainer Wittmann

LMU Munich School of Management
Ludwig-Maximilians-Universität
Ludwigstrasse 28, 80539 Munich
rainer.wittmann@lmu.de

Prof. Dr. Johann Kranz

LMU Munich School of Management
Ludwig-Maximilians-Universität
Ludwigstrasse 28, 80539 Munich
kranz@lmu.de

Abstract

Digital transformation is an important and omnipresent topic for corporations that want to stay relevant and survive in today's business environment. The success of digital transformation depends on a multitude of factors, one of which is digital transformation governance. This study investigates the moderating effect of CIO membership in the top management team on the relationship between enabling factors of digital transformation and digital transformation success. Furthermore, different digital transformation governance configurations are investigated regarding their effect on the success of digital transformation. We make use of a large scale, multi-national survey among manufacturing firms to answer these two research questions. With our study, we demonstrate the importance of including the CIO in the top management team to take advantage of existing resources and capabilities. Additionally, we show that firms with a CIO being responsible for digital transformation perform significantly better in their digital transformation endeavors.

Keywords: Digital Transformation, Governance, Chief Information Officer, CIO, Top Management, Digital Transformation Responsibility

Introduction

Digital transformation poses an ongoing challenge to firms. They need to improve, reinvent, or even replace successful products and services to keep up with the ever-changing customer demand (Chan et al. 2019), need to adapt organizational structures and processes to be able to introduce innovative technologies (Legner et al. 2017), and need to implement new strategies and governance structures to deal with the emergence of fierce competitors. Digital transformation, which “frequently involves the transformation of key business operations and affects products and processes, as well as organizational structures and management concepts” (Matt et al. 2015), is a way for corporations to continuously modernize both themselves and their offerings. It includes investing in more flexible information technology, rethinking of organizational structures, and embracing of digital technologies.

Digital technologies and digital innovation, which are described as the core of digital transformation, have been of special interest to information systems (IS) research in the past (Kohli and Melville 2019; Leonhardt et al. 2020; Vial 2019). Digital innovation can be defined “as the creation of (and consequent change in) market offerings, business processes, or models that result from the use of digital technology” (Nambisan et al. 2017). The introduction of digital technologies, such as artificial intelligence, blockchain and distributed ledger technology, and the Internet-of-Things (IoT) have increased the pressure on corporations to adapt to the changing environment and to incorporate digital innovation into their products and services, their internal processes, and their governance structures (Kohli and Melville 2019).

The various challenges associated with digital transformation lead companies to formulate digital transformation strategies, which serve as a guideline for coordinating, prioritizing, and implementing digital transformation (Matt et al. 2015). Establishing these strategies can introduce digital transformation governance structures and lead to the redistribution of management responsibilities (e.g., Ceipek et al. 2021). Some firms transfer the responsibility for digital transformation to the CIO, while others have established Chief Digital Officers (CDO) (Singh and Hess 2017; Tumbas et al. 2018). Throughout this manuscript, we use the term CIO for the company's most senior IT executive, irrespective of the actual job title.

A plethora of research has investigated both the effects of a CIO in the top management team on various dependent variables and corporate success measures (e.g., Bendig et al. 2022; Chatterjee et al. 2001; Karimi et al. 1996; Leidner et al. 2010; Taylor and Vithayathil 2018), as well as the role of the top management in the digital transformation (e.g., Hess et al. 2016; Singh and Hess 2017; Wrede et al. 2020). However, research that jointly investigates the influence of CIO membership in the top management team on digital transformation success is scarce, yet important for firms seeking to adapt organizational structures and responsibilities to succeed in digital transformation. Further, we aim to increase our understanding of the influence of different digital transformation governance configurations and CIO membership in the top management team on digital transformation success. Hence, our research is guided by the following research questions:

- RQ1:** What is the effect of CIO membership in the top management on the relationship between digital transformation enablers and digital transformation success?
- RQ2:** Do different digital transformation governance configurations have a significant effect on digital transformation success?

To answer these questions, we will analyze data from a large, multi-national industry survey regarding the current state of IoT practices in manufacturing corporations, including 902 participants. To analyze the influence of managerial responsibility for digital transformation on digital transformation success we conduct moderated multiple linear regression analyses and an analysis of variance (ANOVA) with Bonferroni correction.

The remainder of this paper is structured as follows. First, we introduce the theoretical foundation of this research project with special focus on digital transformation, digital innovation, the role of the CIO, and governance configurations. Second, the research methodology is delineated, including the data collection, operationalization of variables, the development of the research models and hypotheses, followed by the data analysis. Third, the results of our analysis are presented, which are subsequently discussed, and implications are drawn. This paper closes with a discussion of the findings, limitations, and avenues for future research.

Theoretical Foundation

Digital Transformation

Digital transformation can be defined 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” (Hinings et al. 2018, p. 53) or more abstract and conceptual as “a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies” (Vial 2019, p. 121). It comprises the radical challenges and modifications of corporations and industries, but also to individuals and society, through the introduction of digital technologies (Agarwal et al. 2010; Majchrzak et al. 2016). What sets digital transformation apart from other kinds of transformation is its potential to not only transform products and services, but also internal processes and strategies and even the identity of firms in the process. It can thereby be described as a multi-dimensional transformation that affects the whole organization (Berger et al. 2020) Based on the constant emergence and the ongoing development of digital technologies, digital transformation can be seen as a continuous process rather than a terminating one.

The rapid advances and diffusion of digital hardware and software technologies have put digital transformation on the agenda of most companies (Fitzgerald et al. 2013; Kofler 2018). Companies need to focus on

changing their business models, products, and services, the development of internal structures and procedures in terms of efficiency or customer orientation, as well as the development of an organizational culture and infrastructure that empowers creativity and innovation (Kofler 2018). Incumbent businesses and even industries that had been unaffected by disruptive forces, such as health care and financial services are being threatened by digital innovations and new competitors (Christensen et al. 2000; Dobni 2006; Haffke et al. 2016). The exploration of new ways of doing business, with new technologies, processes, and strategies to generate knowledge and skills, and the exploitation of existing structures, products, and technologies to drive core business activities, are two main goals of corporate IT. Finding a balance between exploration and exploitation poses a great challenge to corporations (Kranz et al. 2016), which is extensively discussed in another stream of research (Montealegre et al. 2019; Werder and Heckmann 2019) The resulting mix of management-oriented and technological competencies must be present in corporate management (Bijedić et al. 2018) and leads to a convergence of IT- and business strategies towards a unified digital business strategy (Bharadwaj et al. 2013; Haffke et al. 2016; Hess et al. 2016). Consequently, the role of a companies' IT department has evolved from a support function to the business to being a critical strategic partner that helps to enable the business strategy and to accomplish organizational goals (Leonhardt et al. 2017; Tumbas et al. 2017).

To deal with the complexities of and the challenges associated with digital transformation, firms formulate digital transformation strategies “that embrace the implications of digital transformation and drive better operational performance” (Hess et al. 2016, p. 123). They serve as a guideline for coordinating, prioritizing and implementing digital transformation (Matt et al. 2015). Thus, a digital transformation strategy comprises all aspects of digital transformation, which are distributed throughout the firm. Compared to IT strategies, that focus on the management of IT infrastructure, or business strategies that deal with products, markets and business models, a digital transformation strategy is a holistic blueprint “that supports companies in governing the transformations that arise owing to the integration of digital technologies, as well as in their operations after a transformation” (Matt et al. 2015, p. 340). Because of the ever-changing digital technology landscape, digital transformation strategies must either be technology agnostic, or adjustable to changing conditions and new requirements (Ciriello et al. 2018).

