A Perfect Match or an Arranged Marriage? How Chief Digital Officers and Chief Information Officers Perceive Their Relationship: A Dyadic Research Design

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Abstract

Several organizations have introduced a new leadership role, the Chief Digital Officer (CDO), as a centralized role in their top management team (TMT), tasked with accelerating and coordinating their digital transformation. While previous research proposes a complementary, tight alignment between the CDO and the Chief Information Officer (CIO), role redundancies and the fight for recognition and resources also suggest an inherent tension. We provide insights into CIO-CDO collaboration quality based on role, TMT cooperation, conflict theory, and a dyadic design approach of 11 CIO-CDO relationships with 33 expert interviews in two waves. Our findings indicate that the CIO-CDO relationship may not always be as complementary as proposed in the literature; instead, in the vast majority of our dyads, there is too much role conflict to achieve tight alignment, leading to separation behavior between the roles. We identify the involvement in the introduction of the other role, the CIO demand-side orientation, and the CDO supply-side orientation as important contingency factors determining the quality of the CIO-CDO relationship. Finally, unless the CIO-CDO relationship resembles a perfect match, a unified Chief Digital and Information Officer (CDIO) role may better resolve the challenges we identify in our sample's dyads. Our insights extend the understanding of the CIO-CDO relationship.

Keywords: Digital transformation, CIO, CDO, CDIO, functional TMT members

Introduction

Rapid technological advances have put pressure on existing industries and created new business opportunities. Thus, finding and managing ways to sustain digital transformation is a top priority of organizational leaders. Digital transformation has been defined as "a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies" (Vial, 2019, p. 118). To address this challenge, several organizations have decided to centralize their digital responsibilities (Firk, Hanelt, Oehmichen, & Wolff, 2021) by introducing a new leadership role, the Chief Digital Officer (CDO), in their top management team (TMT) (Tumbas, Berente, & Brocke, 2018). The purpose of the CDO is to accelerate the organization toward a digital mindset and trigger digital initiatives (Kunisch, Menz, & Langan, 2022).

These developments have been enabled by IT, which has developed toward a strategic differentiator over the past decades (Haffke, Kalgovas, & Benlian, 2016). While IT was originally a business support function, its strategic relevance has increased. Similarly, the leadership role of the IT function has evolved considerably from that of a technical IS manager to a management position that both ensures IT operations and acts as a business enabler for business divisions (Chen, Preston, & Xia, 2010). With the advent of innovative digital technologies, Chief Information Officers (CIOs) often no longer only focus on traditional IT strategy and its execution (Haffke et al., 2016) but are interested in digitalization (Urbach et al., 2019) and are expected to go beyond their traditional focus by also taking charge of digital innovation opportunities (Chen et al., 2010; Chen, Zhang, Xiao, & Xie, 2021).

Given this new reality in many organizations of the co-existence of both CDO and CIO roles, we need to investigate the quality of collaboration between these roles. First, whereas the functionalist

perspective of previous TMT research proposes that TMT members are hired for a specific function (Georgakakis, Heyden, Oehmichen, & Ekanayake, 2022), a CIO and CDO are to some extent hired for the same function (Chen et al., 2021; Tumbas et al., 2018). Further, there is much more ambiguity about the roles of both the CIO (e.g., Peppard, Edwards, & Lambert, 2011) and the CDO (e.g., Haffke et al., 2016; Tumbas, Berente, & vom Brocke, 2017) individually, and thus the CIO-CDO relationship overall. Second, as "both the digital and IT functions essentially serve to drive innovation with digital technologies" (Tumbas et al., 2018, p. 195), the relationship and collaboration between the two roles are critical for an organization's success in the digital terrain, calling for tight CIO-CDO alignment (Haffke et al., 2016). Third, as the CDO role is not yet institutionalized and needs to gain legitimacy by demarcating its jurisdiction, particularly from that of the CIO (Chen et al., 2021; Tumbas et al., 2018), the TMT literature suggests that these executive leaders are more likely to have a tense relationship in their fight for recognition and strategic decision-making (Sleep & Hulland, 2019).

The research points out that CIOs and CDOs may complement each other in a symbiotic way (Haffke et al., 2016; Horlacher, 2016). The collaboration may be particularly effective in the case of a CIO role with a high supply-side orientation and a CDO role focusing on the demand side (Schumann & Döring, 2022). Furthermore, CDOs may advocate for the CIO role, as the CDO's appointment strengthens the CIO's authority and role (Haffke et al., 2016; Singh & Hess, 2017). While the CIO and the CDO role have distinct tasks and responsibilities, "many CDO responsibilities seemingly mirror those of the CIOs" (Chen et al., 2021, p. 3), possibly leading to power struggles (Tumbas et al., 2017). While the literature suggests that CDO and CIO roles are complementary, we propose that there is another side to the coin and that the CIO-CDO relationship quality might depend on several contingencies. First, most studies on the CIO-CDO relationship

