The impact of digital transformation on Top Management Teams: A systematic literature review and analysis on the role delineation of the Chief Digital Officer and the Chief Information Officer

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The impact of digital transformation on Top Management Teams: A systematic literature review and analysis on the role delineation of the Chief Digital Officer and the Chief Information Officer

Completed Research Paper

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Abstract

Driven by the adoption of novel technologies, digital transformation has turned into a strategic priority for many firms. In response, the recently introduced role of the Chief Digital Officer (CDO) however, causes dissent regarding its delineation from the Chief Information Officer (CIO). Hence, the present study employs a systematic literature review and analysis to investigate how the tasks and responsibilities, requirements and skills, and the role types of the CDO and CIO differ in the context of digital transformation. A detailed examination of their duties reveals that the CDO focuses almost exclusively on demand-side activities, whereas the CIO is in charge of information systems (IS) supply-side and demand-side tasks. The intersection with the role of the CDO increases as the CIO's demand-side focus grows. The implications of this study are summarized in a first guideline that supports firms that employ a CIO and consider the appointment of a CDO.

Keywords: Chief digital officer, chief information officer, digital transformation, systematic literature review, top management teams

Introduction

Today, digital transformation (DT) represents one of the decisive factors that determine the continued existence of organizations and their economic success (Zhang et al., 2021). DT is not only important to digitally born companies, but it is more and more critical to every industry and business unit. For example, companies digitize their offers, embed software-based technologies in their products, or use big data for customer profiling. Although not a new phenomenon, companies are still struggling to develop suitable digital strategies for their business to benefit from the opportunities arising from rapid technological change (Hess et al., 2016). This particularly poses risks for those firms who fail to identify the issue as a strategic priority in order to execute their digital strategy (Kutnjak et al., 2019).

Given the emerging challenges arising from DT, centralizing responsibilities could provide an appropriate mode of control (Firk et al., 2021). One means of centralization is the creation of a specific top management team (TMT) position. In response, a growing number of firms have initiated digitization efforts and introduced an additional C-level position - the Chief Digital Officer (CDO). Although several CDO positions have already been established and the phenomenon has received considerable attention from researchers and practitioners, the scope of responsibilities is still broad and often not precisely defined due to the varying nature of challenges in DT (Kessel & Graf-Vlachy, 2021; Kunisch et al., 2020; Rickards et al., 2015). Thus, it is necessary to distinguish the CDO from adjacent C-level executives that might at a first glance...
have similar areas of responsibility. Of great interest is the distinction between the CDO and the Chief Information Officer (CIO) as recent research has observed possible overlaps (e.g., Firk et al., 2021; Haffke et al., 2016; Singh & Hess, 2017; Walchshofer & Riedl, 2017; Ulrich & Lehmann, 2018). Yet, it is decisive for firms to know, how they can deploy CDOs and how this new role can complement CIOs in the best possible manner. While recent research analyzes the roles of CDO and CIO rather individually, the field still demands more systemization as it is fragmented by nature. Thus, there is no in-depth review that systematically aggregates the results of academic research on the delineation of the two roles. Consequently, it becomes increasingly difficult to build on previous findings and to identify further avenues for research.

This study, therefore, aims to address the following research question by means of a systematic literature review and analysis: How do the Chief Digital Officer and Chief Information Officer differ in the context of digital transformation? In detail, we systematize literature on CDO and CIO research among the three broad themes: tasks and responsibilities (1), requirements and skills (2), and their role types (3). The overall objective of the study is to categorize and distinguish the above-mentioned aspects between the two senior management roles to support organizations in their decision on whether to appoint a CDO in their current situation. Currently, the lack of a holistic perspective of relevant human capabilities prevents researchers and practitioners from considering all relevant aspects of CIO and CDO research that must be taken into account. Our findings extend existing works on the delineation of CIO and CDO roles and in determining the need for a CDO appointment. In particular, our study provides three important contributions to the literature. First, by distinguishing information systems (IS) supply-side and demand-side activities (Chen et al., 2010), we can delineate the relevant tasks from one another and identify potentially overlapping responsibilities. Second, as recent digital technologies demand specialized know-how, we shed more light on the necessary skill set required to fulfill each role. Third, we explain why overlapping responsibilities are strongly dependent on the role types of CIO and CDO and that the need for the CDO depends on the strategic orientation of the CIO. The main implications are synthesized in a first guideline that outlines the determinants for a CDO appointment.

The remainder of this paper is structured as follows. The foundation is laid by an investigation of the impact of DT on TMTs. After a detailed review of the methodology applied, the results of the literature review are presented, followed by a discussion on the role delineation. We then derive implications for theory and practice. Finally, limitations of the paper as well as avenues for future research are identified.

Theoretical background: Digital transformation and its relevance for top management teams

From an economic perspective, the past two decades have been characterized by volatility, uncertainty, and increasing complexity in several respects (Tratkowska, 2019). Impressive enhancements in information, communication, and technology have created new functionalities with a crucial influence on customer preferences and market dynamics (Bharadwaj et al., 2013; Osmundsen et al., 2018; Ulrich & Lehmann, 2018). A main driver of this development stems from DT (Hanelt et al., 2021; Tratkowska, 2019; Vial, 2019). A recent definition of the term is provided by Verhoef et al. (2021, p.1), who describe DT as “a change in how a firm employs digital technologies, to develop a new digital business model that helps to create and appropriate more value for the firm”. Based on a similar definition, other studies such as those by Fitzgerald et al. (2014) or Singh and Hess (2017), address value creation even more explicitly, in terms of improved customer experience and streamlined operations.