Several factors have been investigated in the literature, that influence digital transformation success. The introduction, use, and management of innovative technologies is the base of any kind of digital transformation. As discussed above, digital innovation is the core of digital transformation. Without digital innovation and the appropriate IT capabilities, digital transformation cannot be successful (e.g., Gurbaxani and Dunkle 2019). Furthermore, corporate culture, has been identified as a major influencer of digital transformation success (e.g., Hartl 2019; Ostroff et al. 2020). A corporate culture that is conducive to digital transformation success promotes risk taking, embraces fast decision-making, rewards personal initiative, fosters clear communication both bottom-up and top-down, and improves corporate agility (Gurbaxani and Dunkle 2019). A third highly relevant factor in digital transformation success is the corporation's ability to gather, manage and analyze large data sets to gain deeper insights into internal processes, customer relations and product usage. The usage of this data allows firms to improve and innovate both internally and externally (e.g., Chen et al. 2017; Dremel et al. 2017).

Digital Transformation Governance

The top management of a company must adapt to the above introduced characteristics of digital transformation and master unprecedented challenges (Wrede et al. 2020). Hence, it is important for a firm's competitiveness, that the top management, can align its management behavior with the firms environment and has the capacity to remain updated with technological trends and their effects (Bijedić et al. 2018). It is the manager's responsibility, to assess the current technology competencies and detect the new competencies that will be needed in the organization (Hess et al. 2016). Moreover, there are important new responsibilities, which need to be incorporated in the management of a firm. First, the competitive landscape has changed through digitalization by lowering entry barriers to markets, by simplifying customer access, and by allowing for constant change (Bijedić et al. 2018). To stay competitive, managers need to balance exploration and exploitation activities to achieve organizational agility (Hess et al. 2016). Second, there are investment decisions that need to be made under greater uncertainty (Bijedić et al. 2018). Because of the technological complexity it is difficult to estimate, which specific technology is most suitable and which costs will be offset by later revenues (Saam et al. 2016). Investing in innovative technology raises uncertainty regarding if and when the investment will pay off. Thus, investing in the wrong technology carries

the risk of immense sunk costs (Bijedić et al. 2018). Lastly, top management must guide and support a cultural change in their company, as digital transformation leads to more complex and dynamic processes (Wrede et al. 2020), which need to be incorporated and adopted by the workforce. This culture of change, agility, and cooperation must be carefully introduced, supported, and guided in the right direction (Osmundsen et al. 2018). Otherwise, it can evoke uncertainties among employees (Petrikina et al. 2017) and can potentially lead to resistance behavior regarding the change (Soto Setzke et al. 2018).

To deal with these new requirements and complexities of introducing and governing digital transformation strategies, many firms introduce new organizational and governance structures to redistribute the management responsibilities in the firm (Singh and Hess 2017). Traditionally, it is the chief information officers (CIO) responsibility to manage the exploitation of the existing IT resources of the firm. With the advent of innovative digital technologies and the need to explore new technological avenues, the role of the CIO has gained strategic relevance over the past decades, along with the development of digital technologies, to a strategic differentiator and a source of competitive advantages (Haffke et al. 2016; Leonhardt et al. 2017). Some firms have consequently increased the CIO's responsibilities to include the managing of the company's digital transformation. As the topic of digital transformation lies outside of the traditional responsibilities and capabilities of the CIO, other firms have established a new role dedicated to digital transformation, the chief digital officer (CDO). Unlike the CIO, who is responsible for the traditional IT strategy and its execution, the CDO is in charge of the digital transformation strategy and all its components.

The Evolution of the CIO Role and its Influence on the Firm

The continuing evolution of the CIO role in firms is well researched and documented in the IS literature. Starting out as a functional role in charge of acquiring, implementing, and managing technical infrastructure to ensure data storage and processing, CIOs had neither strategical influence, nor were they traditionally part of the top management (Rockart et al. 1982). During the 1980s and 1990s, the top management started to recognize the increasing relevance of IT and IS to the operation of the firm. Hence, the CIO grew to be an important partner to the management of a firm and increasingly reported directly to the CEO (Applegate and Elam 1992). Towards the end of the 1990s, a CIO was more and more seen as strategic partner that develops a unified business and IT vision, designs IT architecture and delivers comprehensive information systems (Feeny and Willcocks 1998). During the 2000s, the role of the CIO switched from a pure supply side function, as described above, to actually creating value in terms of increasing revenues, reducing operational costs, and improve both customer satisfaction and loyalty (Guillemette and Paré 2012). CIOs are further tasked to create an agile business environment and culture that can quickly react to changing circumstances through the intelligent and innovative use of IT, and to ensure IT security and regulatory compliance (Chun and Mooney 2006).

The effect of CIO membership in the top management of a firm is extensively discussed in the IS literature and generally accepted to be positive. For example, Taylor and Vithayathil (2018) found that the presence of technological leadership in the top management team, in form of a CIO, is linked to increased future sales in both short and long term. A CIO in the top management can lead the firm towards a better equilibrium between exploitation of existing IT resources and exploration of new technological opportunities (Bendig et al. 2022) and guide the top management to be more open towards new and innovative technologies (Leidner et al. 2010). Additionally, the CIO can increase the competitiveness of a firm's business strategy (Karimi et al. 1996), increase profit and lower total operating expenses (Preston and Karahanna 2009), and even increase market valuation (Chatterjee et al. 2001). Moreover, Chen et al. (2021) found that CIO characteristics positively relate to CIO issue selling effectiveness, which in turn lead to higher digital innovation success.

Methodology

Data Collection

The "Industry 4.0 Barometer" is an annual survey to gain insights into the current state of digital transformation. The survey is conducted by the management consultancy MHP and LMU Munich. The data is collected via personal contacts and the market research company *Prolific*. In 2021, the survey collected data from four regions: German speaking countries (DACH), the USA, the UK, and China. All participants are employees of firms of different sizes in manufacturing industries. 75% of participants were members of

their firm's top three hierarchical tiers. From the 902 participants in the data set, we excluded 353 due to short handling times and incomplete responses for relevant questions. The resulting data included 549 participants.

Variables and Operationalization

In the development of the questionnaire, standard psychometric scale development procedures were employed. As far as possible, existing and validated scales were used, adapted to the context of the study. For constructs without previously validated scales, new instruments were developed based on related theory and discussion with experts from academia and practice, following MacKenzie et al. (2011). The constructs were validated qualitatively (n=9) and quantitatively (n=21) in a pilot study with IT professionals and scholars. In line with recommendations for studies in management and for simplicity, brevity, and to conserve space in the questionnaire, some of the constructs are measured with a single item (Fuchs and Diamantopoulos 2009). Table 1 shows the questions relevant for RM1 and RM2.

As the success of digital transformation is difficult to quantitatively measure, we make use of a question regarding measurable success with digital products and services to assess digital transformation success. A firm that has significant success with digital products and services, has transformed some of their offerings to a digital state, which can be interpreted as successful digital transformation. Furthermore, using this question ensures that the firm has actually created new value and is able to capture this additional source of revenue. The responses to this question are recorded on a 7-point Likert scale.

