Chief Digital Officers – Review and Research Agenda

Lena Kessel
ESCP Business School

Lorenz Graf-Vlachy
TU Dortmund, ESCP Business School

Follow this and additional works at: https://aisel.aisnet.org/wi2021

Chief Digital Officers – Review and Research Agenda

Lena Kessel[1] and Lorenz Graf-Vlachy[1,2]

[1] ESCP Business School, Berlin, Germany
{lkessel, graf-vlachy}@escp.eu
[2] TU Dortmund University, Dortmund, Germany
lorenz.graf-vlachy@tu-dortmund.de

Abstract. Practitioners intensely discuss Chief Digital Officers (CDOs). Some stress CDOs' critical role in recrafting digital strategies and accelerating digital transformation. Others predict the disappearance of CDOs. Similarly, academics have recently taken interest in this novel executive role and conducted substantial research on CDOs which is, however, scattered across disciplines and outlets. Thus far, there is no systematic review that consolidates these initial gains in knowledge and, more importantly, derives a comprehensive agenda for future research. To remedy this, we conduct a structured literature review and integrate findings on theoretical lenses and key themes in studies on CDOs. In particular, we propose a framework that organizes CDO research in three broad themes: antecedents of CDO presence, the CDO in the organization, and consequences of CDO presence. We then build on this framework to develop an extensive agenda for future research on CDOs.

Keywords: Chief Digital Officer, Systematic Literature Review, Research Agenda, IS Executives

1 Introduction

Many organizations across different industries around the world employ Chief Digital Officers (CDOs) to initiate and conduct digital transformations [1, 2]. About 15 years into the existence of the CDO position [2], it is still hotly debated. Some practitioners stress CDOs' importance, arguing that digital transformation requires actors that drive digital strategy at the top management level [3, 4]. Others predict the disappearance of CDOs and headline that "Chief Digital Officers are doomed to fail" [5], referring to a consulting study that reported a slowdown in CDO appointments between 2016 and 2018 [6].

In parallel to this lively debate among practitioners, researchers have increasingly devoted attention to CDOs as they, on the one hand, "might help to manage digital transformation more effectively" ([7], p. 4) and, on the other hand, might create costs because the CDO position may increase internal complexity within top management teams (TMTs) [7]. Aside from the CDO's role itself, academics discuss antecedents of CDO presence [2], the CDO's organizational context [8], and consequences of CDO presence [9]. Numerous studies on CDOs have been published across disciplines and

outlets, including both conference proceedings and journals, as well as practitioner-oriented outlets in the fields of information systems (IS) and management.

However, a comprehensive in-depth review of this highly fragmented literature on CDOs does not exist, making it difficult to build on previous findings and identify the most promising research questions for future studies that can bring further clarity to the phenomenon of CDOs. An extant review on IS executives includes findings from five studies on CDOs and focuses on specific facets of the CDO literature to answer the question of how IS executives contribute to organizational performance [10]. Yet, this review is severely limited in several ways. First, it focuses on Chief Information Officers (CIOs) rather than on CDOs. Second, the five reviewed studies on CDOs are only a small subsample of what has been published on CDOs. Third, the review looks at IS executives' contribution to organizational performance from the theoretical perspective of an input-mediator-outcome framework [11], restricting findings to specific thematic details the theoretical framework suggests to investigate. Another review published explicitly as "research in progress" proposes a literature review on CDOs, but does not offer a complete overview of our knowledge on CDOs as it only discusses preliminary findings from five papers [12]. Aside from that, it does not suggest a research agenda for the IS community. In sum, extant work does not yet provide a sufficiently comprehensive review of extant research as well as avenues for future research to remedy the current disintegrated state of the CDO literature.

Our literature review fills this gap, analyses and synthesizes the scattered literature on CDOs, and provides a discipline-spanning overview of theories and topics within CDO research. From this analysis, we derive a framework that organizes the literature on CDOs in three broad themes: antecedents of CDO presence, the CDO in the organization, and consequences of CDO presence. This framework serves as a knowledge map [13] upon which we build an agenda for future research on CDOs. For the IS community, we thus provide a structured overview of the topic at hand as well as useful directions towards fruitful research avenues. Our research agenda can guide future studies, offering direction for researchers by compiling the most pressing open questions, e.g., on interacting factors that lead to CDO presence, on CDOs' relationships with other top executives, as well as on CDOs' impact on firms' digital agendas and performance. Additional opportunities for research on CDOs include, for instance, the exploration of factors that drive CDOs' specific actions or might moderate CDOs' impact on firm-level outcomes.

2 Methodology

To ensure a comprehensive account of the literature on CDOs, we followed established processes for systematic literature reviews [e.g., 14]. To identify relevant literature, we selected *"Chief Digital* Officer*"*[1] as a keyword that had to appear in either title, abstract, or keywords. We manually ensured that CDOs were in fact the focus of every

---

[1] We refrained from searching for the term "CDO", because CDO also abbreviates other, irrelevant phrases, e.g., "Collateralized Debt Obligations." We assume that authors writing about Chief Digital Officers will spell out this term instead of using only the abbreviation CDO.

study and not only, e.g., interview partners in studies on other topics. In addition, we only included English studies to keep the cited literature accessible to a global English-speaking audience. We surveyed peer-reviewed papers published until June 2020.

To account for literature across outlets, we consulted several databases in the following order. First, given the multidisciplinary nature of the topic, we searched for relevant peer-reviewed journal articles in Web of Science (WoS). This allowed us to identify articles on CDOs across disciplines and yielded seven relevant references. Second, due to the practical relevance of CDO research, we also consulted EBSCO Business Source Premier (EBSCO) that lists peer-reviewed studies from practitioner-oriented journals not included in WoS. This search yielded four additional articles. Third, considering the recent emergence of CDO research, we also included publications in relevant conference proceedings and searched the Association for Information Systems eLibrary (AISeL). After removing duplicates, irrelevant documents like interviews, theses below doctoral level, literature reviews, and "research in progress" papers without results, the search in AISeL yielded ten additional studies. Fourth, we consulted IEEE Xplore, which yielded three more studies. Fifth, to find publications from the field of management, we searched the Academy of Management Proceedings, which yielded two more studies on CDOs, for which we obtained the full text from the respective authors. Additionally, we received one article through an expert recommendation. Overall, we retrieved 24 articles through keyword searches within online databases and three additional articles from their respective authors.