To realize these benefits, organizations need to introduce management practices for coordinating, prioritizing, and implementing DT (Matt et al., 2015). One essential approach is to formulate a DT strategy. This strategy is neither operational nor functional, as it incorporates a business-centric perspective and cross-company characteristics (Hess et al., 2016). Accordingly, DT strategies focus on the “transformation of products, processes, and organizational aspects owing to new technologies” (Matt et al., 2015, p.1). In addition, they deal with potential effects on interactions across company boundaries with customers, competitors, and suppliers (Al-Taie et al., 2018). Thus, it strongly differs from an Information Technology (IT) strategy, which, due to its narrower scope, has a rather limited impact on innovations in business development (Bharadwaj et al., 2013). In general, IT strategies focus on the management of application systems and IT infrastructure, but also address the future use of new technologies (Hess et al., 2016). However, they do not necessarily consider the expansion or transformation of products resulting from the integration of digital innovations (Matt et al., 2015).
From the TMT’s perspective, formulating and implementing DT strategies implies a modified decision-making context as well as unprecedented challenges (Wrede et al., 2020). Since DT strategies are mostly governed by members of the TMT, their decisions significantly determine the approach and practical implementation within the firm (Li et al., 2021a; Wrede et al., 2020). The success of the DT strategy further strongly depends on the existence of clear responsibilities with regard to its management (Weinrich, 2017). In previous years, the supreme decision-making power within the TMT on the company’s DT strategy has usually been in the hands of the Chief Executive Officer (CEO) or the CIO (Turedi, 2020; Zafar et al., 2016).

The CIO function is undoubtedly one of the TMT positions that has undergone the most remarkable evolution since its emergence (Haffke et al., 2016; Van Toorn et al., 2019). Initially encountered as a data processing manager in the 1960s (Ball & Anderson, 2017; Ives & Olson, 1981), the role evolved in line with growing IS-related challenges into an IT director with a strong operational focus. In this first stage of the development of the CIO role, the main scope of duties focused on the provision of reliable IT operations (Ross & Feeny, 2003). Driven by the growing importance of IT for the core business, however, many corporations began to value the strategic importance of IT and the opportunities it presented (Fortino, 2008). This led to an extension of the CIO role from a purely technical one to a business manager who also took on strategic tasks in addition to his operational activities. In recent years, the role of the CIO has been further transformed into that of a proactive business visionary (Li et al., 2021b) with the ambition to make a lasting contribution to business strategy through the exploitation of emerging IT applications (Hsu & Liu, 2019). Although the CIO has been an integral part of TMTs within internationally operating organizations for many years, the role is still subject to continuous change (Ball & Anderson, 2017).

It follows from the above, according to Haffke et al. (2016), that organizational ambidexterity has ended up being a popular research stream. Hence, it describes the CIO’s development and ability to manage the contrasting objectives of exploiting current IT resources and capabilities to create value for the firm (IT exploitation) and of exploring innovative opportunities and novel solutions by the use of IT (IT exploration). Research analyzes this maturity process of the CIO by distinguishing between supply-side and demand-side roles (Al-Taie et al., 2018). The supply-side refers to the traditional CIO responsibilities revolving around IT exploitation, whereas the demand-side is about effective business leadership related to IT exploration for business innovation and transformation. Given the aforementioned evolution of the role and the associated complexity to successfully achieve both, effective supply-side and demand-side functions, recent research predicts the bifurcation of the CIO role (Walchshofer & Riedl, 2017). Indeed, researchers and practitioners have reported that CIOs face difficulties in adjusting to their broadened area of responsibility, which makes it increasingly difficult to accomplish the required tasks (Horlacher & Hess, 2016). Thus, Peppard et al. (2011) emphasize the CIO might revert to the original technical responsibilities of the role, while other executives coordinate and oversee the use of IT for innovation and strategic differentiation.

Against this backdrop, a new TMT position has also been emerging for some time, whose centralized role relates specifically to the development and execution of DT strategies (Chhachhi et al., 2016; Doonan, 2018; Firk et al., 2021; Kutnjak et al., 2019; Tumbas et al., 2017). MTV Networks appointed the world’s first CDO in 2005 (Singh & Hess, 2017). Since then, the number of CDO appointments has increased steadily, albeit this trend was initially limited to the American market (Singh et al., 2017). A few years later, however, the position of the CDO also found its way onto the boards of globally operating companies of European origin. It was found that in the DACH region alone, the number of active CDOs almost tripled from around 184 in 2016 to approximately 541 in 2019 (Merx & Merx, 2020).

Frequently cited reasons for the necessity of a CDO are on the one hand of external nature, in the form of an omnipresent pressure to integrate digital components into the business aiming to keep up with changes in customer needs and competition (Haffke et al., 2016). On the other hand, intra-company factors play a decisive role as well. For instance, Firk et al. (2021) mention insufficient coordination of digital initiatives due to a high degree of diversification and lagging digital infrastructure as one of the main reasons. Finally, the presence of a CIO and the scope of duties are decisive factors in determining the need for a CDO (Haffke et al., 2016). Yet, there is confusion among researchers and practitioners about what CDOs are supposed to achieve, what their responsibilities are, and how they can collaborate with the CIOs to embrace the opportunities arising from digital technologies (Firk et al., 2021; Horlacher & Hess, 2016). Thus, we believe it is particularly important to put the two roles in perspective.
Methodology: Systematic literature review

To gain an overview of the current state of research and a detailed understanding of the CDO and CIO roles in the context of DT, a systematic literature review was chosen as the most appropriate methodology. Due to the growing relevance of an examination of their roles and an increasing number of scientific publications within the last years, the selected approach provides the opportunity for an in-depth analysis and delineation of both positions, to identify research gaps and highlight avenues for further investigation. As the literature review is conducted according to established standards (Kraus et al., 2020; Tranfield et al., 2003) following a clearly defined research strategy, it also ensures transparency of the literature selection and thus reproducibility (Figure 1). Accordingly, the study uses three successive steps, namely planning the review (1), conducting the review (2), and reporting and synthesizing the findings (3). On this basis, the individual steps of the literature selection are described in the following (Tranfield et al., 2003).