The moderating variable of CIO membership in the top management was measured directly. The participants of the survey were asked to indicate, whether the CIO is a member of the top management or board of directors of their firm or not. Possible answer options were "Yes" and "No".

To inquire the available IT resources for digital transformation, the survey included five questions. The participants were asked to rank the availability of modern and high-bandwidth communications technology at and between their production facilities and plants. As new technologies, used in digital transformation projects, are oftentimes quite data intensive and rely on fast information exchange (e.g., IoT, DLT, and big-data applications), the availability of modern communication technologies can be seen as a prerequisite of digital transformation (Question ITRA 1). Furthermore, the participants were asked to assess the current state of the companies IT architecture regarding consistency of the systems throughout the firm (ITRA 2) and the modularity and extendibility of the architecture (ITRA 3). Finally, the scalability of the available IT resources was assessed by the participants (ITRA 4 and ITRA 5). All questions were evaluated on a 7-point Likert scale from "Do not agree at all" to "Fully agree". To evaluate the IT resource availability, we use the mean value of the five introduced items.

It is essential for various departments to cooperatively find, define, implement, and test innovative products and new or improved processes. For this cooperation to be viable and to enable both value creation and capture, the right corporate culture for digital transformation needs to be created and promoted. As a measure of culture, the participants were asked to assess the corporate culture concerning its conduciveness to digital transformation, for example regarding risk-taking, speed of decision making, and fault tolerance. The question was evaluated on a 7-point Likert scale from "Do not agree at all" to "Fully agree".

Not only do most innovative technologies depend on fast information exchange and processing, but also on the management of large datasets from potentially various data sources. The management of such resources is not trivial and can be seen as a prerequisite of digital transformation. To assess the data management capabilities of the participating firms, the participants were asked to compare their own capabilities to those of their competitors. To include this rather complex topic in our analysis, we use the mean of five items (DMC 1 to DMC 5). All questions were evaluated on a 5-point Likert scale from "Very poor" to "Very good".

Lastly, to gain insights into the digital transformation governance responsibilities, the participants were asked to indicate, who is overall responsible for the digital transformation of the firm. Possible answers were the CEO, the CIO, various other management positions (CDO, CMO, COO, or CTO), or departments or business units themselves.

In all questions, the participants were able to select an additional option of "Don't know". Participants that selected this option in at least one of the relevant questions were excluded for the data analysis, as we can make no inference as to the firm's current state of enabling factors and digital transformation success.

Dependent variable	Items and Scales
Digital transformation success	My company has achieved significant success (net profit and/or additional sales) with digital products and services.*
Moderating variable	
CIO in top management	Is the CIO/IT manager a member of your company's management or board of directors? 1) Yes, 2) No, 3) Don't know
Independent variables	
IT resource availability	We have a powerful communication architecture (e.g., 4/5G, Enterprise WAN) in and between our plants.* All our business processes are built on an integrated, service-oriented IT architecture.* Our IT architecture is modular, i.e., software modules can be quickly integrated and joined together via defined interfaces.* We can quickly scale our IT infrastructure up or down (e.g., through cloud solutions).* We can connect business partners via APIs (application programming interfaces).*
Corporate culture	The corporate culture is conducive to digitalization (e.g., in terms of risk-taking, fault tolerance, speed of decision-making and implementation, personal initiative, organizational structure).*
Data management capabilities	Please rate your company's capabilities compared to competitors in terms of: Continuous preparation and management of data (e.g., data lake, central data platform, uniform rules).** Staff skills and competencies for advanced data analysis methods (e.g., regarding data integration/platform, analysis algorithms, application programming interfaces (APIs)).** Technical infrastructure for advanced data analytics (e.g., in-memory databases, central data hub, distributed file system).** Company processes with partially and fully automated decisions (e.g., through artificial intelligence or machine learning processes).** Continuous collection and analysis of data along the entire value chain (from inbound logistics to production to customer service).**
Digital transformation governance	Who has the overall responsibility for digitization in your company? 1) CEO, Executive Board or Managing Director 2) CIO or IT management 3) CDO or person with digital responsibility 4) CMO or marketing manager 5) COO or Head of the operating business 6) CTO or Technical Director 7) Departments or business units themselves 8) Other

Notes: Questions marked with * were answered on a 7-point Likert scale from “Do not agree at all” to “Fully agree”. Questions marked with ** were answered on a 5-point Likert scale from “Very poor” to “Very good”.

Table 1: Scale items for construct measures

Variable	SV	Mean	SD	1	2	3	4	5	6	7	8	9	10	11
1 ITRA 1	1-7	4.81	1.67											
2 ITRA 2	1-7	4.47	1.60	0.61										
3 ITRA 3	1-7	4.38	1.65	0.51	0.68									
4 ITRA 4	1-7	4.57	1.55	0.42	0.58	0.58								
5 ITRA 5	1-7	4.57	1.68	0.41	0.58	0.58	0.55							
6 CULT	1-7	4.69	1.37	0.27	0.28	0.29	0.26	0.21						
7 DMC 1	1-5	3.52	0.95	0.39	0.52	0.59	0.51	0.49	0.30					
8 DMC 2	1-5	3.45	1.07	0.34	0.46	0.54	0.46	0.48	0.27	0.61				
9 DMC 3	1-5	3.33	1.00	0.39	0.53	0.54	0.50	0.47	0.30	0.61	0.64			
10 DMC 4	1-5	2.95	1.13	0.38	0.43	0.48	0.38	0.45	0.30	0.52	0.59	0.53		
11 DMC 5	1-5	3.45	0.99	0.41	0.48	0.50	0.43	0.49	0.32	0.64	0.58	0.60	0.58	
12 DTS	1-7	4.70	1.74	0.40	0.44	0.40	0.38	0.45	0.24	0.38	0.32	0.36	0.36	0.37

ITRA: IT resource availability, CULT: Corporate culture, DMC: Data management capabilities, SV: Scale values, SD: Standard deviation

Table 2: Measurement information and correlations

Table 2 and Table 3 show measurement information for the model variables and the results of the psychometric analysis of the construct variables, including factor loadings and cross loadings. With a Cronbach’s alpha (CA) of 0.86 and factor loadings of above 0.7, the composing questions fit to the ITRA construct. A composite reliability (CR) of 0.90 and the average variance expected (AVE) of 0.64 attest to a well fit between the items and the construct. Similarly, the DMC construct shows a CA of 0.88 and factor loadings of above 0.75. A CR of 0.91 and AVE of 0.67 are well above the generally accepted values for valid constructs. All cross loadings are at least 0.2 lower than the according construct loadings, with a difference of at least 0.1 being considered as sufficient (Gefen and Straub 2005).