have only interviewed CDOs (Horlacher & Hess, 2016; Singh & Hess, 2017; Tumbas et al., 2018; Tumbas et al., 2017). Second, these studies were published when the role emerged in firms, calling into question whether the collaboration quality between the roles could be observed (yet). While some subsequent studies are conceptual (Bub & Gruhn, 2022) or base their recommendations on the expertise of business consultants (e.g., Back, Bub, & Wagner, 2022), others claim that organizational practice has already moved beyond a dual role split, as new CDO positions, complementary to an existing CIO, would no longer be filled (e.g., Brenner & Brenner, 2022), suggesting that the CIO-CDO relationship may not be sustainable. Third, Haffke et al. (2016) triangulated across the CIO and a digital interviewee from the *same* organization but relied on snowball sampling of the CIO to suggest a digital interview partner, raising concerns about potentially biased responses in light of the potential conflictual relationship. In contrast, in our dyadic design approach, we approached CIOs and CDOs of the *same* organization independently to avoid such biases. We respond to the recent calls for research investigating the co-existence of both CIO and CDO leadership roles (Bendig, Wagner, Jung, & Nüesch, 2022; Kratzer, Westner, & Strahringer, forthcoming).

Thus, we take stock, investigating whether and when the CIO-CDO relationship is sustainable: What is the collaboration quality between CIOs and CDOs in pursuing digital transformation? Our study contributes to the research in three primary ways: First, whereas the literature proposes a complementary and interdependent CIO-CDO relationship (e.g. Haffke et al., 2016; Horlacher, 2016), we find – in the vast majority of our 11 CIO-CDO dyads – that there is much more inherent conflict in the relationships, identifying separation behavior as the opposite of tight alignment in most of our dyads, going beyond the previously identified legitimation challenge (Tumbas et al., 2018). We propose a fragile CDO role, owing to the dependence on the CIO in the CDO's quest to

make a measurable impact. Second, we reveal important contingency factors to better understand the conditions under which a CIO-CDO relationship may be complementary or conflictual. In particular, we extend insights by Schumann and Döring (2022) in proposing a CDO supply-side orientation to be harmful to the relationship. Third, in the case of a conflictual CIO-CDO relationship, we propose a united Chief Digital and Information Officer (CDIO) role to resolve the outlined role and resource conflicts, extending the knowledge on the resource interdependency of the CIO-CDO relationship (Haffke et al., 2016; Tumbas et al., 2017). We argue that creating two roles that are too similar can undermine the digital transformation mission, as both roles tend to act beyond their intended scope.

Literature Review

Digital transformation and the CDO

Digital technologies accelerate the evolution, disruption, and competitive dynamics of an organization's environment (Downes & Nunes, 2013). The pace, dynamism, and disruptiveness of digital transformation urge most incumbents to adopt strategies, processes, and innovations to address it (Banker, Hu, Pavlou, & Luftman, 2011; Furr, Ozcan, & Eisenhardt, 2022; Gonzalez, Ashworth, & McKeen, 2019). Further, it forces organizations to disrupt existing business models (Bharadwaj, El Sawy, Pavlou, & Venkatraman, 2013) and markets (Verhoef et al., 2021), since it affects the nature and content of the value proposition (Piepponen, Ritala, Keränen, & Maijanen, 2022). Thus, digital transformation blends IT innovation, which primarily focuses on process innovation, with digital innovation, which focuses primarily on product innovation (Horlacher, 2016). With the greater acceptance of digital end-customer goods and services, as well as the speed of technological development and innovation (Setia, Setia, Venkatesh, & Joglekar, 2013), there is now an emphasis from the business side on efficiently exploiting the promises of digital innovation

(Bharadwaj et al., 2013; Haffke et al., 2016). Recent research has conceived digital transformation design and execution as a challenge of organizational change (Hanelt, Bohnsack, Marz, & Antunes Marante, 2020; Plekhanov, Franke, & Netland, 2022; Vial, 2019) that requires specific organizational structures (Verhoef et al., 2021). TMT members' diverse backgrounds, experiences, and knowledge contribute to their strategic choices, leading to various organizational outcomes such as strategic change processes (Hambrick, 2007; Hambrick & Mason, 1984).

Following this notion, organizations are often challenged to drive digital transformation and decide to add another strategic leader responsible for digital transformation by establishing and implementing a dedicated, central CDO function. CDOs are expected to embrace the full spectrum of opportunities offered by emerging technology innovations and to push their companies to the forefront of digital transformation (Singh, Klarner, & Hess, 2020). They are often responsible for defining, refining, and implementing an overarching digital strategy for the firm and directing the necessary change management initiatives to prepare it for the digital era (Haffke et al., 2016; Singh & Hess, 2017). The CDO is tasked with 1) accelerating digital transformation and 2) coordinating digital transformation (Firk et al., 2021). Unlike other digital leaders such as CIOs or Chief Data Officers, CDOs do not have a clearly defined functional ambit; instead, they engage cross-functionally with business divisions, resulting in various CDO position profiles in terms of skills and duties (Kunisch et al., 2022). This is reflected in the challenge and attempts to measure CDO performance, tasks, competencies, and roles (Ademi & Tumasjan, 2022; Horlacher & Hess, 2016; Seeher, Beimborn, & Holotiuk, 2020; Tahvanainen & Luoma, 2018). They sit at the crossroads of business and IT, coordinating, orchestrating digital efforts, and generating digital innovation across the organization (Schäfer, Schneider, Drechsler, & vom Brocke, 2022). In their emphasis on processes and technologies, the research has focused on the structural configurations of the CDO