For the identification of potential literature, EBSCO Business Source Premier was selected as the primary database in view of the research question. In addition, the search engine Google Scholar was used for the literature search due to the wide range of available publications. Another crosscheck has been performed with the Web of Science database to verify the sample size. However, applying the same search strategy did not yield any additional relevant studies. Before proceeding with the selection of the literature, a set of inclusion and exclusion criteria was determined. First, since the CIO position, unlike the CDO, has been around for several decades and has undergone remarkable changes during that time, this paper focuses on a current comparison of the two roles. Hence, the relevant time period for the literature search is limited to January 2016 until September 2021. Second, the search is restricted to peer-reviewed publications that are available in either English or German. This includes published peer-reviewed journal articles as well as conference proceedings, whereas research-in-progress articles, individual book chapters, and non-scientific publications (i.e., grey literature) were explicitly excluded from the literature search. The following terms, which had to appear in either the title, abstract, or keywords of the article were defined: “chief digital officer”, “CDO”, “chief information officer”, “CIO”, as well as “digital transformation” in combination with one of the aforementioned search terms. The keywords and search strings were discussed with experts from both theory and practice and cross-checked with recent literature in this field to ensure that our final sample provides a comprehensible basis for the desired purpose of this study (Kraus et al., 2020).

Based on the application of the search strategy within the timeframe outlined above, a total of 8,616 literature records were identified. In a next step, only English or German articles were included, which reduced the number of relevant articles. Subsequently, an additional round of literature selection was conducted to exclude non-academic sources and grey literature as recommended by Kraus et al. (2020). Consequently, the remaining 207 articles were screened for duplicates. Within the identified articles, the reference lists were studied, and we performed a forward and backward search to identify possibly missing publications. Ultimately, a manual assessment and detailed examination of the remaining 66 articles were conducted to detect literature that was obviously irrelevant to the research question. Such articles either matched the exclusion criteria or were clearly not thematically related to CDO or CIO research. For instance, literature that originated from the term Chief Information Officer but dealt with the position of the Chief Information Security Officer was excluded from further analysis. As a result, a final sample of 46 peer-reviewed articles dealing with the role of the CDO and/or CIO was obtained.

*Figure 1: Research and sampling process*
The resulting sample of identified publications served as the basis for our systematic data analysis. We followed the well-accepted, iteratively, and inductively developed approach by Gioia et al. (2012) and clustered text segments from all articles into meaningful concepts, themes, and aggregated dimensions. Based on a pattern-inducing technique, we are able to show the readers what goes under the identified constructs. The entire inductive coding process was conducted by both authors following a collaborative approach. First, both authors worked individually through all studies in the sample to ensure a common understanding. In a next step, coding results were compared, and potential differences were discussed until a common agreement was researched. The coding process was divided into three different phases. Initially, a list of first-order concepts was extracted from the literature (Phase I). Thereafter, these were condensed into second-order themes (Phase II) and finally merged into meaningful higher-order aggregate dimensions (Phase III). This iteratively developed scheme provides the theoretical basis for the subsequent presentation of the research findings. After a discrete examination of the CDO and CIO, their tasks and responsibilities, requirements and skills as well as role types will be contrasted. Finally, we discuss our results and derive implications for researchers and practitioners. Thus, our study goes beyond summarizing existing studies and, to our knowledge, is the first review of CDO and CIO research to use a pattern-inducing technique by Gioia et al. (2012), which has also been used in related research in the field (e.g., Wrede et al., 2020).

**Research findings**

**The Chief Information Officer (CIO)**

Tasks and responsibilities

As an established member of the TMT and a liaison between IT and business, the role of the CIO covers a broad spectrum of IT and managerial responsibilities (Benlian & Haffke, 2016; Grover et al., 1993; Hsu & Liu, 2019). Accordingly, both economic and technical tasks fall in the CIOs range of responsibility, which in turn could be divided into strategic, administrative, and operational activities (Nissen et al., 2016). Another possibility of separating the CIOs tasks, which, however, attracts considerably more attention in IS literature relates to the distinction between supply-side and demand-side IS activities (Haffke et al., 2016). Accordingly, based on this criterion, IS supply-side tasks focus on IT exploitation, operational efficiency, and performance intending to achieve higher IT service levels and lower infrastructure costs. Frequently mentioned examples lie in the area of budgeting, resource allocation, security as well as internal control, and risk (Hsu & Liu, 2019; Jones et al., 2020; La Paz et al., 2019; Miyamoto, 2016; Walchshofer & Riedl, 2017). In contrast, IS demand-side tasks are primarily concerned with the exploration of IT-based innovations and the resulting strategic growth opportunities for the company (Chen et al., 2010; Horlacher & Hess, 2016; Peppard et al., 2011). Demand-side tasks of the CIO thus include developing and executing an IT strategy that is in line with the corporate strategy (e.g., Al-Taie et al., 2018; Gong et al., 2019; Hsu & Liu, 2019; Jones et al., 2020; Hussain et al., 2016; Miyamoto, 2016; Nissen et al., 2016). In order to provide a holistic view of the CIOs tasks and responsibilities, Figure 2 summarizes the related research findings.
Requirements and skills