	CA	CR	AVE	Factor Loadings										
				ITRA 1	ITRA 2	ITRA 3	ITRA 4	ITRA 5	CULT	DMC 1	DMC 2	DMC 3	DMC 4	DMC 5
ITRA	0.86	0.90	0.64	0.713	0.863	0.852	0.784	0.784	0.326	0.624	0.570	0.607	0.532	0.582
CULT	1.00	1.00	1.00	0.268	0.279	0.293	0.263	0.205	1.000	0.303	0.267	0.299	0.303	0.316
DMC	0.88	0.91	0.67	0.468	0.591	0.646	0.557	0.582	0.364	0.835	0.832	0.828	0.775	0.829

ITRA: IT resource availability, CULT: Corporate culture, DMC: Data management capabilities, CA: Cronbach’s alpha, CR: Composite reliability, AVE: Average variance expected

Table 3: Psychometric properties and factor loadings for construct variables

Additional to the above introduced variables for the research model, we include a control variable for the region, in which the firm is situated. The survey was conducted in four regions, namely DACH (German speaking countries), the USA, the UK (including North Ireland), and China. We will include this information as dummy variables in the regression models to control for both cultural and economic differences between these regions.

Hypotheses Development

Impact of CIOs in Top Management

As introduced in the theoretical background of this paper, the direct positive effects of the three factors of IT resource availability, corporate culture, and data management capabilities on digital transformation success are well established in the IS literature (e.g., Chen et al. 2017; Dremel et al. 2017; Gurbaxani and Dunkle 2019; Hartl 2019; Ostroff et al. 2020). As such, we focus our argumentation in the next paragraphs on why the presence of the CIO in the top management of a firm plays a significant role in those established relationships.

The top management team of a firm and its composition have a profound effect not only on firm performance (Hambrick and Mason 1984), but more specifically on the strategic orientation of the firm. Including the CIO in the top management team opens up a more direct line of communication with all other senior executives of the firm, enabling the CIO to create a shared IT strategy and vision with the whole management team (Preston and Karahanna 2009). Additionally, it “enables the CIO to promote a vision for IT, exchange ideas about IT initiatives, and assure proposals are heard by the appropriate executive, thus facilitating the CIO’s role” (Banker et al. 2011, p. 488). A more distant relationship between the CIO and the top management, on the other hand, results in a lower effectiveness and impact of the CIO (Raghunathan and Raghunathan 1989) and indicates that the top management has set a low strategic value on IT (Watson 1990).

As a source of technology leadership capabilities (Helfat and Martin 2015), the CIO can guide the firm in its effective and efficient exploitation of existing IT resources, and in the exploration of new technological avenues. Both practitioners and academics agree that it is advantageous for a firm to situate the CIO role as close as possible to the CEO (Banker et al. 2011). It is viewed as an indication for the power and trust placed in the CIO (Applegate and Elam 1992) and implicates the successful use of IT (Armstrong and Sambamurthy 1999). By including the CIO in the top management, companies incorporate the IT perspective in strategic decisions and display strategic foresight (Reich & Nelson, 2003), which leads to a consistent outperformance of competitors on several success measures (Preston et al. 2008). Because of the origin of the CIO role, the CIO is deeply familiar with implementing and maintaining IT and IS infrastructure from a technical perspective. Through the development of the role and its close proximity to the top management, the CIO is additionally experienced with envisioning a business strategy and with creating an environment and culture that is conducive to innovation. Based on this discussion of prior literature, we postulate that the presence of a CIO in the top management of a firm plays a moderating role on digital transformation success. Consequently, we propose the following hypotheses:

- H1:** The membership of a CIO in the top management has a positive moderating effect on the relationship between available IT resources and digital transformation success.
- H2:** The membership of a CIO in the top management has a positive moderating effect on the relationship between corporate culture and digital transformation success.
- H3:** The membership of a CIO in the top management has a positive moderating effect on the relationship between data management capabilities and digital transformation success.

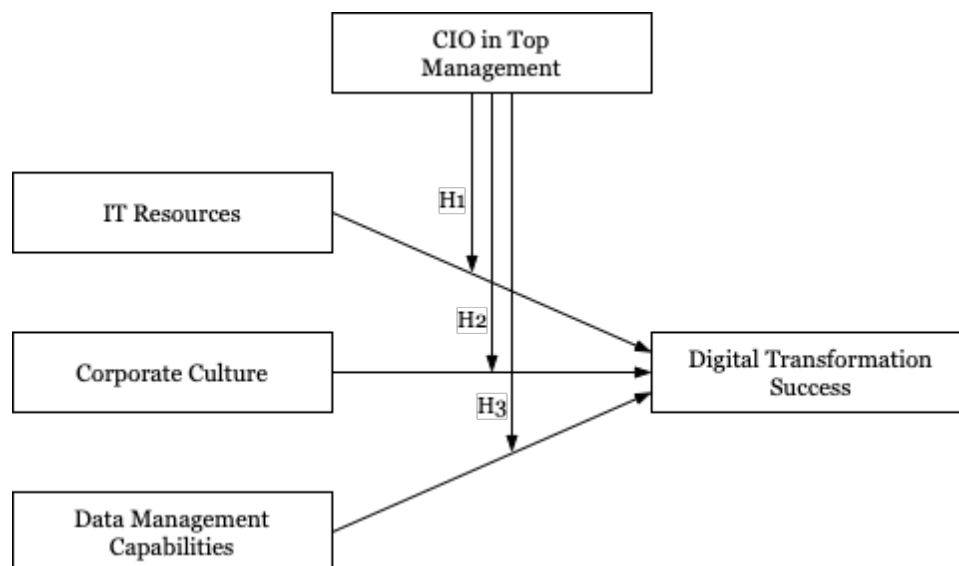


Figure 1: Research model 1 (RM1)

Based on the relevant literature, we develop the research model (RM1), displayed in Figure 1. With it, we aim to answer the first research question regarding the moderating effect of CIO membership in the top management on digital transformation success. We use the availability of IT resources, the company culture, and data management capabilities as independent variables for our research.

The Effect of Digital Transformation Governance Configurations

To answer our second research question, we aim to compare different digital transformation governance configurations regarding their influence on digital transformation success. The responsibility for digital transformation includes the formulation of a unified digital transformation strategy, the supervision of digital transformation projects, and the nurturing of a conducive corporate culture.

There are different ways a firm can manage its digital transformation. As the digital transformation of corporations is driven by technological innovations, many corporations have tasked the CIO to be responsible for it. Other firms transfer this responsibility to the CEO, other members of the top management team, department heads, or business unit managers. In consideration of the profound influence of the CIO on digital transformation, with the above postulated influence of CIO membership in the management team (see RM1), we use a 2x2 matrix to divide our data set into four groups. In the first dimension we separate firms depending on whether a CIO is part of the top management or not. The second dimension differentiates between firms where the CIO is responsible for digital transformation or not. A visualization of this group configuration can be seen in Figure 2.

CIOs in the top management can use their extensive skills and knowledge to find an advantageous equilibrium between exploitation of existing IT resources and exploration of new technological avenues (Bendig et al. 2022) and can better introduce innovative technologies into the firm (Leidner et al. 2010). Additionally, both competitiveness and profit can be increased by including the CIO in the top management (Karimi et al. 1996; Preston and Karahanna 2009). Moreover, a CIO's characteristics are positively related to CIO issue selling effectiveness, which in turn is positively correlated to digital innovation success. This allows us to formulate the following hypothesis regarding digital transformation governance configurations:

- H4:** A firm with a CIO both in the top management and responsible for digital transformation is more successful in their digital transformation than other firms.