role (Ademi & Tumasjan, 2022; Firk et al., 2021; Kunisch et al., 2022). For instance, it has looked at the characteristics that influence the likelihood of CDO role presence, including firms' performance, task demands, task environments, transformation urgency, coordination needs, and mimicry behavior. Further, Singh et al. (2020) outline how organizational design parameters and vertical coordination mechanisms help explain how CDOs pursue digital transformation.

The IT department and the CIO

The IT function and the CIO role have changed significantly over their evolutions (Haffke et al., 2016; Kratzer et al., forthcoming) and encompass substantial variations. When IT was viewed as a commodity by many organizations, with little contribution to strategic differentiation (Carr, 2003), IT often reported to the CFO and was subject to strong cost pressure. Over time, the CIO role changed, and CIOs are "increasingly expected to play not only the traditional supply-side leadership role that focuses on exploiting existing IT competencies to support known business needs but also the demand-side leadership role that focuses on exploring new IT-enabled business opportunities that result in competitive advantage" (Chen et al., 2010, p. 231). With IT being increasingly important for competitive differentiation in many industries (Bendig et al., 2022; Peppard et al., 2011), the reporting line is more likely to have changed to the CEO (Banker et al., 2011). Although other tech-savvy TMT members are essential in levering digital technologies, the CIO role is supposed to lead digital initiatives, as the other TMT members have insufficient IT knowledge and are not attentive enough to identify IT opportunities (Chen et al., 2021; Masli, Richardson, Watson, & Zmud, 2016). Today's CIOs balance the responsibility for ensuring (IT) availability, implementing technological strategy and innovation, and helping to develop organizational strategy and transformation (Jones, Kappelman, Pavur, Nguyen, & Johnson, 2020). Similarly, Bendig et al. (2022) summarize that CIO tasks encompass many change-oriented

activities, including redesigning firm strategy and fostering IT-enabled change projects and programs. They further embrace and reiterate the earlier idea that by "acting as an entrepreneur, the CIO is a change agent who plans and initiates change" (Carter, Grover, & Thatcher, 2011, p. 21) and acts as an innovation leader (Chen et al., 2021; Li, Li, Wang, & Thatcher, 2021), and that a CIO role in the TMT increases a firm's relative exploration orientation (Bendig et al., 2022).

TMT cooperation and conflict perspectives on the CIO-CDO relationship

To better understand the contexts and variations of the CIO-CDO relationship, we drew on role theory, TMT cooperation and conflict, and research on the cooperation between specific TMT members. A comprehensive overview of role theory, TMT cooperation and conflicts, and TMT role relationships is summarized in a table in Appendix B. First, role theory generally defines and categorizes roles by assuming that individuals behave differently based on their place in a social system (Biddle, 1986; Ren & Guo, 2011). Role theory can establish precise behavioral expectations of social system members and can identify the fundamental building blocks of their cooperations, links, and interdependencies (Georgakakis et al., 2022; Mathias & Williams, 2017). The functionalist perspective, which proposes that TMT members are hired for a specific function (Georgakakis et al., 2022), is especially valuable because a CIO and a CDO are to some extent hired for the same function (Chen et al., 2021; Tumbas et al., 2018). Firk, Gehrke, Hanelt, and Wolff (2022) suggest that the CDO is an *integrating* TMT member. This proposition is based on the assumption that the CIO and the CDO act according to their role, but it remains to be seen whether the CDO still serves as an integrator with the existing IT organization when the functions that the two TMT members were hired for overlap. Lastly, while Firk et al. (2022) propose digital knowledge as an add-on to a functionally distinct composition of the TMT, they do not consider an existing CIO role, nor the interplays between the roles of the CIO and the CDO.

Second, we draw on cooperation and conflict research on TMTs as teams. Mainly informal structure (Ma, Kor, & Seidl, 2021) may play a role in the CIO-CDO relationship, since both tend to act beyond the initial scope of their role. Further, the TMT research reports on the correlation between TMT functional diversity – functional assignment diversity – and performance outcomes, but not on the dynamics of potentially too similar roles (Bunderson & Sutcliffe, 2002; Buyl, Boone, Hendriks, & Matthyssens, 2011; Certo, Lester, Dalton, & Dalton, 2006). The research demonstrates that top managers' general and functionally varied abilities contribute to improved innovation results (Custódio, Ferreira, & Matos, 2019; Haynes & Hillman, 2010; Heyden, Reimer, & Van Doorn, 2017; Kor, 2006). Yet we lack an understanding of the implication of low functional assignment diversity, i.e., when TMT roles overlap. These perspectives are valuable for understanding the CIO-CDO relationship because they provide an understanding of the two roles' functions compared to the informal structures in practice and the implications of a potential overlap of functional assignments and skills on performance. A misalignment of the formal and informal functional structures can render productive cooperation conflictual.