We proceeded to read through all articles and excluded three articles which did not contain any insights on CDOs. Moreover, we performed a backward search and found one additional relevant article cited within our initial sample. In addition, reading through the articles revealed that authors occasionally consider executives with other titles, e.g., "digital directors" as CDOs [7]. We therefore drafted a list with such titles and repeated the search with these keywords, which, however, did not yield any additional relevant studies[2]. After this process, we arrived at a final sample of 25 articles.

During several rounds of reading, we inductively and iteratively [15, 16] coded each article based on central theoretical, methodological, and thematic details.[3] Regarding empirical research designs, we identified ten qualitative and five quantitative studies, five mixed-method approaches, three fuzzy set qualitative comparative analyses, and one Delphi-study. From the analysis of theories and themes, we iteratively developed a concept-centric organizing framework [14] that organizes knowledge on CDOs.

---

[2] We repeated the search in WoS, AISeL, IEEE Xplore, and EBSCO with the keywords "Digital* Transformation* Officer*," "Chief Digital* Evangelist*," "Digital* Director*," "Digital* Officer*," "Group* Digital* Director*," "Head* of Digital*," Head* of Digitalization*," "SVP* Digital*," "Vice President* Digital*," "Head* Digital*," "Global* Head* of Digital*", "Chief Digital* Marketing* Officer*," "Digital* Platform* Officer*," "ED-Digital*" (suggested by [1, 7, 9, 43]).

[3] A concept matrix with details on the coding is available upon request.

3 Findings

3.1 Organizing Framework for CDO Research

The organizing framework aggregates the findings from our analysis of studies on CDOs (Fig. 1). This framework helps not only structure extant knowledge but will also prove useful for identifying opportunities for future research. It displays the major theoretical perspectives and organizes major themes identified within the study sample.

Regarding theoretical perspectives, scholars have analyzed CDOs using *role perspectives*, *contingency theory*, *configurational theory*, *institutional perspectives*, *psychological perspectives*, *signaling theory* and various *IS frameworks*.

Regarding the themes, the framework is organized in three sections. On the left, it displays the *antecedents of CDO presence,* i.e., factors that can explain how and why CDOs are appointed. More specifically, the framework differentiates between factors that relate to *individuals* (e.g., CIOs)*,* the *firm* (e.g., firm-specific organizing logics), and the *environment* (e.g., competitors)*.* The surrounding arrow indicates that these factors, alone or in combination, can lead to CDO presence [17].

In the center, the framework displays *the CDO in the organization*, a theme that comprises several subtopics. Research observes *CDOs* as actors in organizations who can assume various *role profiles,* possess certain *professional backgrounds and skills*, and can be evaluated using differing *key performance indicators* (KPIs). Additionally, scholars looked at CDOs' relations specifically with *CIOs* and explored the *organizational context* around CDOs in terms of *IT governance*, *reporting*, and *company size.*

The right side of the framework highlights that, not surprisingly, researchers also studied the *consequences of CDO presence,* specifically *performance* consequences (both from a *digital innovation perspective* and a *financial perspective*) and consequences for companies' *alliance behavior*.
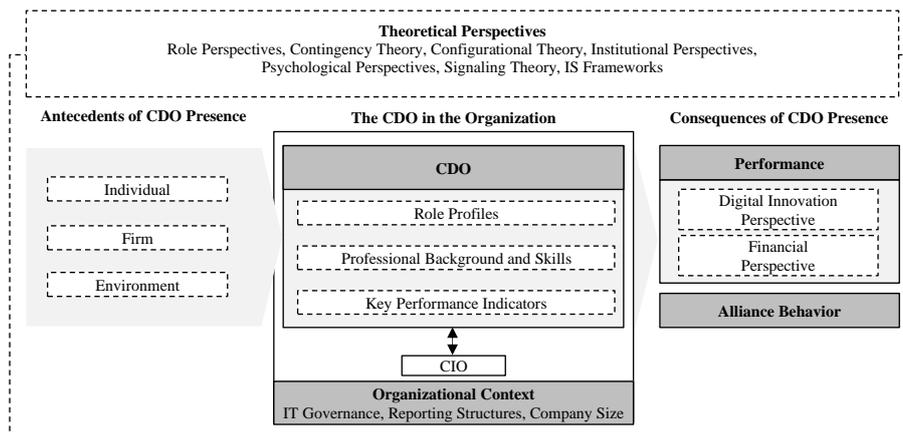

Figure 1. Organizing Framework for CDO Research

3.2 Main Theoretical Perspectives in CDO Research

Empirical studies look at CDOs from a variety of theoretical perspectives. Several researchers use *role perspectives* to shed light on CDOs' diverse role profiles. Specifically, scholars use conceptualizations that build on Mintzberg's [18] managerial roles, or on concepts for actors in the context of innovation [e.g., 19]. They distinguish, e.g., between the CDO in the role of an entrepreneur, spokesperson, monitor, leader, or liaison [20], or classify the CDO as a process promoter, relationship promoter, or innovation champion [21]. Furthermore, scholars refer to theories of role ambiguity [22] to explain how job overlaps between CDOs and CIOs can lead to depressed stock prices for firms that appoint CDOs [23].

Researchers also use *contingency theory* which suggests that firms' effectiveness is determined by the fit of governance choices with the internal and external situation of the company [24]. They use contingency theory to describe firm-internal and environmental factors that might lead to CDO appointment [1, 7]. Moreover, contingency theory can help to explain how organizational complexity shapes CDO presence and the fit between CDO role types, CDOs' influence, external market pressure, and digital transformation performance [21].