Results

Impact of CIOs in Top Management

We analyzed the data set using multiple linear regression and introduce a moderating effect to the model. The full regression specification including the control variables and interaction terms is presented in equation (1). Table 4 shows the results of the regression analysis with and without the moderating effect. In model 1, we can see that all three independent variables have a significant positive effect on the success of digital transformation. With an adjusted R squared of 0.29 at a significance of $p > 0.001$, the model is a good fit to our data set. Introducing the control variables in model 2 increases the model fit marginally. Both CULT and DMC have an increased β coefficient and are more significant, compared to model 1, whereas the effect size of ITRA is marginally lower. Of the control variables, only the DACH region has a significant positive effect on DTS.

$$Y = \beta_0 + \beta_1 * ITRA + \beta_2 * CULT + \beta_3 * DMC + \beta_4 * ITRA * CIO_TMT + \beta_5 * CULT * CIO_TMT + \beta_6 * DMC * CIO_TMT + \beta_7 * DUMMY_DACH + \beta_8 * DUMMY_USA + \beta_9 * DUMMY_UK + \varepsilon \quad (1)$$

Furthermore, we display the results of the regression analysis with moderating effects of the CIO membership in the top management team. Models 3 to 5 introduce the interaction terms between the CIO membership in top management and the independent variables. We observe significant moderation on the effects of ITRA and DMC on DTS, confirming hypotheses 1 and 3. The positive β coefficients of the interaction terms indicate that a CIO in the top management improves DTS for similar values of both ITRA and DMC. Hypothesis 2 has to be rejected, as we find no significant moderating effect of CIO membership in top management on the influence of CULT on DTS. The overall model fit stays almost constant at an adjusted R squared of slightly less than 0.3.

	Model 1	Model 2	Model 3	Model 4	Model 5
Adjusted R²	0.2902***	0.2945***	0.2976***	0.2957***	0.2959***
Independent Variables	β -coeff.	β -coeff.	β -coeff.	β -coeff.	β -coeff.
ITRA	0.4114***	0.3739***	0.3509***	0.3740***	0.3744***
CULT	0.0726*	0.0939**	0.0905**	0.0710	0.0921**
DMC	0.1312**	0.1529***	0.1216**	0.1319**	0.1099*
Interaction Terms					
ITRA*CIO_TMT			0.0950*		
CULT*CIO_TMT				0.0699	
DMC*CIO_TMT					0.0775*
Control Variables					
DUMMY_DACH		0.1359**	0.0975	0.0974	0.1008
DUMMY_USA		0.0729	0.0302	0.0338	0.0350
DUMMY_UK		0.0547	0.0137	0.0160	0.0179

ITRA: IT resource availability, CULT: Corporate culture, DMC: Data management capabilities, CIO_TMT: CIO membership in top management team, p-Values: *** p > 0.01, ** p > 0.05, * p > 0.1

Table 4: Regression results for research model 1

The Effect of Digital Transformation Governance Configurations

To gain deeper insights into the role of different digital transformation governance configurations, we divided our data set into four groups depending on whether the CIO is part of the top management or not, and whether the CIO is responsible for digital transformation or not. First, we calculated the mean values of DTS for all four groups, displayed in Figure 2. The highest mean is recorded in group one, with the CIO being in the top management and being responsible for digital transformation. Firms with neither the CIO in the top management, nor having the CIO responsible for digital transformation, show the lowest mean DTS. Figure 3 displays a box plot to visualize the differences of DTS in the four groups. Black lines are the median values, the red dot represents the mean values.

		CIO responsible for digital transformation	
		Yes	No
CIO in Top Management	Yes	Group 1, Mean DTS: 5.45 (n = 88)	Group 2 Mean DTS: 4.36 (n = 69)
	No	Group 3 Mean DTS: 5.10 (n = 203)	Group 4 Mean DTS: 4.08 (n = 189)
DTS: Digital transformation success			

Figure 2: Group configurations with mean digital transformation success

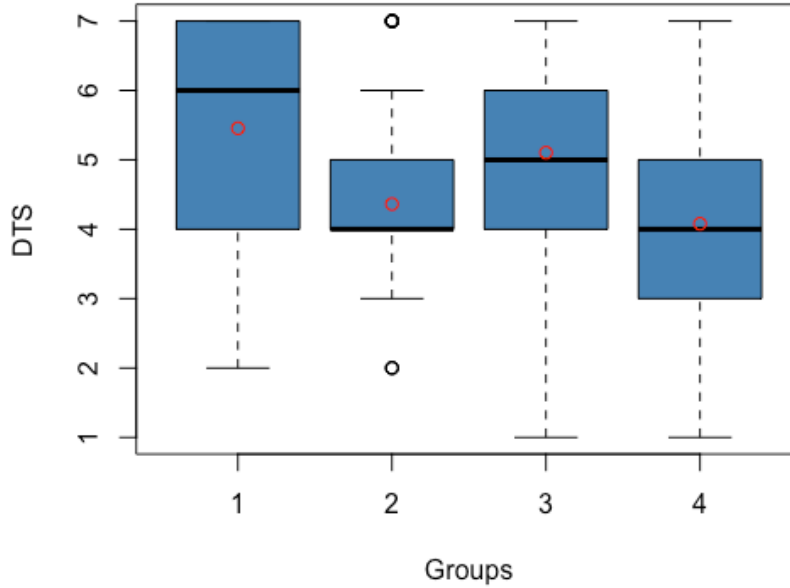
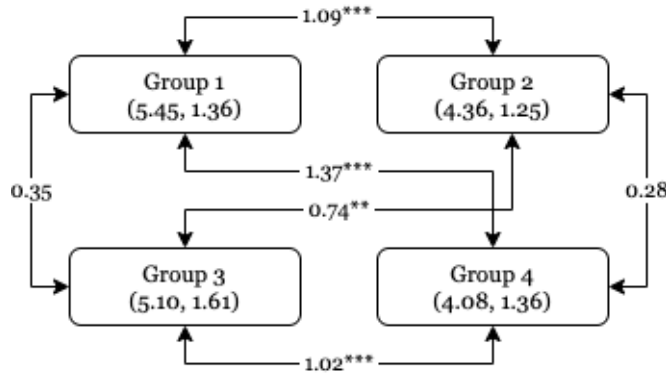


Figure 3: Boxplot of digital transformation success in the four groups

$$f = \frac{\frac{SSB}{k-1}}{\frac{SSE}{N-k}} \text{ with } SSB = \sum n_j * (\bar{X}_j - \bar{X})^2 \text{ and } SSE = \sum \sum (X - \bar{X}_j)^2 \quad (2)$$



Note: p-Values: *** p > 0.01, ** p > 0.05, * p > 0.1

Figure 4: Results of the ANOVA, mean and standard deviation in brackets

To analyze the differences in digital transformation success regarding their statistical significance, we conducted a one-way analysis of variance (ANOVA) with DTS as dependent variable. Significance levels are adjusted using a Bonferroni correction in order to correct for multiple testing. Equation (2) specifies the ANOVA statistic, where the variable k is the number of groups in our model, N is the number of participants in all groups, n_j is the sample size per group, \bar{X}_j is the mean of DTS in group j , \bar{X} is the overall mean of DTS, and X is the observed DTS for an individual participant. The sum of squares between groups (SSB) is computed by summing the squared differences between each group mean and the overall mean in DTS. The error sum of squares (SSE) is calculated by summing the squared differences between each observation and its group mean. The overall model displays a very good fit with an F-value of 38 at a significance of $p > 0.001$. The results show that having the CIO responsible for digital transformation, increases DTS significantly, regardless of whether the CIO is part of the top management team or not (groups 1 and 3 compared to groups 2 and 4, respectively). The differences between groups 1 and 3, and 2 and 4 are not significant,

whereas the differences between 1 and 4, and 2 and 3 are highly significant. Hypothesis 4 is partially supported by our data. Firms in group 1 have a significantly higher DTS than groups 2 and 4. Group 1 has a higher mean value of DTS compared to group 3 as well, albeit not statistically significant.