Third, we build on the sparse knowledge of the cooperation among functional TMT members (Denford & Schobel, 2021), with very few studies investigating cooperation between functional members (Menz, 2012). The insights into the relationships of specific TMT roles that have emerged from this literature can be clustered into three topics: structural engagement, perceptions of the other's strategic role, and some form of information-sharing. First, in the CIO-CFO relationship, a lack of informal communication within the structural engagement framework and physical separation cause the unsuccessful partnership (Denford & Schobel, 2021; Schobel & Denford, 2013). For the CIO-CMO relationship, relationship structure is proposed as a determinant of relationship alignment (Sleep & Hulland, 2019; Whitler, Boyd, & Morgan, 2017). Structural engagement, mostly reflected in the reporting structure, is another source of conflict. Second, in

the CIO-CFO relationship, a lack of personal congruence and physical work proximity sets the two parties further apart, and their opinion of the other's strategic function determines their cooperation quality (Denford & Schobel, 2021; Schobel & Denford, 2013). Whitler et al. (2017) confirm these insights in their research on the CIO-CMO relationship by emphasizing viewpoint, goals, and accountability, while Sleep and Hulland (2019) identify interdependence, CIO-CMO relationship structure, and CIO-CMO diversity. Benlian and Haffke (2016) extend these insights in their research on the CEO-CIO relationship, while Park, Mathieu, and Grosser (2020) extend these insights in their theoretical work by emphasizing the individual perspectives of both parties in the relationship. As the perspective on each other's role emerges as a determinant in each TMT role relationship study, this underlines the importance of gaining insights from the CIO and the CDO and raises awareness that these perspectives can diverge. Third, regarding information-sharing, in the CIO-CFO relationship, trust, knowledge-sharing, and influence practices make for a successful partnership (Denford & Schobel, 2021; Schobel & Denford, 2013). Hess and Sciuk (2022) summarize these insights in their research on the CEO-CDO relationship by highlighting the need for coordination. This aspect is condensed as information-sharing, because it indicates whether different types of information are shared or withheld, ultimately determining the relationship's quality. Outlining these common determinants of a functioning TMT relationship emerging from this section helps us to analyze the CIO-CDO relationship. Particularly, all three determinants – structural engagement, perceptions of the other's strategic role, and some form of information-sharing – open up the discrepancy between the formal and informal role structures, and the extent of this discrepancy can determine the quality of the relationship and the collaboration.

The CDO-CIO organizational setup and relationship

The research on the CIO-CDO relationship proposes symbiosis and interdependence (Horlacher, 2016). In such an ambidextrous solution (Back et al., 2022), the CIO assumes the role of a strategic IT specialist (Haffke et al., 2016; Singh & Hess, 2017). At the same time, the CDO is the digital transformation specialist for the company as a whole (Singh, Barthel, & Hess, 2017) and is in charge of outward-facing digital technologies that often include corporate products and services as well as customer contacts (Back et al., 2022; Bub & Gruhn, 2022; Horlacher, 2016). To ensure the success of a CIO-CDO relationship, several aspects could be identified: a shared understanding (Preston & Karahanna, 2009; Reich & Benbasat, 2000) of the goals of digital transformation, as well as specialization, trust (Karahanna & Preston, 2013), and coordination regarding specific collaboration (Horlacher, 2016; Singh et al., 2017). The research has further identified aligned values of TMT members (Amason, 2010) and a transactive memory system (TMS) (Choi, Lee, & Yoo, 2010) as elements of a well-functioning relationship.

The magnitude of the overlap – and thus the conflict potential – depends on how the organization and the job holders define their area of responsibility and influence (Haffke et al., 2016; Johanning, 2020). Tumbas et al. (2018) elaborate on the power struggles from the CDO perspective and report on CDOs' need to gain legitimacy and make jurisdictional claims. Thus, without clarification in a company, there is the risk of friction, especially between the CIO and the CDO (Back et al., 2022; Tumbas et al., 2018). On the one hand, Haffke et al. (2016) suggest that, with the advent of the CDO, CIOs will be less involved in the strategic dimension of IT leadership. Thus, the CIO role would be relegated to managing the traditional supply side of IT with a focus on cost-efficient and secure provision of IT deployment and support (Back et al., 2022; Haffke et al., 2016). A CIO with such a focus on the supply side may be complementary to a CDO role focusing on the demand side

(Schumann & Döring, 2022). While this suggests a clear delineation, it remains an open question whether CIOs practicing demand-side leadership and having the ambition to drive digital innovation will accept this delineation (Bendig et al., 2022; Urbach et al., 2019). On the other hand, Bendig et al. (2022) suggest that the strategic aspects of the CIO role have not diminished but have increased in light of digital transformation, with other TMT members expecting the CIO to drive the digital innovation agenda (Chen et al., 2021) as the agent in charge of this organizational change (Bendig et al., 2022; Carter et al., 2011). In sum, interactions and disagreements are unavoidable when functional TMT members (e.g., the CIO and the CDO) make strategic decisions (Bromiley & Rau, 2016). Some studies were published on the CDO addressing the CIO-CDO relationship when the role emerged in firms; the collaboration quality between the roles could not yet be observed. Thus, exploring the collaboration in the CIO-CDO relationship through the role, cooperation, and conflict perspectives is appropriate in order to understand how to better manage and sustain digital transformation.