Other scholars use *configurational theory*, a meta-theoretical approach that builds on the notion that "the whole is best understood from a systemic perspective and should be viewed as a constellation of interconnected elements" ([25], p.1). It tries to assess causal complexity in organizational settings by analyzing the presence or absence of conditions that are associated with certain outcomes [25]. Studies on CDOs leverage configurational theory to derive CDO types from the analysis of CDOs' skills, networks, and behaviors that seem to determine CDOs' scope of action [21]. Moreover, academics build on configurational theory to develop propositions on how the presence/absence of CDOs, combined with the presence/absence of market pressures or vertical IT governance mechanisms, are associated with digital innovation performance [21, 26].

The role of the CDO is also explored from *institutional perspectives* that combine institutional entrepreneurship [27] and logics of action [28]. For instance, scholars build on institutional perspectives to define CDOs as institutional entrepreneurs who enter departments with an action logic different from logics of incumbent IS executives [29].

In addition, several scholars adopt *psychological perspectives* on teamwork in an IS context. Theory of shared vision [30] explains how team members' similar understanding on topics leads to more efficient teamwork. Theory of transactive memory systems (TMS) [31] explains that teams with a TMS tend to generate superior results. TMS describes a state that emerges when teams specialize in different areas of expertise, when they trust each other, and when they manage to assign tasks to the respective specialists, so that every team member can do the work he or she is best at [32]. Both theories are used in explorations of CDO-CIO cooperation [33].

Scholars also use *signaling theory* which suggests that companies can reduce knowledge asymmetries between the organization and outsiders by sending costly signals [34, 35]. Specifically, public announcements of CDOs can be viewed as strategic signals to investors that a firm engages in strategic efforts in digital transformation [9].

Moreover, scholars use several theoretical *frameworks* that have been developed for *IS contexts*. One recurring framework relates to demand- and supply-side tasks of IS executives. Demand-side oriented executives tend to focus on strategic tasks, customers, competitors, and value propositions, whereas supply-side managers focus on cost-efficient internal IT infrastructure [20, 36–39]. Scholars refer to demand-side oriented and supply-side oriented tasks to differentiate between the CDO and CIO roles [17, 20]. In addition, scholars apply frameworks for vertical and horizontal IT governance mechanisms [40] to analyze CDOs' organizational context. Vertical governance mechanisms determine the centralization of decision-making, e.g., CDOs' position at the top management level [8, 26, 41]. Horizontal governance mechanisms describe structural design choices that regulate cross-functional collaboration, e.g., between CDOs and other TMTs who collaborate on digital projects [8, 40, 41].

3.3 Antecedents of CDO Presence

Antecedents of CDO presence comprise factors that concern individuals, the entire firm, or its external environment. Such factors, alone or in combination, might trigger CDO appointments [17].

Antecedents on the Individual Level. Companies hire CDOs when they lack individuals with digital leadership skills. Specifically, they appoint CDOs when their executives perceive their CIO as unable to deal with digital strategy development and IT support simultaneously [1, 17, 42]. Such perceptions that CIOs are less qualified for digital strategy development, in turn, seem to be caused by stereotypical descriptions of CIOs, e.g., as detail-oriented IT experts without leadership skills [17, 42].

In addition, board composition, specifically by way of behavioral tendencies associated with age, might affect CDO presence. Scholars propose, e.g., that boards with older directors are less likely to hire CDOs because they are less open to change [1].

Antecedents on the Firm Level. Regarding the entire firm, internal complexity, specifically firm size and increasing product-market diversification (in terms of product portfolio and geographic scope) are associated with CDO presence [1, 2, 7, 17].

Additionally, a firm's digitization focus area seems to impact CDO presence [17]. Firms with high dependence on intangible assets (e.g., media firms) seem more likely to appoint a CDO than firms in industries dependent on tangibles (e.g., mining companies) [7]. Moreover, firms with an external focus on digitization, e.g., in marketing, might also be more likely to appoint CDOs than firms with an internal focus, e.g., in operations [1, 17].

Finally, companies with declining sales might appoint CDOs because they might hope that CDOs generate new revenue opportunities by accelerating the design of digital products and services [1].

Antecedents at the Environment Level. Companies who hire CDOs also seem to react to digital-savvy competitors in their industries [2, 7, 17, 29, 42, 43]. In particular, the number of CDO appointments rises with the number of digital-savvy competitors [7]. Moreover, several scholars suggest that the adoption of CDOs might be driven by intra-industry mimicry [1, 7, 9].

Country-specific institutional settings that influence companies' access to information and communication technologies (ICT), e.g., regulatory frameworks or the simple availability of ICT infrastructures likely also influence CDO presence [7].

3.4   The CDO in the Organization

CDOs' Role Profiles. Extant research indicates that CDOs' roles vary with company context, that CDOs are not necessarily restricted to one role profile, and that their roles can develop over time [1, 2, 21, 44, 45]. Thus far, scholars have developed several CDO role typologies and propose key indicators to measure differing role type's performance [46]. To give a concise summary of these typologies, we classify existing schemes for CDOs' role profiles into two categories – functional and cross-functional CDOs.

Functional CDOs tend to have specialist role profiles as, e.g., heads of the IT or marketing department [1]. Functional CDOs like "digital marketers" can for example specifically focus on data analytics to enhance the customer experience [47]. Similarly, IT experts can specialize on technological tasks [45]. Research suggests that such functional roles imply low role ambiguity because CDOs can focus purely on their functional duties, e.g., marketing [48].

Cross-functional CDOs, in contrast, work across departments and often across hierarchy levels and fulfill rather generalist tasks [1, 21, 45], frequently with a focus on promoting or coordinating digital initiatives across functional silos [49]. Cross-functional CDOs may be able to innovate business models by prototyping digital innovations or by supporting others to do so [2, 21, 45]. Requirements for cross-functional CDOs tend to vary considerably and imply relatively high levels of role ambiguity [48].

Prior research distinguishes different cross-functional CDO roles. Cross-functional CDOs who promote digital initiatives across departments and hierarchies are frequently labeled "evangelists" [2, 17, 45, 46] or "liaisons" [20]. Evangelists can train employees on digital topics by, e.g., organizing workshops to foster employees' digital expertise or by inviting experts who share their knowledge on digital transformation [2, 17, 20]. Evangelists can also serve as "digital advocates" [17] for the IT function by promoting the IT functions' ideas at the top management level [2, 17]. Moreover, evangelists often use internal and external networks, e.g., other CDOs in the corporate group, competitors, or customers to gather ideas they can introduce to their companies [20, 45].