Discussion and Implications

Our study aimed at answering two important questions about the influence of digital transformation governance on digital transformation success (DTS). First, linking to the extensive literature regarding the inclusion of a CIO in the top management of companies, we investigated the moderating effect of CIO membership in the top management team on the relationship between enabling factors of digital transformation and DTS. Second, we explored the influence of different digital transformation governance configurations on DTS.

The regression analysis in research model 1 revealed two important results. First, we confirm the positive influence of IT resource availability (ITRA), a conducive corporate culture (CULT), and data management capabilities (DMC) on the success of corporate digital transformation, in line with the relevant literature (e.g., Chen et al. 2017; Dremel et al. 2017; Gurbaxani and Dunkle 2019; Hartl 2019; Ostroff et al. 2020). Second, by including the interaction terms to the regression model to measure the moderating effects of CIO membership in top management on DTS, we uncovered a significant moderating effect on the relationship between DTS and both ITRA and DMC. Having the CIO as part of the top management allows a company to make better use of the existing IT resources and capabilities for data management to improve DTS.

Additionally, the ANOVA in our second research model suggests that firms with a CIO that is responsible for the digital transformation of the firm are more successful in their digital transformation endeavors, regardless of whether the CIO is part of the top management or not. Having the CIO responsible for digital transformation and as part of the top management is the most advantageous digital transformation governance configuration, whereas firms without a CIO in the top management and someone else being responsible for digital transformation show the least success in their digital transformation.

The results of our study have implications for both research and practice. First, we add to the literature regarding the role of the CIO in the firm. As described in the literature review section of this paper, the effect of CIO membership in the top management team is generally accepted to be positive. For example, CIO presence is proven to improve both the short and long term sales growth (Taylor and Vithayathil 2018), to establish a better equilibrium between the exploitation of existing and the exploration of new IT and IS systems (Bendig et al. 2022), to guide the top management to be more accepting of innovative technologies (Leidner et al. 2010), and additionally has a positive influence on several firm performance measures (e.g., Chatterjee et al. 2001; Karimi et al. 1996; Preston and Karahanna 2009). We contribute to this stream of research by demonstrating the positive effect of the CIO role on digital transformation by improving the use of existing resources and capabilities on the success of digital transformation (RQ1), as well as in a direct manner (RQ 2).

Second, our results show that firms perform better when the CIO is a member of the top management team and responsible for the firm's digital transformation. Through the way the role of the CIO has developed over the past decades, from a purely functional manager of IT resources, towards a strategic partner to the top management, implementing IT- and business strategies, the CIO is deeply familiar with managing IT systems to the economic advantage of the firm. Making the CIO responsible for digital transformation unlocks a considerable advantage regarding digital transformation that can be used to increase the competitiveness of the firm. The capabilities and responsibilities that are embodied in the CIO role should be exploited by the firm to reap its benefits. Especially if a CIO is already part of the top management team, it is a waste to not make them also responsible for digital transformation.

An interesting perspective on the question of digital transformation governance that should be investigated by further research are the roles, responsibilities, and reporting structures in the management team. Prior research has identified that firms that pursue cost leadership, are more likely to have the CIO reporting to the CFO, whereas firms that try to differentiate themselves and their products from their competitors are most likely to have the CIO reporting directly to the CEO (Banker et al. 2011). Additionally, the binary differentiation to assign firms to one of the four groups in our second research model can only be seen as a preliminary way of inferring about the exact position and responsibilities of the CIO in the firm, as respond-

ents from different departments and different levels in the hierarchy of the firm could have a different perception of the precise involvement of the CIO in the digital transformation. Furthermore, the social capital of the CIO was proven to have a direct influence on strategic IS alignment and an indirect effect on firm performance (Karahanna and Preston 2013). It could be highly interesting and profitable to improve on our measurement tools and combine our research with the above introduced streams. Finally, the theoretical lens of task-technology fit and its positive influence on individual and firm performance (Goodhue and Thompson 1995) could be included in future research. As the digital transformation introduces new tools and technologies into the firm, their fit to the employees' tasks may influence the acceptance, use, and consequently the success of the introduced tools and thereby also influence the success of the digital transformation.

As with every research project, a few limitations have to be reported. First, two of the constructs used in our research were single-item constructs, namely the prevailing corporate culture and its conduciveness to digital transformation and the measurement for digital transformation success. Especially for such complex theoretical concepts, one-item measurements tend to oversimplify the underlying concept. Some scholars have advocated the use of single-item constructs, but mostly in more straightforward concepts like job satisfaction (Scarpello and Campbell 1983) or customer loyalty (van Doorn et al. 2010). Moreover, we use a firm's success with digital products and services as a proxy for digital transformation success, which is not fully fitting. It is a reasonable conclusion that a firm with successful digital offerings is also successful in their digital transformation. But as we showed in the theoretical background section of this paper, digital transformation is as much about the transformation of internal processes and the whole company, as it is about business models. Second, our research model might suffer from omitted variable bias, as we were not able to include control variables about firm characteristics, industry specific factors, and attributes about the respondent. Third, based on the available data, we have no way of inferring the direction of causality in our multi-group analysis. We assume in our research model that the existence of a CIO and the responsibility of digital transformation are influencing the success of digital transformation. It might also be the case that a firm gains momentum and takes first successful steps in its digital transformation and therefore promotes or appoints a CIO to the top management team. Finally, the overwhelming majority of participants in the survey were employees of manufacturing firms, which leads to our results to not being easily generalizable to other industries. All limitations should be addressed by further research. Designing a questionnaire specifically with the purpose of measuring digital transformation success, corporate culture, and available IT resources with all their dimensions and nuances would be beneficial to replicate the results of our research in a more rigorous manner. Furthermore, a follow-up project should repeat the research in other industries to provide generalizability or to investigate differences between firms from different industries. A multiple case study approach could be used to solve the reverse causality issues identified above.

Conclusion

The goal of our research project was to investigate the influence of different digital transformation governance configurations on the success of the digital transformation of the firm. We developed relevant research questions, conceptualized the important concepts based on existing literature and used a data set from a large-scale, multi-national industry panel survey regarding the current state of IoT practices in manufacturing corporations to answer our research questions and accept or deny our hypothesis. Our results have several important implications for both the IS field and practitioners. First, we provide further evidence of the positive influence of IT resource availability, corporate culture, and data management capabilities on the success of corporate digital transformation. Furthermore, we have shown the significant influence of different digital transformation responsibility configurations on the successful digital transformation in firms. We confirmed two of our hypotheses about the moderating effect of CIO membership in the top management of a firm, implicating that having a CIO in the top management improves the success with digital transformation and the use of existing IT resources and data management capabilities. We further showed with a multi-group comparison that firms are most successful in their digital transformation, if they have a CIO in the top management team, who is also responsible for the digital transformation of the firm. Finally, we discuss the limitations of our research and provide avenues of further research.