Method

We focused on expert interviews to get firsthand and in-depth perspectives from people. Qualitative research can help to understand social mechanisms that underpin management (Gehman et al., 2018; Gephart Jr, 2004), making it ideal for exploring and analyzing the CIO-CDO collaboration quality. We draw on experiences from interviewing the members of couples separately (Taylor & De Vocht, 2011; Valentine, 1999). Here, most previous empirical CIO-CDO research considers only one perspective (e.g., Horlacher & Hess, 2016). When interviewing individuals on their own, we get "his narrative" and "her story." When interviewing couples together, we hear the stories they tell each other. Individual interviews (as opposed to joint interviews) may offer more insights, since participants may divulge information to a researcher that they would not reveal if their partner

(or, in our case, their counterpart) were present (Taylor & De Vocht, 2011).

Sample and context

We used purposeful sampling to discover information-rich dyads – pairs from which researchers may learn the most about the key issues in their research topics (Patton, 1990). We chose our sample in two steps: We looked for (1) incumbent organizations with traditional business models challenged by digital transformation and (2) companies that employed both a CDO and a CIO. Because CDOs are typically present in larger, incumbent organizations, we only identified CIO-CDO couples in large incumbent multinational corporations (MNCs). We interviewed current CIOs and CDOs or those who had recently left the company. From those, we chose organizations that vary in size, industry, and level of digital technology adoption in various industries. We looked at organizations in diverse industries with comparable organizational features (i.e., large European enterprises, traditional industries, and business models). Participating companies employed at least 5,000 workers. To eliminate biases, we concurrently and separately obtained interview appointment confirmation from 12 CIOs and CDOs, who were then interviewed using videoconferencing technologies.

Data collection

We contacted the interviewees through our networks as well as LinkedIn. We conducted 35 in-depth interviews (i.e., 12 dyads of CIOs and CDOs and 11 follow-up interviews in wave 2), fully aware of the CIO-CDO relationship's scope and the challenge of interviewing business elites (Ma, Seidl, & McNulty, 2021). One dyad was excluded from the analysis because, after the interview, it turned out that the interviewees were not exact counterparts, leading to 11 dyads and a set of 33 interviews. Theoretical saturation (Glaser & Strauss, 1967) was reached when it became clear that

the additional value of emerging new concepts was limited. The interviews of both waves (of which 28 were conducted in German) were transcribed to allow for a more organized analysis. The data from wave 1 were collected between December 2020 and January 2022. To clarify, triangulate, and reinforce our findings, we conducted a second data collection wave between June and November 2022 with interviews of between 30 and 60 minutes. We interviewed seven CIOs and four CDOs of the original interviewee group, interviewing all but two participants from data collection wave 1 who still held their position. The wave 2 interviews enabled us to discuss, build on, and substantiate our insights with the interviewees. While we found a consistent and firm picture of the CIO-CDO relationship after two waves of data collection, the second data collection allowed us to develop more context and nuance. Table 1 contains an anonymized list of interviewees. We provide an overview of gender, time in the position, company size, the country of the company headquarters, and the interview length in the two interview waves. Despite our emphasis on Germany, we included international CIOs and CDOs from MNCs. The vast majority (18 interview partners) were in Germany, while four were in other countries (the United States, France, and Switzerland). Our goal was to have a significant variance of industries to provide insights into the CIO-CDO relationship quality that is applicable across industries.

INSERT TABLE 1 ABOUT HERE

Since we aim to extend knowledge of the CIO-CDO relationship, we pursued an abductive approach (Gioia, Corley, & Hamilton, 2013; Ketokivi & Mantere, 2010; Klag & Langley, 2013). Accordingly, the content and structure of the interviews build on existing and previously discussed

research on CIO and CDO roles and relationships as well as CIO stereotype and derailment. These research topics led to a semi-structured interview guide with four identified primary themes: 1) general information about the current role; 2) reflection on the inside and outside view of the role; 3) the CIO-CDO relationship and conflicts, and 4) CIO-CDO relationship practices. This approach promised to reveal how CIOs and CDOs perceive their roles and allowed us to gain rich data. We continually balanced recognizing existing knowledge about the relationship with being open to new insights. We followed the interview guide to ensure comparability while keeping a semi-structured design that is open to new developments and emerging themes (Murphy, Klotz, & Kreiner, 2017). While we developed semi-structured interview guides for each of the two roles to account for the differences beyond the approximately 80% of common questions, we attach a joint and condensed interview guide for both data collection waves in Appendix A for clarity. With one exception, two authors were present in all wave 1 interviews to ensure the effective triangulation of observations and a contextualization of insights. In wave 2, one author conducted all follow-up interviews, while the other author was present in half of the interviews in wave 2. Lastly, we conducted a follow-up study with four CDIOs to underline our proposition for the merged CDIO role in the case of a conflictual relationship. The interview guide for and insights from CDIO interviews can be found in Appendix D.