Based on the multitude of responsibilities of a CIO, a variety of requirements and skills arise (Ball & Anderson, 2017; Ghawe & Brohman, 2016; Shalamanov et al. 2020; Zimmermann et al., 2016). Research by La Paz (2017) and Thoomkuzhy and Thangiah (2020) revealed that today’s CIOs often have an undergraduate academic background in engineering, informatics, or IT management, which has frequently been broadened by a master’s degree in business administration. However, Ball and Anderson (2017) also found that academic background has only a limited impact on a CIO’s skills compared to prior work experience in other roles or as a CIO. One major reason is that an understanding of the firm’s core functions and its business landscape is crucial for the role of the CIO (Gerth & Peppard, 2016; Walchshofer & Riedl, 2017). Another highly relevant capability of the CIO lies in strategic and financial IS planning (Ball & Anderson, 2017; Thoomkuzhy & Thangiah, 2020). Closely linked to project and change management competence, financial management skills in terms of planning, budgeting, and investment appraisal make a decisive contribution to success (Babin & Grant, 2019; La Paz, 2017; De Tuya et al., 2017). Figure 3 entails the most frequently cited requirements and skills of CIOs based on their underlying first-order concepts.

Role types

Going back to the origins of the CIO role, the position was clearly defined as the company’s IT director, who was responsible for ensuring stable IT operations (Ross & Feeny, 2003). With noticeably increasing pressure for digitization during the turn of the millennium, the range of tasks and thus also the necessary competencies of the CIO began to broaden significantly (Fortino, 2008). Accordingly, this also influences the conception of role types. As one of the first scholars, Smaltz et al. (2006) addressed the reappraisal of the CIO role, incorporating present influences and recent findings. The classification used in their study was based on supply-side roles (Utility Provider, Information Steward, and Educator) and demand-side roles (Strategist, Relationship Architect, and Integrator). This distinction, focusing on the degree of strategic orientation of the CIO’s role, was replicated by Al-Taie et al. (2018) and discussed by Peppard et al. (2011), among others, in the course of deriving different CIO role types.

Considering the recent findings and identified role types of La Paz et al. (2019), Gerth and Peppard (2016), and Gonzalez et al. (2019), it becomes apparent that those are subject to a similar rationale despite different terminology. The first CIO role type combines the terms Technologist, Service Provider, and Functional CIO. This role type has a strong supply-side focus, which is reflected in almost exclusively operational responsibilities. The second CIO role type merges the terms Enabler, Innovator, Solution Provider, as well as Transformational CIO, which likewise originated from the aforementioned authors. As an interim role to the merely strategic orientation, this role type takes on both supply-side and demand-side tasks. In this role, the CIO is also responsible for implementing the new IT infrastructure (Gonzalez et al., 2019) and performance improvements across functional areas (La Paz et al., 2019). Lastly, the third role type focuses almost exclusively on demand-side tasks. As a Strategist (La Paz et al., 2019), Strategic Contributor (Gerth & Peppard, 2016), or Strategic CIO (Gonzalez et al., 2019) emphasis is on strategic growth and innovation (Gonzalez et al., 2019). Moreover, this role type prioritizes the orientation of strategic goals while overseeing...
The role delineation of CDO & CIO

IS design and operations (La Paz et al., 2019), and thus has the greatest voice within the TMT compared to other role types (Gerth & Peppard, 2016). Table 1 provides an overview of CIO role types discussed in recent studies. In the following section, we examine the CDO's role.

<table>
<thead>
<tr>
<th>Degree of distinction</th>
<th>Study</th>
<th>Role types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three role types</td>
<td>Gonzalez et al. (2019)</td>
<td>Strategic CIO, Transformational CIO, Functional CIO</td>
</tr>
<tr>
<td></td>
<td>Gerth &amp; Peppard (2016)</td>
<td>Service Provider, Solution Provider, and Strategic Contributor</td>
</tr>
<tr>
<td>Four role types</td>
<td>La Paz et al. (2019)</td>
<td>Strategist, Enabler, Technologist, and Innovator</td>
</tr>
</tbody>
</table>

Table 1: Summary of CIO role types in academic research

The Chief Digital Officer (CDO)

Tasks and responsibilities

The CDO is known as a DT specialist (Firk et al., 2021; Singh & Hess, 2017). However, for many of the globally present organizations, this novel TMT position covers different areas of responsibility. Some of the determining parameters are the industry in which the company operates, the status quo regarding the progress in DT, and the organizational structure in view of CIO presence (Haffke et al., 2016; Horlacher & Hess, 2016; Tumbas et al., 2018). Nevertheless, independent of such industry- and company-specific aspects, research finds consensus in the definition of the CDO's main task as the person responsible for formulating, implementing, and communicating a corporate digital strategy (Chhachhi et al., 2016; Firk et al., 2021; Horlacher & Hess, 2016). Besides the responsibility to establish a digital strategy for the organization, the CDO is also in charge of exploring digital innovation that might help the organization to generate additional value and yield incremental revenues (Singh & Hess, 2017; Tumbas et al., 2017; Tumbas et al., 2018; Venkatakrishnaiah & Ramanathan, 2019; Weinrich, 2017). Moreover, the CDO does not only coordinate digitization initiatives and collaboration between different functions (Singh et al., 2017; Singh & Hess, 2017) but also strengthens communication between business and IT aiming to overcome siloed thinking (Chhachhi et al., 2016; Haffke et al., 2016; Walchshofer & Riedl, 2017). To continuously foster business model innovation, the CDO must identify and grow digital talent (Singh et al., 2017; Walchshofer & Riedl, 2017) and evaluate the potential of new technology trends for the organization (Singh & Hess, 2017; Tumbas et al., 2017; Weinrich, 2017). Looking at the responsibilities from a top management perspective, the CDO holds a vital function as a communicator of digital opportunities within the TMT (Singh & Hess, 2017).