References

- Agarwal, R., Gao, G. G., DesRoches, C., and Jha, A. K. 2010. "The Digital Transformation of Healthcare: Current Status and the Road Ahead," *Information Systems Research* (21:4), pp. 796–809.
- Applegate, L. M., and Elam, J. J. 1992. "New Information Systems Leaders: A Changing Role in a Changing World," *MIS Quarterly* (16:4), p. 469.
- Armstrong, C. P., and Sambamurthy, V. 1999. "Information Technology Assimilation in Firms: The Influence of Senior Leadership and IT Infrastructures," *Information Systems Research* (10:4), pp. 304–327.
- Banker, Hu, Pavlou, and Luftman. 2011. "CIO Reporting Structure, Strategic Positioning, and Firm Performance," *MIS Quarterly* (35:2), p. 487.
- Bendig, D., Wagner, R., Jung, C., and Nüesch, S. 2022. "When and Why Technology Leadership Enters the C-Suite: An Antecedents Perspective on CIO Presence," *The Journal of Strategic Information Systems* (31), pp. 1–20.
- Berger, S., Bitzer, M., Häckel, B., and Voit, C. 2020. "Approaching Digital Transformation - Development of a Multi-Dimensional Maturity Model," *Proceedings of the European Conference on Information Systems (ECIS)*, pp. 1–18.
- Bharadwaj, A., El Sawy, O. A., Pavlou, P. A., and Venkatraman, N. 2013. "Digital Business Strategy: Toward a Next Generation of Insights," *MIS Quarterly* (37:2), pp. 471–482.
- Bijedić, T., Paschke, M., Pasing, P., and Schröder, C. 2018. "Digitalisierungskompetenzen in Der Führungsebene Im Mittelstand," *IfM-Materialien* (Vol. 272), Bonn.
- Ceipek, R., Hautz, J., De Massis, A., Matzler, K., and Ardito, L. 2021. "Digital Transformation Through Exploratory and Exploitative Internet of Things Innovations: The Impact of Family Management and Technological Diversification," *Journal of Product Innovation Management* (38:1), pp. 142–165.
- Chan, C. M. L., Teoh, S. Y., Yeow, A., and Pan, G. 2019. "Agility in Responding to Disruptive Digital Innovation: Case Study of an SME," *Information Systems Journal* (29:2), pp. 436–455.
- Chatterjee, D., Richardson, V. J., and Zmud, R. W. 2001. "Examining the Shareholder Wealth Effects of Announcements of Newly Created CIO Positions," *MIS Quarterly* (25:1), pp. 43–70.
- Chen, D. Q., Zhang, Y., Xiao, J., and Xie, K. 2021. "Making Digital Innovation Happen: A Chief Information Officer Issue Selling Perspective," *Information Systems Research* (32:3), pp. 987–1008.
- Chen, H. M., Kazman, R., Schütz, R., and Matthes, F. 2017. "How Lufthansa Capitalized on Big Data for Business Model Renovation," *MIS Quarterly Executive* (16:1), pp. 19–34.
- Christensen, C. M., Bohmer, R., and Kenagy, J. 2000. "Will Disruptive Innovations Cure Health Care?," *Harvard Business Review* (78:5), pp. 102–112.
- Chun, M. W. S., and Mooney, J. 2006. "CIO Roles and Responsibilities: Twenty-Five Years of Evolution and Change," *Proceedings of Americas Conference On Information Systems (AMCIS)* (5), pp. 3079–3091.
- Ciriello, R. F., Richter, A., and Schwabe, G. 2018. "Digital Innovation," *Business & Information Systems Engineering* (60:6), Springer Fachmedien Wiesbaden, pp. 563–569.
- Dobni, C. B. 2006. "Developing an Innovation Orientation in Financial Services Organisations," *Journal of Financial Services Marketing* (11:2), pp. 166–179.
- van Doorn, J., Lemon, K. N., Mittal, V., Nass, S., Pick, D., Pirner, P., and Verhoef, P. C. 2010. "Customer Engagement Behavior: Theoretical Foundations and Research Directions," *Journal of Service Research* (13:3), pp. 253–266.
- Dremel, C., Herterich, M. M., Wulf, J., Waizmann, J. C., and Brenner, W. 2017. "How AUDI AG Established Big Data Analytics in Its Digital Transformation," *MIS Quarterly Executive* (16:2), pp. 81–100.
- Feeny, D. F., and Willcocks, L. P. 1998. "Core IS Capabilities for Exploiting Information Technology," *MIT Sloan Management Review* (39:3), pp. 9–21.
- Fitzgerald, M., Kruschwitz, N., Bonnet, D., and Welch, M. 2013. "Embracing Digital Technology: A New Strategic Imperative," *MIT Sloan Management Review* (55:1), pp. 1–13.
- Fuchs, C., and Diamantopoulos, A. 2009. "Using Single-Item Measures for Construct Measurement in Management Research," *Die Betriebswirtschaft* (69), pp. 195–210.
- Gefen, D., and Straub, D. 2005. "A Practical Guide To Factorial Validity Using PLS-Graph: Tutorial And Annotated Example," *Communications of the Association for Information Systems* (16), pp. 91–109.
- Goodhue, D. L., and Thompson, R. L. 1995. "Task-Technology Fit and Individual Performance," *MIS Quarterly* (19:2), pp. 213–233.
- Guillemette, M. G., and Paré, G. 2012. "Toward a New Theory of the Contribution of the IT Function in