Data analysis

As we pursued an abductive approach (Gioia et al., 2013; Ketokivi & Mantere, 2010; Klag & Langley, 2013), we alternated between gathering and evaluating the data. We reviewed the literature on CIO-CDO relationships to organize the developing terminologies, codes, and categories and to describe possible contributions in a consistently comparative way (Murphy et al., 2017). Following primary data acquisition, we began our in-depth research by categorizing the data

with codes and detecting unique patterns (Glaser & Strauss, 1967; Strauss & Corbin, 1990). The coding process was informed by the Gioia methodology (Gioia et al., 2013), guiding us to develop theory through methodical data collection and analysis. We alternated between coding the data and identifying concepts in related CIO-CDO literature (Bansal, Smith, & Vaara, 2018; Gioia et al., 2013; Klag & Langley, 2013). Where there was a lack of agreement on any coding, we re-examined the data, engaged in discussions, and reached an alignment.

The first results of the data analysis revealed that the respondents considered the mutual relationship to be inherently conflictual; however, we noted different sources and extents of these conflicts. Building on and structuring these first results, we developed second-order themes that reflect nascent concepts. Ultimately, we integrated these nascent second-order themes into aggregate dimensions (Gioia et al., 2013). Analyzing the data enabled us to identify role friction, separation behavior, involvement in the introduction of the other role, inverse ambidextrous leadership orientation, resource dependency, and resource duplication; thus, we structured the coding scheme along these terms. This third analysis phase provided a more balanced picture of how the different ideas and processes could be linked. After arranging all first-order categories, second-order themes, and aggregate dimensions, we constructed our data structure. The building of a data structure is central to the Gioia technique (Gioia et al., 2013), which we utilized to illustrate our data analysis and to provide complete transparency on the basis and development of this study's results. We developed a coding scheme to demonstrate our data analysis (Figure 1) and a model to visualize it (Figure 2). Finally, Table 1 is enriched with three important contingency factors that emerged from our empirical dyadic data that influence the CIO-CDO relationship in complementary or conflictual directions. These factors are: 1) involvement in introducing the counterpart role, 2) CIO demand-side orientation, and 3) CDO supply-side orientation. While involvement in introducing the counterpart role was mentioned explicitly by the interviewees, we

classified the CIO demand-side orientation and CDO supply-side orientation on the basis of the coding of the interview information, as shown in Appendix C as an example.

INSERT FIGURE 1 ABOUT HERE

Findings

We set out to investigate the CIO-CDO relationship collaboration quality to identify whether such shared leadership is a sustainable arrangement for digital transformation. We find that the vast majority of our dyadic CIO-CDO relationships seem inherently conflictual, with complementary and symbiotic CIO-CDO relationships being the exception. In most of our dyadic relationships, we observe a distancing between both roles. We frame this finding as role friction and separation behavior. To contextualize our results and help reveal the conditions in which a CIO-CDO relationship may or may not be complementary, we elaborate on three identified contextual differences across our dyadic relationships: involvement in introducing the other role, CIO demand-side orientation, and CDO supply-side orientation. If a particular CIO-CDO relationship is conflictual, we conclude and propose a united Chief Digital and Information Officer (CDIO) role as a means to resolve the outlined role and resource conflict.

Role friction

Legitimation denial

The first challenge concerns the delineation of the roles. In particular, we found some role friction, entailing legitimation denial and the CIO's claim to merge IT leadership and digital leadership. While legitimation denial alludes to the lack of acceptance of the other role, the claim to merge IT

and digital leadership reflects the desire to integrate both aspects that were once purposely split. As our analysis illustrates that the CIO mainly questions the CDO's presence, we framed this as a legitimation denial. As one CIO said: "They [the digital unit] can drive technical innovation. You can do this as IT [as well]. But you cannot be on the road at trade shows, giving great presentations and cleaning up at home [legacy systems] simultaneously. That does not work" (Interviewee 4). He explained that he did not want to explicitly oppose the board decision, but indicated his concern about the notion of the CDO as an outwardly oriented marketer. Another CIO summarized the essence of this finding as follows: "A CDO cannot do anything without CIO and IT. (…) What the added value of a CDO really is, he [the CEO] did not make [the introduction of the CDO] clear to me in a way that I would have understood, which is the basis for conflict" (Interviewee 8). However, one CDO understood that the newly created CDO role takes something away from established, familiar roles: "Neither the CTO nor the CIO was pleased when my role was created. Because they said, 'Look, this is partly what we should be doing'" (Interviewee 1).