Cross-functional CDOs who coordinate digital initiatives across departments are often described as "coordinators" [2, 17, 20, 47]. They can establish links between business units by initiating platforms like digital councils where managers meet to realign scattered digital initiatives [47]. Some scholars use the terms "digital harmonizer" [47], "digital orchestrator" [17], "networker and catalyzer" [45], or "process promoter" [21] to refer to similar roles.

Cross-functional CDOs in the role of "entrepreneurs" span boundaries between customer trends and process development, and adapt new products or business models, often in cooperation with CIOs [2, 17, 20, 47]. Entrepreneur CDOs tend to directly engage in prototyping digital innovations, e.g., by leading digital incubators [17] or by integrating innovative solutions into existing products like augmented reality in online

shopping apps [2]. Scholars also use the terms "innovator," "accelerator," or "innovation champions" to describe such entrepreneurial CDO roles [17, 21, 46, 47].

CDOs' Professional Background and Skills. Research suggests that leading digital transformation requires multidisciplinary professional skills in business and IT, as well as various soft skills [2, 21, 45, 50, 51]. Moreover, the needed skills appear to differ between functional and cross-functional CDOs. Professional experience in the functional domain, e.g., IT or marketing seems especially important for functional CDOs [48]. Cross-functional CDOs appear to especially benefit from management and soft skills that enable them to thrive in cross-functional roles with high role ambiguity [2, 48, 50, 51]. Furthermore, some cross-functional CDOs have limited knowledge in IT or business strategy [21, 45].

Regarding soft skills, CDOs seem to benefit from visionary and strategic thinking as well as inspirational skills to draft digital strategies and convince employees to follow their vision for digital transformation [2, 21, 45, 50]. Moreover, CDOs profit from resilience [2], i.e., the ability to resist employees' and TMTs' criticism towards change management as well as the ability to acknowledge and overcome failure by learning from mistakes [2].

KPIs for CDOs. Different CDO roles might require different criteria in performance evaluations. Seeher et al. [46] derive a set of ten KPIs for evangelist, marketer, orchestrator and innovator CDOs. For evangelists, they suggest measuring how CDOs manage to spread enthusiasm for digital transformation. Conducting surveys that measure employees' attitude towards digital transformation represent one out of several options of doing so. For marketers, KPIs can measure customer loyalty and satisfaction. KPIs for orchestrator CDOs can consider the alignment of departments' digital initiatives and could for example measure the share of digital revenue compared to total revenue. KPIs for innovators might, e.g., include the number of launched digital initiatives.

CDOs and CIOs. CDOs are frequently appointed in addition to CIOs [1], which has sparked interest in observing both IS executives simultaneously [33]. On the one hand, scholars describe CDOs and CIOs as complementary and interdependent actors [1, 17, 20, 33, 46, 47]. On the other hand, some scholars consider CDOs unnecessary as long as CIOs are equipped with sufficient influence on digital strategy [42]. The following discusses differences and similarities between CDOs and CIOs, and their collaboration. *Distinctions and Similarities between CDOs and CIOs.* Some scholars find that CDOs and CIOs follow distinct action logics, with CDOs engaging in demand-side tasks with a focus on digital strategy development and customers, and CIOs rather focusing on supply-side tasks and the technological aspects of digital innovation [2, 20, 29]. Others argue that CDOs and CIOs perform similar tasks, depending on contextual factors, e.g., professional backgrounds [42, 43, 52]. Hansen and Sia [52], for example, propose that CIOs who have business and marketing expertise can achieve the same as CDOs.

Additionally, the CDO role may be the result of a transformation of the CIO role. CIOs have increasingly faced the challenge of handling demand- and supply-side tasks simultaneously, which has eventually become overwhelming. At a point, the CIO role split into two separate roles – the demand-side oriented CDO and the supply-side oriented agile IT director. In such cases, CDOs perform a different role than CIOs and are

likely to act in the role of digital strategists while CIOs fulfill a more technology-oriented role as the head of the IT function . Yet, in cases where the CIO role still remains demand-side and supply-side oriented, CDOs might be unnecessary because CIOs already fulfill the role of digital strategists [17].

Collaboration between CDOs and CIOs. Several factors might lead to successful collaboration between CDOs and CIOs. First, clearly defined roles can facilitate teamwork in the CDO-CIO dyad. If CDOs are, for example, responsible for managerial tasks and CIOs for technological tasks associated with digital transformation, roles tend to be clearly defined, reducing potential friction. Second, coordination mechanisms like regular meetings between CDO, CIO, and the board can further facilitate CDO-CIO cooperation. Third, similar professional and educational backgrounds in both business and IT also seem to foster successful collaboration [33].

CDOs' Organizational Context. Researchers have considered the organizational context around CDOs in terms of IT governance, reporting structures, and company size.

Regarding IT governance, the interplay of vertical and horizontal organizational governance mechanisms seems to affect CDOs' effectiveness as it regulates their top-down and cross-functional interactions [8, 41]. Vertical governance mechanisms describe the centralization of CDOs' decision authority. CDOs can have a central C-suite position [2, 20, 47, 51] or a decentral position, e.g., as head of a business unit [8, 41]. A central CDO position seems reasonable if the company intends to disseminate the digital vision from the top and wants to find uniform solutions for all departments. A decentral CDO position can be beneficial if CDOs need to quickly adapt digital services to the specific needs of a business unit and do not have time for potentially time-consuming discussions with other departments. Besides the vertical position, horizontal mechanisms, i.e., formal board meetings or digital steering committees, foster the cross-functional interaction between CDOs, TMTs, and digital work groups. Horizontal mechanisms can, for example, trigger decentralized CDOs' interaction with other digital executives or the board [8, 41].

Regarding reporting structures, CDOs seem to report to the board and to Chief Executive Officers (CEOs) [44], or to other IS executives and IS staff [51]. Specifically, Berman et al. [51] propose that CDOs reporting to CIOs might be more efficient than CDOs reporting to CEOs.