In this way, the firm’s digital progress earns separate attention from a C-level executive (Chhachhi et al., 2016; Venkatakrishnaiah & Ramanathan, 2019; Weinrich, 2017) and allows the CDO to demonstrate the value of digital technologies. Figure 4 summarizes the identified tasks and responsibilities of the CDO.

Figure 4: Taxonomy of CDO tasks and responsibilities, based on Gioia et al. (2012)
The role delineation of CDO & CIO

Requirements and skills

Since the CDO is a rather new TMT position, requirements and necessary skills have only been sparsely researched. Walchshofer and Riedl (2017) found that in most cases, a science or engineering degree, complemented by relevant professional experience is required to be considered for a CDO position. In addition, Venkatakrishnaiah and Ramanathan (2019) address the relevance of industry- and company-specific knowledge, but also a general understanding of business management practices. Not surprisingly, one of the most relevant skills of the CDO lies in the area of change and transformation management. However, there are further skills that are closely related to the above-mentioned tasks and responsibilities and thus constitute a good CDO. Apart from change and transformation management skills, IT expertise (Singh et al., 2017) and an affinity for digital products and services (Walchshofer & Riedl, 2017) are critical for CDOs, as otherwise, they would not be able to detect IT requirements for digital opportunities (Singh & Hess, 2017; Venkatakrishnaiah & Ramanathan, 2019). To overcome hurdles and convince decision-makers (Singh & Hess, 2017), the CDO needs above all communication and negotiation skills (Chhachhi et al., 2016; Walchshofer & Riedl, 2017). A great CDO differs by the ability to view the product or service from the customer’s point of view (Haffke et al., 2016, Walchshofer & Riedl, 2017). Thus, identifying customer needs is a prerequisite that enables the CDO to create value and improve the customer experience through digital innovation (Tumbas et al., 2017). Figure 5 provides an overview of the requirements and skills of the CDO.

Role types

Based on the review of the tasks and relevant skills of the CDO, it becomes evident that these are not only diverse but also dependent on the specific role within the organization. This prompted research examining potential role types of CDOs. Haffke et al. (2016), as well as Horlacher and Hess (2016), were among the first scholars to address this issue utilizing a case study approach. Whereas Haffke et al. (2016) focused on the implications of digitization as perceived by the organization, Horlacher and Hess (2016) applied Mintzberg’s concept of managerial roles. Hence, Haffke et al. (2016) identified four role types of CDOs: Digital Evangelist, Digitization Coordinator, Digital Innovator, and Digital Advocate. In comparison, Horlacher and Hess (2016) found that the majority of CDOs can be categorized into Mintzberg’s roles of the Entrepreneur, Spokesperson, Leader, and Liaison.

The initial research findings based on four role types of CDOs allowed Singh et al. (2017) as well as Singh and Hess (2017) to incorporate further insights and refine previous considerations on different role types. Thus, the more recent understanding defines three CDO role types: Entrepreneur, Digital Evangelist, and Coordinator. The role of the Entrepreneur is to explore IT-enabled business innovations, identify their potential for the organization, and incorporate them into the formulation of the DT strategy (Horlacher & Hess, 2016; Singh & Hess, 2017). Thus, entrepreneurial CDOs are not only drivers of the firm’s digital transition but also significantly involved in its realization (Singh et al., 2017). The Digital Evangelists’ role is to inspire the entire organization with regard to the application potential of new technologies (Singh et al., 2017). This often requires a profound cultural change across departmental boundaries (Singh & Hess, 2017). Lastly, the Coordinators’ role includes the alignment of digitization initiatives within the firm and fostering an organizational shift from decoupled silo functions to a cross-functional organization (Haffke et al., 2016; Singh et al. 2017; Singh & Hess, 2017). Table 2 provides an overview of recent CDO role types.
The role delineation of CDO & CIO

### Degree of distinction

<table>
<thead>
<tr>
<th>Study</th>
<th>Role types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Singh et al. (2017)</td>
<td>Entrepreneur, Digital Evangelist, Coordinator</td>
</tr>
<tr>
<td>Tumbas et al. (2017)</td>
<td>Digital Accelerator, Digital Marketer, Digital Harmonizer</td>
</tr>
<tr>
<td>Haffke et al. (2016)</td>
<td>Digital Innovator, Digital Evangelist, Digitization Coordinator, Digital Advocate</td>
</tr>
<tr>
<td>Horlacher &amp; Hess (2016)</td>
<td>Entrepreneur, Spokesperson, Leader, Liaison</td>
</tr>
</tbody>
</table>

### Table 2: Summary of CDO role types in academic research

#### Topic 1: Comparing tasks and responsibilities

The main differences between the CDO and CIO tasks arise from the distinction between supply-side and demand-side activities (Chen et al., 2010; Horlacher & Hess, 2016; Peppard et al., 2011). While the CDO deals almost exclusively with transformational and strategic issues, both of which are demand-side oriented, the CIO is responsible for a broader spectrum of tasks ranging from purely operational duties on the supply-side to strategic issues on the demand-side. This causes the increasingly discussed intersection of CDO and CIO responsibilities within IS literature (e.g., Firk et al., 2021; Haffke et al., 2016; Singh & Hess, 2017; Ulrich & Lehmann, 2018; Walchshofer & Riedl, 2017). Figure 6 depicts CIO and CDO responsibilities based on supply- and demand-side tasks (grey shaded). The role-specific tasks of the CIO include the management of IT operations in the areas of budgeting, resource allocation, security, as well as internal control and risk, the creation and maintenance of IT infrastructure and architecture, the development of systems and applications aiming to increase operational efficiency and the planning and implementation of IS projects (e.g., Benlian & Haffke, 2016; Chan, 2021; Chen et al., 2017; Smith et al., 2021). Concerning the demand-side focus of the CDO’s responsibilities, four specific tasks stand out: coordinating DT efforts, exploring digital innovation to identify opportunities for value creation, inspiring the TMT with digital options to improve and expand the core business, and shaping firm culture and cultivating digital talent.