The CIO claim to merge IT leadership and digital leadership

An inherent consequence of legitimation denial is that the role incumbents think that a unified leadership role would be more effective in managing and sustaining digital transformation, which we framed as a claim to merge IT leadership and digital leadership. A CIO with an ambition to lead both the exploitation and exploration said: "One must ask oneself whether separating the areas makes sense. If you ask me, my answer is no. I think it is simply because we are two very different personalities and, accordingly, have two different strategies" (Interviewee 10). A CIO who later transitioned to a CDIO role in the same company reported on his experience: "When we created the unified CDIO (…), things got fixed faster. (…) If you have two separate departments, they tend

to oppose. (…) One head means that the shared values are disseminated to both sides"
(Interviewee 22).

Separation behavior

Mutual avoidance

Connected to the role friction and a potential consequence is mutual avoidance. As it is mainly the
CIO who calls the legitimation of the CDO into question, and the responsibilities often need to be
sufficiently differentiated, coordinated, and therefore mutually accepted, this can lead to mutual
avoidance behavior. A CDO explained the inherent conflict that leads to such behavior: "The
interaction with the CDO and the IT department was not clearly defined (…). It works quite well,
but not without friction. Because there is no clear separation; there are always misunderstandings
about whose decisions lie in which area" (Interviewee 3). Thus, this inherent conflict can lead to
one party deciding not to wait to collaborate with the other, as another CIO illustrated: "My strategy
is to not talk about it but to do what I think is right. And then either the other part [CDO] contributes,
or I do it myself" (Interviewee 10). However, another CIO admits to actively excluding the other
party owing to the indicated challenges: "We did not have much daily contact because I had a
defined area (…). You imagine the collaboration wrong. Because I had my area of responsibility
and he had his. So, cooperation is all relative" (Interviewee 8). A CDO described working with the
other partner as not desirable and therefore actively avoiding it, seeking different ways: "[The IT
organization] might help you to do some data protection [burden] (…). Or I was helping to fill out
any risk matrices we did. Otherwise, I have always said [to IT], please leave us [the digital unit]
alone" (Interviewee 13).

Adverse framing

Another consequence of disconnected roles is adverse framing. Adverse framing means that the two roles see each other in terms of opposition and try to make the other appear to be less relevant. For instance, a CIO explained: "The CDO discusses what he has seen at the competition and which new ideas we could integrate here. (…) The CDO is the person who does the marketing to the outside world. (…) I only have one more [person, the CDO] to explain the world to" (Interviewee 4). A CIO became cynical regarding the other role: "The CDO role has the advantage that it allows you to (…) keep launching little hot air balloons that look fancy at first, but then fizzle out. The others are already looking elsewhere" (Interviewee 8). However, this adverse framing behavior is not one-sided, as both roles can exhibit this thinking. Many interviewees were in agreement about their immediate association with the IT department. While one CDO described the other department as "Understaffed, not up to speed skills-wise, and conservative" (Interviewee 11), another characterized it as "Understaffed, overworked, and undermanaged" (Interviewee 3).

Involvement in the introduction of the other role

Top-down decision-making

In the CIO-CDO dyads, we found that the circumstances of introducing the CDO role in particular, but the other role in general, matter and provide context and variation to the CIO-CDO relationship quality. We observe a top-down decision to introduce the CDO as a counterpart to the CIO and to hire a specific candidate for this role. A CIO reported as follows, making clear that the introduction was not his decision: "Then they [the executive board/CEO] said: 'Do you have a problem with us installing a CDO there?' I said: 'No, it is all good'" (Interviewee 4). Another CIO had the same experience: "At some point, our CEO was with us (…) and (…) he asked me what I thought of the

CDO, and I said: not much. Then he said: Oh, we decided on this yesterday in the Group Executive Board" (Interviewee 8).

Participatory involvement

We also observed dyads where the existing TMT member was involved and participated in the hiring decision of the other role. This tended to benefit the collaboration quality, as opposed to a top-down decision to introduce a CDO and who to hire for the CIO and CDO role, respectively. A CDO confirmed this by referring to this as the usual practice of aligning and coordinating: "Yes, absolutely. So we always do it like this. I am on the board with us, and when other board colleagues or important functions of other board colleagues have to be filled by their teams, then we are part of the hiring process" (Interviewee 5). Another CDO confirmed this, making clear that he was not only involved in the hiring of the counterpart role but also in the firing of the predecessor: "Yes. But also, I was very involved in the departure of the previous CIO. And I was not emotional about that" (Interviewee 21).

Inverse ambidextrous leadership orientation

CIO demand-side orientation

In the CIO-CDO dyads, we found that the extent of the separation varied significantly based on the degree to which the CDO and CIO, respectively, crossed the area of responsibility and influence of the other role. We approached this through CIO demand-side orientation, indicating the inference of the area of influence of the other role. A CIO with low demand-side orientation described: "My role is (…) about how you want to operate IT infrastructure. (…) you also have to [establish] governance and order to a certain extent. You have to ensure that certain security levels are established, that risk management is carried out, and that certain synergistic effects are leveraged in a group, for example, by ensuring that joint [IT] purchasing is organized"

(Interviewee 14). A CIO with medium demand-side orientation illustrated this by assigning some digital resources to her area of responsibility: "The CDO showed me what they do. And then she introduced me to the digitalization team (…). Of course, there were things that I [rather] see in IT" (Interviewee 6). Another CIO with high levels of demand-side orientation commented: "As a CIO, you have to keep pushing that business and IT work very closely together and that IT is not seen as a cost factor but as a value creator" (Interviewee 8).