Regarding company size, CDOs' activities and responsibilities tend to vary between small and medium sized enterprises (SMEs) and large-scale enterprises (LSEs) [20, 44]. CDOs in SMEs have greater freedom in shaping their roles whereas CDOs in LSEs have more distinct responsibilities and a more limited scope of action [20, 44]. CDOs in SMEs, for example, rather deal with digital strategy and IT, while CDOs in LSEs seem responsible for digital strategy while CIOs are dealing with technology [20].

3.5 Consequences of CDO Presence

CDOs' Impact on Digital Innovation Performance. Digital innovation performance, also referred to as business digitization, indicates companies' progress in effectively using, developing, and commercializing digital processes, products, and services [21].

Extant research looks at the interplay of CDO presence, contextual factors and its effects on digital innovation performance [21, 26, 45].

Configurational analyses suggest that CDOs provide opportunities for improving digital innovation performance if existing organizational bodies are not in charge of digital projects [26]. Moreover, configurational analyses explore the performance consequences of different CDO types (determined by their skills, networks, and behaviors) in situations of various degrees of influence (in terms of CDOs' decision-making authority) and differing degrees of competitive pressure in the industry [21, 45]. For example, the findings from such studies suggest that CDOs who strongly support others and possess large internal networks (e.g., process promoters) might be most effective in situations of low influence and high competitive pressure. In such contexts, process promoters can make use of their relationships inside the company to implement digital solutions that might generate a competitive advantage. In contrast, CDOs with functional skills and large external networks might be more adequate in situations of high influence and low pressure. Since the main barrier to initiate digital transformation initiatives in such contexts may be a lack of TMT interest in a digital agenda, CDOs with external networks can gather outside ideas and use their political skills and high influence to put digitization on the company's agenda.

CDOs' Impact on Financial Performance. Scholars investigate both internal accounting-based and external stock-market-based indicators to study changes in financial performance due to CDO appointment [7, 9, 23, 51].

Regarding accounting measures, Berman et al. [51] find a positive correlation between CDO presence and the ROI for digital investment in surveyed firms. Moreover, they find that companies with high financial performance in terms of revenue growth and profitability seem to particularly express the need for a CDO.

Regarding stock market measures, Firk et al. [7] rely on Tobin's Q. They highlight that CDO presence has a positive effect on performance if the company shows high levels of dependence on intangibles and a high degree of internal diversification. In contrast, a high number of digital entrants in the industry and low external digital readiness (e.g., no adequate digital infrastructure in the country of operation) seems to weaken the effect of CDO presence on firm performance.

Additionally, authors assessed performance in terms of share price increases [9, 23]. They suggest positive effects of CDO appointments under certain conditions. First, CDOs with a business background and a specialist role profile tend to be perceived positively by investors [9]. Second, as job overlaps between CDO and CIO can be sources of conflict, investors especially value CDO appointments in companies without CIOs [9, 23]. Third, investors perceive CDO appointments negatively if they assume that CDO appointments have a mere signaling function and reflect mimicry rather than a well-considered strategic choice [9].

CDOs and Alliance Behavior. Findings from a quantitative study in the banking industry suggest that CDO presence is positively related to banks' alliances with startups offering technology-driven financial services (fintechs). This suggests CDOs as an option for banks that intend to cope with digitization pressure through alliances with fintechs. Moreover, it might suggest that fintechs might wish to look for banks with CDOs if they are seeking collaborations [53].

4   Agenda for Future Research

Our synthesis of the current knowledge on CDOs allows us to derive avenues for further research that can shed light on CDOs' emerging and controversially discussed role (Tab. 1).

Table 1. Avenues for Future Research and Selected Research Questions

Research Avenue	Selected Research Questions
Antecedents of CDO Presence	Which interacting factors lead to CDO presence and how can research address causal complexity?
	Do qualitative findings on antecedents of CDO presence generalize?
	How can a fashion perspective explain CDO presence?
The CDO in the Organization	What are the results of CDOs' micro-role transitions and how to manage them?
	How can KPIs for CDO roles be validated, extended, and operationalized?
	How does the CIO-CDO role transition unfold and how can it be managed?
	How do CDOs without functional background in business strategy and IT cope with digital transformation?
	Which agency relationships exist between CEOs, CDOs, and CIOs?
	Do qualitative findings on IT governance, company size, and other contingencies that determine CDOs' scope of action generalize?
	Which reporting structures are suitable in which organizational context?
Consequences of CDO Presence	Are links between CDO presence and consequences causal?
	What are signaling consequences of CDO-related announcements?
	How do CDOs impact strategic actions like alliances with start-ups, mergers and acquisitions, or changes in organizational structure?
Selected further Opportunities	How do environmental contingencies affect CDOs' presence and impact?
	How does the board of directors affect CDOs' activities and impact?
	How do CDOs' personal characteristics affect CDOs' activities and impact?
	What are causes and effects of CDOs' disappearance in firms?

As research on antecedents of CDO presence suggests that many factors might lead to CDO presence [1, 7, 17], further studies might wish to address causal complexity due to multiple factors interacting, and potential bias (e.g., confirmation bias or endogeneity [54]) in identified linkages between antecedents on the individual, firm, and environment level as well as CDO presence. Further quantitative studies could also help assess the generalizability of ideas derived from qualitative research. Moreover, fashion perspectives [55] might represent a useful theoretical lens to observe reasons why CDOs are on the one hand seen as necessary to coordinate digital transformation [4], but on the other hand claims arise regarding CDOs' potential temporariness [6]. In light of findings that propose CDO appointments occur as a result of mimicry [1, 7, 9], it might be worthwhile to investigate whether firms appoint CDOs because they are an efficient choice in line with the company's overall strategy, or rather because fashion-setting organizations like consulting firms "hype" them as innovative contributors to digital

transformation and firms appoint CDOs merely to signal innovativeness. Further, such insights might help predict whether CDOs will remain a fixture in the C-suite or disappear once their novelty has worn off.