- Organizations,” *MIS Quarterly* (36:2), pp. 529–551.
- Gurbaxani, V., and Dunkle, D. 2019. “Gearing up for Successful Digital Transformation,” *MIS Quarterly Executive* (18:3), pp. 209–220.
- Haffke, I., Kalgovas, B., and Benlian, A. 2016. “The Role of the CIO and the CDO in an Organization’s Digital Transformation,” *Proceedings of International Conference on Information Systems (ICIS)*.
- Hambrick, D. C., and Mason, P. A. 1984. “Upper Echelons: The Organization as a Reflection of Its Top Managers,” *Academy of Management Review* (9:2), pp. 193–206.
- Hartl, E. 2019. “A Characterization of Culture Change in the Context of Digital Transformation,” *Proceedings of Americas Conference on Information Systems (AMCIS)*, pp. 1–10.
- Helfat, C. E., and Martin, J. A. 2015. “Dynamic Managerial Capabilities,” *Journal of Management* (41:5), pp. 1281–1312.
- Hess, T., Benlian, A., Matt, C., and Wiesböck, F. 2016. “Options for Formulating a Digital Transformation Strategy,” *MIS Quarterly Executive* (15:2), pp. 123–139.
- Hinings, B., Gegenhuber, T., and Greenwood, R. 2018. “Digital Innovation and Transformation: An Institutional Perspective,” *Information and Organization* (28:1), pp. 52–61.
- Karahanna, E., and Preston, D. S. 2013. “The Effect of Social Capital of the Relationship Between the CIO and Top Management Team on Firm Performance,” *Journal of Management Information Systems* (30:1), pp. 15–56.
- Karimi, J., Gupta, Y. P., and Somers, T. M. 1996. “The Congruence between a Firm’s Competitive Strategy and Information Technology Leader’s Rank and Role,” *Journal of Management Information Systems* (13:1), pp. 63–88.
- Kofler, T. 2018. “Digitale Transformation in Unternehmen,” *ZD.B Digital Dialogue Positionspapier*.
- Kohli, R., and Melville, N. P. 2019. “Digital Innovation: A Review and Synthesis,” *Information Systems Journal* (29:1), pp. 200–223.
- Kranz, J. J., Hanelt, A., and Kolbe, L. M. 2016. “Understanding the Influence of Absorptive Capacity and Ambidexterity on the Process of Business Model Change – the Case of on-Premise and Cloud-Computing Software,” *Information Systems Journal* (26:5), pp. 477–517.
- Legner, C., Eymann, T., Hess, T., Matt, C., Böhmman, T., Drews, P., Mädche, A., Urbach, N., and Ahlemann, F. 2017. “Digitalization: Opportunity and Challenge for the Business and Information Systems Engineering Community,” *Business & Information Systems Engineering* (59:4), pp. 301–308.
- Leidner, D. E., Preston, D., and Chen, D. 2010. “An Examination of the Antecedents and Consequences of Organizational IT Innovation in Hospitals,” *The Journal of Strategic Information Systems* (19:3), pp. 154–170.
- Leonhardt, D., Haffke, I., Kranz, J., and Benlian, A. 2017. “Reinventing the It Function: The Role of IT Agility and IT Ambidexterity in Supporting Digital Business Transformation,” *Proceedings of European Conference on Information Systems (ECIS)*, pp. 968–984.
- Leonhardt, D., Hanelt, A., and Kranz, J. J. 2020. “How Digital Innovation Projects Cultivate Shifts in IT Functions’ Organizing Logics: Insights from a Multiple Case Study,” *Proceedings of European Conference on Information Systems (ECIS)*, pp. 1–14.
- Mackenzie, S. B., Podsakoff, P. M., and Podsakoff, N. P. 2011. “Construct Measurement and Validation Procedures in MIS and Behavioral Research: Integrating New and Existing Techniques,” *MIS Quarterly* (35:2), pp. 293–334.
- Majchrzak, A., Lynne Markus, M., and Wareham, J. 2016. “Designing for Digital Transformation: Lessons for Information Systems Research from the Study of ICT and Societal Challenges,” *MIS Quarterly* (40:2), pp. 267–277.
- Matt, C., Hess, T., and Benlian, A. 2015. “Digital Transformation Strategies,” *Business & Information Systems Engineering* (57:5), Springer Fachmedien Wiesbaden, pp. 339–343.
- Montealegre, R., Iyengar, K., and Sweeney, J. 2019. “Understanding Ambidexterity: Managing Contradictory Tensions Between Exploration and Exploitation in the Evolution of Digital Infrastructure,” *Journal of the Association for Information Systems* (20:5), pp. 647–680.
- Nambisan, S., Lyytinen, K., Majchrzak, A., and Song, M. 2017. “Digital Innovation Management: Reinventing Innovation Management Research in a Digital World,” *MIS Quarterly* (41:1), pp. 223–238.
- Osmundsen, K., Iden, J., and Bygstad, B. 2018. “Digital Transformation: Drivers, Success Factors, and Implications,” *Proceedings of Mediterranean Conference on Information Systems (MCIS)* (12), pp. 1–15.
- Ostroff, C., Barcellos, B., and Abhari, K. 2020. “Digital Culture, Neither Strategy nor Technology, Drives

- Digital Transformation,” *Proceedings of Americas Conference on Information Systems (AMCIS), TREOs*.
- Petrikina, J., Schirmer, I., Saxe, S., Krieger, M., Stoeckler, N., and Baldauf, U. 2017. “Improving the Readiness for Change – Addressing Information Concerns of Internal Stakeholders in the SmartPORT Hamburg,” *Proceedings of Americas Conference on Information Systems (AMCIS)*, pp. 1–10.
- Preston, D. S., Chen, D., and Leidner, D. E. 2008. “Examining the Antecedents and Consequences of CIO Strategic Decision-Making Authority: An Empirical Study,” *Decision Sciences* (39:4), pp. 605–642.
- Preston, D. S., and Karahanna, E. 2009. “How To Develop a Shared Vision: The Key To IS Strategic Alignment,” *MIS Quarterly Executive* (8:1), pp. 1–8.
- Raghunathan, B., and Raghunathan, T. S. 1989. “Relationship of the Rank of Information Systems Executive to the Organizational Role and Planning Dimensions of Information Systems,” *Journal of Management Information Systems* (6:1), pp. 111–126.
- Rockart, J. F., Ball, L., and Bullen, C. V. 1982. “Future Role of the Information Systems Executive,” *MIS Quarterly* (6), pp. 1–14.
- Saam, M., Viete, S., and Schiel, S. 2016. “Digitalisierung Im Mittelstand: Status Quo, Aktuelle Entwicklungen Und Herausforderungen,” *ZEW - Leibniz Centre for European Economic Research (ZEW-Gutach)*, pp. 1–7.
- Scarpello, V., and Campbell, J. P. 1983. “Job Satisfaction: Are All the Parts There?,” *Personnel Psychology* (36:3), pp. 577–600.
- Singh, A., and Hess, T. 2017. “How Chief Digital Officers Promote the Digital Transformation of Their Companies,” *MIS Quarterly Executive* (16:1).
- Soto Setzke, D., Hoberg, P., Murgoci, A., Franzbonenkamp, S., Gaß, J., Wolff, T., and Krcmar, H. 2018. “Digitale Transformation Bei Den Berliner Philharmonikern,” in *Digitale Transformation*, Wiesbaden: Springer Gabler, pp. 121–145.
- Taylor, J., and Vithayathil, J. 2018. “Who Delivers the Bigger Bang for the Buck: CMO or CIO?,” *The Journal of Strategic Information Systems* (27:3), pp. 207–220.
- Tumbas, S., Berente, N., and vom Brocke, J. 2017. “Three Types of Chief Digital Officers and the Reasons Organizations Adopt the Role,” *MIS Quarterly Executive* (16:2), pp. 121–134.
- Tumbas, S., Berente, N., and vom Brocke, J. 2018. “Digital Innovation and Institutional Entrepreneurship: Chief Digital Officer Perspectives of Their Emerging Role,” *Journal of Information Technology* (33:3), pp. 188–202.
- Vial, G. 2019. “Understanding Digital Transformation: A Review and a Research Agenda,” *Journal of Strategic Information Systems* (28:2), pp. 118–144.
- Watson, R. T. 1990. “Influences on the IS Manager’s Perceptions of Key Issues: Information Scanning and the Relationship with the CEO,” *MIS Quarterly* (14:2), p. 217.
- Werder, K., and Heckmann, C. S. 2019. “Ambidexterity in Information Systems Research: Overview of Conceptualizations, Antecedents, and Outcomes,” *Journal of Information Technology Theory and Application* (20:1), pp. 23–52.
- Wrede, M., Velamuri, V. K., and Dauth, T. 2020. “Top Managers in the Digital Age: Exploring the Role and Practices of Top Managers in Firms’ Digital Transformation,” *Managerial and Decision Economics* (41:8), pp. 1549–1567.