Regarding the tasks where CDO and CIO overlap, frequent communication and clear responsibilities are decisive. However, the purpose and likewise the thematic context of the respective task should also be taken into account. For instance, strategy development is an important task for both the CDO and the CIO. Although, the CDO is in charge of developing DT strategies (e.g., Chhachhi et al., 2016; Singh et al., 2017; Tumbas et al., 2018) and the CIO of developing IT strategies (e.g., Jones et al., 2020; Miyamoto, 2016; Nissen et al., 2016). Whereas the alignment of business and IT strategy is a task that can be taken on by both the CDO and the CIO. The same applies to distinct tasks in the areas of customer experience management as well as relationship and change management. Ultimately, the monitoring of IT trends is another task that can be performed by both TMT members.

**Observation 1:** While the CDO focuses almost exclusively on demand-side activities, the CIO is in charge of supply-side as well as demand-side tasks.

![Figure 6: Delineation of tasks and responsibilities](image-url)
**Topic 2: Matching requirements and skills**

The comparison of role requirements and skills shows that they only differ to a limited extent. According to the literature reviewed, both CDO and CIO typically tend to have similar academic backgrounds. Usually, a science, informatics, or engineering degree, is extended by a master's degree in business administration or an MBA in general management (La Paz, 2017; Thoomkuzhy & Thangiah, 2020; Walchshofer & Riedl, 2017). Examining Figure 7, it becomes apparent that several of the CDO and CIO skills that overlap stem from a common origin of responsibility (Figure 6). This is particularly relevant for change management skills, communication and negotiation skills, and the ability to interlink business and IT. In addition, prior leadership experience and industry knowledge including a detailed understanding of business processes in companies are frequently mentioned requirements for CDOs and CIOs.

However, besides the general requirements for both roles, specific skills are also relevant that can be derived from an in-depth analysis. Since IS projects and integration management are an essential part of the CIO’s job, the ability to think in project cycles is important (Sleep & Hulland, 2018). In addition, financial planning skills are likewise relevant as the CIO unlike the CDO has profit and loss responsibility (Singh & Hess, 2017). Besides, profound technical and data management skills of the CIO are of higher relevance in particular in the field of system and application development.

In contrast, the CDO role requires a stronger focus on cross-functional collaboration to enable transformation throughout the organization (Singh & Hess, 2017; Venkataprishnaiah & Ramanathan, 2019; Walchshofer & Riedl, 2017). In addition, the needs and preferences of customers are a top priority for the CDO. These are prerequisites that enable value creation for customers and the company with the use of digital innovation (Haffke et al., 2016; Tumbas et al., 2017; Walchshofer & Riedl, 2017). Since the progress of DT in companies is often accompanied by internal resistance, also resilience and assertiveness are among the core skills of the CDO (Lund, 2017; Singh et al., 2017; Singh & Hess, 2017).

**Observation 2:** Although the requirements and skills of the CDO and CIO differ only to a limited extent, the CDO demands a more customer-oriented and cross-functional approach.

**Figure 7: Delineation of requirements and skills**

**Topic 3: Relations among the role types**

With regard to the number and purpose of individual role types, it becomes evident that neither for the CDO (Haffke et al., 2016; Horlacher & Hess, 2016; Singh et al., 2017; Singh & Hess, 2017; Tumbas et al., 2017) nor for the CIO (Al-Taie et al., 2018; Gerth & Peppard, 2016; Gonzalez et al., 2019; La Paz et al., 2019) an entirely uniform opinion prevails in the IS literature under consideration. Nevertheless, recently a distinction between three role types could be identified predominantly for both CDO, and CIO based on the literature reviewed. Thus, CIO role types depend on the degree of strategic orientation, which can range from functional over transformational to strategic (Gonzalez et al., 2019). In contrast, the role types of the CDO cannot be derived according to the degree of strategic orientation, as the CDO almost exclusively focuses on demand-side IS tasks (Haffke et al., 2016; Horlacher & Hess, 2016). The CDO’s role types, therefore, arise primarily from the different focal points that the role demands in the context of DT (Singh et al., 2017; Singh & Hess, 2017).
Figure 8 illustrates a direct comparison between the role types of CDO and CIO regarding the extent to which they overlap. As observed by Haffke et al. (2016), the role orientation of the CIO has a major impact on the distribution of roles between the CIO and CDO. However, this finding can also be applied specifically to the collaboration of individual role types of CDOs and CIOs. Thus, the greatest similarities in terms of responsibilities and skills can be identified between the CDO and the Strategic CIO. Most importantly, it can be inferred that the overlap of CDO and CIO role descriptions are rather independent of the CDO role type and consequently mainly determined by the role type of the CIO.

**Observation 3:** The strategic orientation of the CIO is crucial in determining the necessity for a CDO appointment since the respective need decreases with an increasingly demand-side focused CIO.