Regarding CDOs' roles in organizations, work using theory on micro role transitions [56] may further improve our understanding of cross-functional CDOs who switch between role types, e.g., between evangelist and entrepreneur [2, 17]. Observing cross-functional CDOs' daily role transitions from the perspective of integrated role transitions [56] would be an opportunity to learn about psychological and organizational consequences of frequent role-transitions and might reveal whether firms should continue to put CDOs in several role profiles or if they should rather define clear CDO roles to reduce, e.g., CDOs' anxiety, a potential consequence of frequent role switches [56].

Moreover, further studies may seek to empirically validate and extend the suggested KPIs for CDOs' diverse roles [46]. So far, scholars proposed KPIs only for evangelists, coordinators, marketers, and entrepreneurs. In addition, some of these KPIs, e.g., employees' attitude towards a digital culture, are not yet readily operationalized.

Furthermore, some scholars propose that the CIO role has split into the distinct roles of CDOs and agile IT directors [17]. Further observing CIO-CDO role transitions from a segmented role transition perspective [56] could provide an opportunity to better understand the process of CIOs' role exit and role entry and might inform about governance mechanisms and human resource management practices that are necessary to manage a successful transition from an ambidextrous CIO role to the demand-side oriented role of CDOs and the supply-side oriented role of agile IT directors.

Regarding CDOs' professional background and skills, studying CDOs with limited expertise in business strategy and IT appears as another fruitful research opportunity. Moving beyond only creativity theories as an explanation for successful CDOs without functional expertise [21], qualitative studies of CDOs with limited previous experience in business strategy and IT might derive insights on how CDOs without such functional expertise cope with challenges of digital transformation.

As CDOs seem to enter organizations as new players next to CIOs [29], further investigations on emerging agency relationships between CEOs, CDOs, and CIOs might be fruitful. CDOs seem to be hired because CEOs expect them to be more effective in digital transformation than CIOs [17]. Agency theory [57] might provide a suitable lens to study agency relations and problems between CEOs and CDOs, and to compare differences between CEO-CDO and CEO-CIO relations.

In terms of the organizational context of CDOs, quantitative studies could assess the generalizability of qualitative findings on IT governance and company size – contingencies that seem to determine CDOs' scope of action [8, 41, 44]. In addition, further research on reporting structures is needed to find out which structures are most used and most effective in certain organizational contexts, e.g., depending on company size or complexity. Further fsQCA analyses in particular might provide the opportunity to investigate contingencies that determine successful reporting structures.

Regarding consequences of CDO presence, future research may examine whether links between CDO presence and performance are in fact causal, i.e., whether appointing a CDO is conducive to successful digital transformation (and under which conditions) [54]. In a similar vein, future research may also further explore the signaling

function of CDO announcements. Scholars propose that companies hire CDOs to signal digital transformation efforts to investors, but CDO announcements are not always positively associated with rising stock prices [9]. Qualitative studies could thus explore reactions of investors and other stakeholders to CDO announcements in more detail. Especially, analyzing announcements of CDOs being promoted into other positions or announcements of abandoning the CDO role might be further relevant events to study.

Future studies can further explore CDOs' impact on strategic actions, e.g., alliances with start-ups, and gather more knowledge on how CDOs impact strategic decision-making in organizations. So far, one study proposes that CDOs might trigger alliances of banks with fintechs [53]. However, the authors do not clearly identify whether CDO presence leads to increasing alliances with fintechs, or if a bank's general focus on digital strategy makes such alliances more likely. Scholars may thus validate whether links between CDO presence and alliance behavior are in fact causal. In addition, extending research to contexts outside the banking sector may be useful. Finally, future studies could observe CDOs' impact on other strategic actions, e.g., mergers and acquisitions or changes to an organization's structure [58], and gather more knowledge on how CDOs impact strategic decision-making in organizations.

Moving beyond our framework, we propose selected further opportunities for research, in particular moderating factors, an Upper Echelons perspective, and a focus on the potential disappearance of the CDO. First, scholars can investigate how and why environmental contingencies, e.g., the industry context, impact CDOs' presence and their influence on firms' digital transformation. Thus far, it is for example unclear why CDO recruitment has slowed down in certain industries but accelerated in others [7]. Future studies might specifically compare CDO presence and effectiveness in different types of industries, e.g., between manufacturing and service industries, between industries of high and low capital-intensity, or between high- and low-technology sectors. More specifically, scholars could, for example, study the fit between CDO presence and CDOs' strategic decisions and industry clockspeed, i.e., the rate of industry change in terms of product innovations, process replacements, strategic shifts (e.g., alliances or acquisitions), or structural change [58]. Such studies might reveal further factors that may determine whether CDOs are a viable strategic choice only in specific industries, which might explain why some observers highlight the importance of CDOs [4], while others downplay it [5].

Second, contingencies that relate to the board of directors and its impact on strategic decision-making might affect CDOs' scope of action. Aside from observing how the age of directors affects the likelihood of CDO hires [1], extant CDO research has largely ignored how board structure, composition, or processes influence CDOs' activities and strategic decisions. As prior studies on board involvement in strategic decision-processes propose relationships between, e.g., board size or friendship ties between board members and the board's involvement in strategic decisions [59], we encourage future researchers to include board composition and activities as moderators of CDOs' activities and impact on firm-level outcomes.

Third, studying CDOs through an Upper Echelons lens [60] can reveal further variables that might determine CDOs' actions and decisions. Upper Echelons Theory suggests that strategic leaders' personal characteristics, e.g., cognition, personality, values,

or experiences, influence organizational outcomes [60, 61]. Examining how CDOs' personality traits or their ability to communicate with a wide array of different stakeholders (e.g., other top managers, employees, customers) shape CDOs' strategic decisions and their impact might yield valuable insights, for example for CDO selection.

Finally, cases of CDOs' succession into CEO positions [62] and consulting firms' reports on CDOs' temporariness suggest that the CDO position might disappear in some or even all firms over time. As the debate on CDOs' potential disappearance is currently largely based on practitioner opinions and consulting reports, there are many opportunities for scholars to explore the antecedents and consequences of CDOs' disappearance, including problems that might arise if nobody fulfills the role of a digital strategist, or opportunities that appear for other executives who might takeover CDOs' tasks.

5   Limitations

While this literature review methodically synthesizes extant knowledge on CDOs and identifies fruitful avenues for future research, our study is not without limitations. First, our results are based on keywords that represent existing labels for CDOs in studies published until June 2020. We followed the process suggested in relevant literature [14] and we included journal articles across disciplines as well as conference proceedings, but the results are naturally limited by the scope of chosen keywords and the time-span of our search. A follow-up study could build upon the results of this paper and perform a bibliometric analysis that considers co-citations within the identified literature on the CDO role and related research fields to overcome the limitations associated with the scope of the chosen keywords [63]. Second, we focused on English-language articles. While most of the scholarly discussion is likely taking place in English, CDOs appear to be a global phenomenon and additional literature may exist in other languages and might, for instance, account for cultural aspects beyond the Western world.

References

1. Kunisch, S., Menz, M., Langan, R.: Chief digital officers: an exploratory analysis of their emergence, nature, and determinants. Long Range Plann. 1–45 (2020)
2. Singh, A., Hess, T.: How chief digital officers promote the digital transformation of their companies. MIS Q. Exec. 16, 1–17 (2017)
3. Trout, L., Reingold, J., van Boetzelaer, N., Gadtaula, P.: CDO decoded: the first wave of chief digital officers speaks, https://www.egonzehnder.com/cdo-decoded (Accessed: 25.06.2020)
4. Mindtree: CDO A champion of change, https://possible.mindtree.com/Chief-Digital-Officer-CDO-Survey-Report.html (Accessed: 24.06.2020)
5. Walde, M.: From dazzling to departed - Why chief digital officers are doomed to fail, https://www.weforum.org/agenda/2020/02/chief-digital-officer-cdo-skills-tenure-fail/ (Accessed: 04.04.2020)
6. Strategy&: The 2019 Chief Digital Officer Study Global Findings, https://www.strategyand.pwc.com/gx/en/insights/2019/cdo/2019-cdo-study-global-

findings.pdf (Accessed 03.06.2020)

7. Firk, S., Hanelt, A., Oehmichen, J., Wolff, M.: Digital in the C-Suite: antecedences and performance effects of chief digital officer appointments. Acad. Manag. Proc. 2019, (2019)

8. Singh, A., Klarner, P., Hess, T.: How do chief digital officers pursue digital transformation activities? The role of organization design parameters. Long Range Plann. 53, (2020)

9. Drechsler, K., Wagner, H.-T., Reibenspiess, V.: Risk and return of chief digital officers' appointment – An event study. In: 40th International Conference on Information Systems. pp. 1–17. AISeL, Munich (2019)

10. Drechsler, K.: Information systems executives: a review and research agenda. In: 28th European Conference of Information Systems. pp. 1–16. AISeL (2020)

11. Ilgen, D., Hollenbeck, J., Johnson, M., Jundt, D.: Teams in Organizations: From Input-Process-Output Models to IMOI Models. Annu. Rev. Psychol. 56, 517–543 (2005)

12. Moker, A.: Association for Information Systems What Do We Know about the Chief Digital Officer ? A Literature Review. In: Americas Conference on Information Systems. pp. 0–5. AISeL (2020)

13. Fisch, C., Block, J.: Six tips for your (systematic) literature review in business and management research. Manag. Rev. Q. 68, 103–106 (2018)

14. Webster, J., Watson, R.: Analyzing the past to prepare for the future: writing a literature review. MIS Q. 26, xiii–xxiii (2002)

15. Paré, G., Tate, M., Johnstone, D., Kitsiou, S.: Contextualizing the twin concepts of systematicity and transparency in information systems literature reviews. Eur. J. Inf. Syst. 25, 493–508 (2016)

16. Bandara, W., Furtmueller, E., Gorbacheva, E., Miskon, S., Beekhuyzen, J.: Achieving rigor in literature reviews: Insights from qualitative data analysis and tool-support. Commun. Assoc. Inf. Syst. 37, 154–204 (2015)

17. Haffke, I., Kalgovas, B., Benlian, A.: The role of the CIO and the CDO in an organization's digital transformation. In: 37th International Conference on Information Systems. pp. 1–20. AISeL, Dublin (2016)

18. Mintzberg, H.: The nature of managerial work. Harper & Row, New York (1973)

19. Hauschildt, J., Kirchmann, E.: Teamwork for innovation - The "troika" of promotors. R D Manag. 31, 41–49 (2001)

20. Horlacher, A., Hess, T.: What does a chief digital officer do? Managerial tasks and roles of a new C-level position in the context of digital transformation. In: 49th Hawaii International Conference on System Sciences. pp. 5126–5135. IEEE, Koloa (2016)

21. Reck, F., Fliaster, A.: How to drive digital transformation? – A configurational analysis on the impact of CDOs. Acad. Manag. Proc. 2018, (2018)

22. Rizzo, J., House, R., Lirtzman, S.: Role conflict and ambiguity in complex organizations. Adm. Sci. Q. 15, 150–163 (1970)

23. Zhan, X., Mu, Y.: Examining the shareholder value effects of announcements of CDO positions. In: 13th International Conference on Service Systems and Service Management. pp. 1–6. IEEE, Kunming (2016)

24. Donaldson, L.: The contingency theory of organizations. Sage, Thousand Oaks (2001)

25. Fiss, P., Marx, A., Cambre, B.: Chapter 1: configurational theory and methods in organizational research: introduction. In: Configurational Theory and Methods in Organizational Research (Research in the Sociology of Organizations). pp. 1–22. Emerald

Group Publishing Limited (2013)

26. Leonhardt, D., Huang, P., Hanelt, A., Mithas, S.: Does one size fit all? Theorizing governance configurations for digital innovation. In: 39th International Conference on Information Systems. pp. 1–17. AISeL, San Francisco (2018)

27. Battilana, J., Leca, B., Boxenbaum, E.: How actors change institutions: towards a theory of institutional entrepreneurship. Acad. Manag. Ann. 3, 65–107 (2009)

28. DiMaggio, P.: Culture and cognition. Annu. Rev. Sociol. 23, 263–287 (1997)

29. Tumbas, S., Berente, N., vom Brocke, J.: Digital innovation and institutional entrepreneurship: chief digital officer perspectives of their emerging role. J. Inf. Technol. 33, 188–202 (2018)