<table>
<thead>
<tr>
<th>CIO Role Orientation</th>
<th>CDO Role Orientation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic CIO</td>
<td>Advanced to strong overlap of the role descriptions</td>
</tr>
<tr>
<td>Transformational CIO</td>
<td>Slight to moderate overlap of the role descriptions</td>
</tr>
<tr>
<td>Functional CIO</td>
<td>None to weak overlap of the role descriptions</td>
</tr>
</tbody>
</table>

**Figure 8:** Relations among the orientation of CDO and CIO role types

**Discussion**

**Contributions**

The results of the literature review regarding the role delineation of the CDO and CIO in the context of DT indicate that a distinct separation of the roles without considering the industry- and firm-specific setting is hardly possible. Although each of the TMT roles largely performs individual tasks (Figure 6), their responsibilities mainly substitute in customer experience management, strategy development, and likewise in monitoring technology trends (e.g., Haffke et al., 2016; Horlacher & Hess, 2016; Singh & Hess, 2017; Tumbas et al., 2017; Walchshofer & Riedl, 2017). Due to overlapping responsibilities of the CDO and CIO, there are only a few requirements and skills that distinguish the roles from one another (Figure 7). However, the degree to which these roles overlap is strongly dependent on the role type (Figure 8). More specifically, we have illustrated that the role descriptions of the CDO and the CIO are predominantly dependent on the role type of the CIO but rather independent of the CDO. In summary, the main findings yield further insights regarding the determination of the need for a CDO. The study highlights that collaboration between CDO and CIO might work particularly well when the CIO has a strong supply-side focus allowing them to complement each other. However, it further indicates that if a CIO with a strong demand-side focus exists, it should be examined whether the CIO would have the capacities and skills to manage DT. On the basis of these considerations, the available resources within an organization can be utilized in the best possible way.

Although, the need for a CDO is certainly not exclusively dependent on the CIO’s orientation in terms of supply-side and demand-side tasks. In particular, the pressure and necessity for DT (Haffke et al., 2016), the complexity of the organization (Singh & Hess, 2017), and whether it is a digitally born company (Locoro & Ravarini, 2017) are key determinants of the need for a CDO. In addition, the business unit to be digitally transformed often plays an important role. According to Haffke et al. (2016), CDOs are more frequently deployed for customer-oriented transformations in the area of marketing and sales than for activities related to logistics and operations. Further, the aforementioned authors also highlight the company-specific need for a dedicated person to orchestrate DT within the organization. Consequently, the in-depth understanding obtained within this study specifies and extends the findings of Haffke et al. (2016) and thus distinguishes itself from previous research which examines the role differences of the CDO and the CIO. The role orientation of the CIO, by means of its division into supply-side and demand-side responsibilities, thus depicts a novel criterion to assess the necessity for a CDO.
Figure 9 presents a simplified illustration of this relationship, which merely aims to improve comprehensibility. The figure illustrates that as the CIO’s demand-side focus increases, the need for a CDO decreases since the CIO is increasingly capable of performing DT tasks. In line with this finding, the CIO’s skills and capacities concerning planning and implementing DT strategies have already been highlighted by Tumbas et al. (2017) as determinants of the need for a CDO. Accordingly, the future of the CDO role is likely to be significantly influenced by company-specific factors. Therefore, the possibly temporary role of the CDO (Tumbas et al., 2017; Walchshofer & Riedl, 2017) thus appears to be closely linked to the relation between the role orientation of the CDO and the CIO. Hence, the co-existence of CDO and CIO might constitute a valid option in dealing with DT and is particularly suitable for companies with a high demand for managing digitization efforts. In contrast, the appointment of a CDO may not be necessary to manage DT, where this role can possibly be performed by a strategically oriented CIO.

**Implications for management and practice**

The findings of the literature review imply that the delineation of the roles of CDO and CIO cannot be generalized in the context of DT. Therefore, a distinct differentiation of the two roles in practice seems only possible in the form of a company-specific assessment. Nevertheless, this study is of high practical relevance for companies’ decision-makers regarding the delineation of the CDO and CIO and the resulting need for a CDO appointment. First, the results from the delineation of responsibilities, skills, and role types provide a comprehensive overview of the role description of the CDO and CIO. Especially organizations that employ a CIO and are considering the appointment of a CDO can benefit from the review as it enables them to reassess the role of their current CIO in the context of DT and to distinguish it from the role of a newly appointed CDO. Building on this assessment, companies gain the opportunity to lay the foundation for an informed decision on the need for a CDO. Second, in order to decide whether to appoint a CDO, a detailed analysis of the necessity should be conducted. In addition to the different decision criteria regarding the need for a CDO appointment, this study emphasizes that companies should especially examine the role of the CIO in terms of their supply-side or demand-side orientation. Particularly, in cases where the incumbent CIO has a strong focus on demand-side tasks, the incremental value of a new TMT position for managing DT should be challenged. In this respect, it is primarily important to ensure that the CIO has both the necessary skills and the capacity to perform the CDO’s tasks. Otherwise, ongoing duties could suffer under the CIO’s new responsibilities in the context of the company’s DT. In contrast, a CIO with a strong supply-side focus often leaves room for a CDO to take on demand-side tasks, enabling a balanced role allocation. Third, a clear role delineation is imperative whenever companies decide to appoint a CDO in order to prevent a role diffusion with the CIO and other TMT members. This could not only be beneficial for collaboration among the TMT but also have a positive impact on the identification with their role as well as their efficiency at the firm level. Moreover, due to the closely related areas of responsibility, it could be of great importance that CDO and CIO maintain an active mutual exchange of information. Especially with regard to tasks that fall within the scope of both TMT roles. This ensures that CDO and CIO complement each other in the best possible way.

In order to assist companies, which employ a CIO and consider appointing a CDO, Figure 10 summarizes the key findings on the role delineation of the CDO and CIO as well as the resulting need for a CDO. This flowchart is intended to serve as a guideline for a preliminary assessment of the need for appointing a CDO. However, it explicitly does not replace an in-depth examination of company-specific factors that may influence the decision. Organizations that identify DT as a strategic priority within their TMT and investigate the appointment of a CDO alongside their CIO, ideally position themselves to be among the winners of DT.