30. Preston, D., Karahanna, E.: How to develop a shared vision: The key to IS strategic alignment. MIS Q. Exec. 8, 1–8 (2009)

31. Wegner, D., Erber, R., Raymond, P.: Transactive memory in close relationships. J. Pers. Soc. Psychol. 61, 923–929 (1991)

32. Lewis, K.: Measuring transactive memory systems in the field: scale development and validation. J. Appl. Psychol. 88, 587–604 (2003)

33. Horlacher, A.: Co-creating value - The dyadic CDO-CIO relationship during the digital transformation. In: 24th European Conference on Information Systems. pp. 1–11. AISeL, Istanbul (2016)

34. Connelly, B., Certo, T., Ireland, D., Reutzel, C.: Signaling theory: a review and assessment. J. Manage. 37, 39–67 (2011)

35. Spence, M.: Job market signalling. Q. J. Econ. 87, 355–374 (1973)

36. Sojer, M., Schläger, C., Locher, C.: The CIO - Hype, science and reality. In: 14th European Conference on Information Systems. pp. 1–12. AISeL, Göteborg (2006)

37. Chen, D., Preston, D., Xia, W.: Antecedents and effects of CIO supply-side and demand-side leadership: A staged maturity model. J. Manag. Inf. Syst. 27, 231–272 (2010)

38. Peppard, J., Edwards, C., Lambert, R.: Clarifying the ambiguos role of the CIO. MIS Q. Exec. 10, 31–44 (2011)

39. Chun, M., Mooney, J.: CIO roles and responsibilities: twenty-five years of evolution and change. Inf. Manag. 46, 323–334 (2009)

40. Brown, C.: Horizontal mechanisms under differing IS organization contexts. MIS Q. 23, 421–454 (1999)

41. Horlacher, A., Klarner, P., Hess, T.: Crossing boundaries: organization design parameters surrounding CDOs and their digital transformation activities. In: 22nd Americas Conference on Information Systems. pp. 1–10. AISeL, San Diego (2016)

42. Gerth, A., Peppard, J.: The dynamics of CIO derailment: how CIOs come undone and how to avoid it. Bus. Horiz. 59, 61–70 (2016)

43. Gimpel, H., Hosseini, S., Huber, R., Probst, L., Röglinger, M., Faisst, U.: Structuring digital transformation: a framework of action fields and its application at ZEISS. J. Inf. Technol. Theory Appl. 19, 3 (2018)

44. Becker, W., Schmid, O., Botzkowski, T.: Role of CDOs in the digital transformation of SMEs and LSEs - An empirical analysis. In: 51st Hawaii International Conference on System Sciences. pp. 4534–4543. AISeL, Manoa (2018)

45. Reck, F., Fliaster, A.: Four profiles of successful digital executives. MIT Sloan Manag. Rev. 1–8 (2019)

46. Seeher, V., Beimborn, D., Holotiuk, F.: How to evaluate the performance of the chief digital officer - A delphi study on KPIs for CDOs. In: 28th European Conference of Information Systems. pp. 1–15. AISeL (2020)

47. Tumbas, S., Berente, N., vom Brocke, J.: Three types of chief digital officers and the reasons organizations adopt the role. MIS Q. Exec. 16, 121–134 (2017)

48. Wade, M., Obwegeser, N.: How to choose the right digital leader for your company. MIT Sloan Manag. Rev. 22–25 (2019)

49. Giebe, C.: The chief digital officer – Savior for the digitalization in German banks? J. Econ. Dev. Environ. People. 8, 6 (2019)

50. Tahvanainen, S., Luoma, E.: Examining the competencies of the chief digital officer. In: 24th Americas Conference on Information Systems. pp. 1–10. AISeL, New Orleans (2018)

51. Berman, S., Baird, C., Eagan, K., Marshall, A.: What makes a chief digital officer successful? Strateg. Leadersh. 48, 32–38 (2020)

52. Hansen, R., Sia, S.: Hummel's Digital Transformation Toward Omnichannel Retailing: Key Lessons Learned. MIS Q. Exec. 14, 51–66 (2015)

53. Hornuf, L., Klus, M., Lohwasser, T., Schwienbacher, A.: How do banks interact with fintech startups? Small Bus. Econ. (2020)

54. Antonakis, J., Bendahan, S., Jacquart, P., Lalive, R.: On making causal claims: a review and recommendations. Leadersh. Q. 21, 1086–1120 (2010)

55. Abrahamson, E.: Managerial fads and fashions: The diffusion and rejection of innovations. Acad. Manag. Rev. 16, 586 (1991)

56. Ashforth, B.E., Kreiner, G.E., Fugate, M.: All in a day's work: boundaries and micro role transitions. Acad. Manag. Rev. 25, 472–491 (2000)

57. Eisenhardt, K.: Agency theory: an assessment and review. Acad. Manag. Rev. 14, 57–74 (1989)

58. Nadkarni, S., Narayanan, V.K.: Strategic schemas, strategic flexibility, and firm performance: the moderating role of industry clockspeed. Strateg. Manag. J. 28, 243–270 (2007).

59. Finkelstein, S., Hambrick, D.C., Canella, A.A.: Theory and Research on Execuitves, Top Management Teams, and Boards. Oxford University Press, New York (2009)

60. Hambrick, D.C., Mason, P.A.: Upper echelons: the organization as a reflection of its top managers. Acad. Manag. Rev. 9, 193–206 (1984).

61. Neely, B.H., Lovelace, J.B., Cowen, A.P., Hiller, N.J.: Metacritiques of Upper Echelons Theory: Verdicts and Recommendations for Future Research. J. Manage. 46, 1029–1062 (2020)

62. Bain Capital and the CDO Club: #LikeABoss: 101 CDOs who have become CEO/president, https://cdoclub.com/2018/05/cdo2ceo/ (Accessed: 03.09.2020)

63. Small, H.: Co-citation in the Scientific Literature : A New Measure of the Relationship Between Two Documents. J. Am. Soc. Inf. Sci. 24, 265–269 (1973)