![Figure 9: Need for a CDO depending on the CIO role orientation](Image 1)
Conclusion

Limitations
This systematically conducted literature review and analysis entails both methodological as well as content-related limitations that should be considered when interpreting the results. Thus, in a primary step, methodological limitations are discussed, which result from the applied search strategy. First, this study exclusively focuses on English and German language peer-reviewed articles published in the period from January 2016 to September 2021. Especially concerning the examination of the CIO role, which has been an integral part of TMTs for more than a decade, an extension of the time period under consideration could yield additional insights for an even clearer differentiation from the CDO role. However, since the study aims at a recent comparison of the two roles, it can be assumed that essential findings from earlier literature have been addressed in the publications examined. Therefore, it was decided to refrain from this. Moreover, it appears that the effects of the global Covid-19 pandemic and the associated increasing digitization of work could increase the relevance of an examination of the CDO’s role. This recent development has not yet been adequately reflected in the literature reviewed. Second, only three databases EBSCO Business Source Premier, Google Scholar, and Web of Science were employed for the literature search. The inclusion of additional databases would have provided the opportunity to obtain an increasingly complete picture of academic research on the delineation of CDO and CIO roles in the context of DT. For economic reasons, however, it was decided against this. Third, the literature search was restricted due to operational differences between the databases and thematically irrelevant results. Respectively, within Google Scholar, only the first 100 literature records for the search term CIO were examined.

In addition to the methodological limitations, the interpretation and discussion of the literature review’s results entail further content-related limitations. First, the study assumes that there is a need for DT within the company. This is necessary since, otherwise, there would not be a need for a CDO, irrespective of the role orientation of the CIO. Particularly in digitally born companies such as Apple, Google, or Meta (i.e. Facebook), the concept of DT already seems to be firmly integrated into the business model limiting the incremental necessity to digitally transform. Thus, the need for DT seems to constitute a moderator of the relationship between the need for a CDO and the role orientation of the CIO. Second, based on the supply-side and demand-side task focus of the CIO, the need for a CDO is determined. Hence, it is assumed that a supply-side oriented CIO is less capable of fulfilling the role of a CDO compared to a demand-side oriented CIO. However, this does not necessarily have to be the case, as supply-side-oriented CIOs may also have the requirements and skills to take on the role of the CDO. Furthermore, besides the CIO’s capabilities, the CIO’s available capacity to perform DT tasks might present another moderator of the relationship. Thus, even a demand-oriented CIO with the ability to handle the responsibilities of a CDO may not be able due to time constraints. Consequently, there would be a high demand for a CDO instead. Finally, since the vast majority of the literature from the final sample originates from industrialized countries, it is unclear to what extent the results can be generalized to organizations in culturally dissimilar economies.

Figure 10: Guideline on the need for appointing a CDO
Avenues for future research

Drawing on the insights obtained from the literature review and the limitations previously considered, future research opportunities can be derived in two major categories: The role of CDO and CIO as well as the need for a CDO. Since both the CDO and CIO roles are subject to ongoing change, a reassessment of the roles, especially given the influence of Covid-19, represents a potentially insightful avenue for further research. Qualitative studies based on interviews or surveys could provide evidence on how the necessity to digitize the business model affects the required skills and responsibilities of the CDO. In this context, it might likewise be interesting to investigate how the role of the CIO is increasingly changing and whether a stronger delimitation of the responsibilities concerning supply-side and demand-side activities would be beneficial given the co-existence of CDO and CIO. On this basis, future research should further address whether the role of the CDO is merely temporary in nature, remains part of the TMT in the long term, or is incorporated into the organization in another way. Since the co-existence of the roles could represent a plausible future scenario for several organizations, reporting lines to the TMT and the degree of collaboration between the two roles could be examined in addition to the delineation between the CDO and the CIO. Finally, it might also be worth investigating if the CDO merely reflects a phenomenon that is gaining momentum in (Western) industrialized economies or whether it can be observed in other parts of the world as well.

With reference to an investigation of the need for a CDO, an extension of this study could be considered by delineating the CDO from other TMT positions. Especially a differentiation of the CDO from positions with presumably notable overlaps such as the Chief Transformation Officer, Chief Strategy Officer, or even the Chief Marketing Officer could be of special interest. An additional avenue for future research could be to explore company-specific reasons for appointing a CDO, as previous research is limited to a rather generic assessment of the need for a CDO. Despite being company-specific, the findings from various companies could be aggregated to provide a significant contribution to a more detailed understanding of the need for a CDO. Furthermore, quantitative validation of this study’s implications that as the CIO’s demand-side focus increases, the need for appointing a CDO declines may be performed. Such a data-based validation could generate additional reliability for subsequent research and for companies that base their decisions on this finding. Finally, an analysis of the market demand for the CDO role, particularly with reference to the different role types highlighted in this paper, also represents a potentially insightful avenue for further research. Perhaps an association can be found between the demand for individual CDO role types and parameters such as the industry in which a company operates. Although not directly related to the findings of this paper, future research should also aim to quantify the value of the CDO to TMTs and organizations. In particular, measuring CDO effectiveness through financial indicators and assessing the impact of CDO presence on the progress of DT offer attractive research avenues. The majority of existing literature is predominantly concerned with the role of the CDO and attempts to capture and characterize the phenomenon. However, based on the role definition of the CDO and the delineation from the CIO that emerged from this study, an examination of the effects of CDO presence provides an exciting opportunity for further research.

Bibliography


The role delineation of CDO & CIO