CDO supply-side orientation

The opposite perspective is the CDO supply-side orientation, indicating the inference of the other role's area of influence. While the impact of CIO demand-side orientation is ambiguous, we observe that the relationship is increasingly harmed the more the CDO displays supply-side behavior and crosses the CIO's area of responsibility. A CDO with high levels of supply-side orientation stated: "I did not want to get computers from the CIO; we did everything independently. The only thing we did was to have the same [IT wholesaler shopping] basket" (Interviewee 13). In turn, another CDO showing low levels of supply-side orientation outlines: "I depend on excellent collegial cooperation from the CIO because, for me, the apparent tech stack is the CIO's responsibility. So I am happy to make recommendations with my team (…) [but] ultimately, the complete platform infrastructure (…), I see that as the clear responsibility of the CIO" (Interviewee 5).

We provide two examples to contrast the CIO-CDO relationships with contingency factors that enable a (dys)functional collaboration. A CDO describes the CIO-CDO relationship, characterized by a participatory involvement in the introduction of the other role, medium CIO demand-side orientation, and low CDO supply-side orientation: "And the fact that we deal intensively with all this content means that we are all in the same boat because often the understanding of our

colleagues on the management board is not always present. Which brings certain processes and technologies with it, and one unites logically because together it is easier" (Interviewee 5). On the other side of the spectrum is a relationship, characterized by a top-down decision-making of the introduction of the other role, high CIO demand-side orientation, and high CDO supply-side orientation. A CIO from another CIO-CDO dyad reported a relationship with no collaboration: "There were no real conflicts, because I did my job, coordinated with him as best I could and tried to help. Because I do not care, he is welcome to join in and sell some of the issues for himself for all I care" (Interviewee 8).

Resource dependency

Implicit CIO decision power over systems

The resource dependency, specifically reflected in the implicit CIO decision power over systems, challenges the mutual relationship, since they raise an inherent conflict between the IT and digital domains. By implicit CIO decision power over systems, we mean the CIO's discretionary power to collaborate more or less constructively with the CDO toward solutions and to enforce IT policies and procedures more or less tightly. We found that the CIO influences the ownership and deep knowledge of IT infrastructure, architecture, and legacy systems. A CIO elaborated on the challenge to separate resources, indicating that legacy systems reinforce the implicit CIO decision power over systems for a collaboration: "He [the CDO] does not have the legacy systems that he must connect to" (Interviewee 4). Further, this implicit CIO decision power over systems is often leveraged to influence relationships. A CIO illustrated how to modulate the mutual relationship through administrative sovereignty: "I agreed with him that all architecture and system decisions would be made in my area because I cannot let anyone touch the systems. (…) After one or two clashes, we clarified that they could not access the systems if they did not comply with

cybersecurity and data protection regulations. And decisions about which software and cloud are used also lie in my area" (Interviewee 8).

Diverging prioritization of IT resources

Closely related yet even more dominant among the interviewees was the diverging prioritization of IT resources in the mutual relationship and pursuit of digital transformation. This bottleneck situation can challenge a productive collaboration when the CIO role has exclusive implementation power, as a CIO illustrated: "Blockchain, for example. (…) And as long as I do not see any added value in the company, I will not do blockchain. And that was the kind of discussion that went through the CDO. I listened and did what I thought was right" (Interviewee 18). Similarly, another CDO explained: "If the CIO does not like the CDO and wants to prove that the CDO is incompetent, then the CIO can do that; then your [CDO] projects go on the 'shit-list,' [the IT staff] do not do my [CDO] projects, and if you [CDO] get IT resources for your projects, then those are the worst people. Then it does not work, then the CDO cannot do anything" (Interviewee 9). As another CIO stated, this circumstance typically leads to a conflictual relationship: "I do not try to implement every wish (…) because, otherwise, that would tear my IT apart. It is something in between steering and braking" (Interviewee 4).

Resource duplication

The CDO developing shadow IT

Our findings showed that CDOs depend on CIOs with regard to access to core IT systems and resources. If these CIO-CDO relationship conflicts cannot be resolved amicably, some CDOs set up shadow IT, contributing to resource duplication. This redundancy in resource utilization and creation through shadow IT is a significant obstacle to an efficient relationship. A CDO elaborated: "Now the CIO could have said, I do not want that (…), or there are no IT resources available, and

you are priority number one-hundred. If necessary, I will build it with someone else. If he said, 'I am not going to build it for you,' the CDO starts to build shadow IT" (Interviewee 9). Similarly, another CDO said: "It is relative that IT decides everything, but in a group like this, you can develop freely in your area. And you can also set up your own IT structures" (Interviewee 13). Despite the challenges and drawbacks of this growing isolation, a CDO framed this development as an exciting opportunity: "And that is why we tried to create our unit, that is, own technical resources (…) to have independence. Success for us means acting a bit like a startup that focuses one-hundred percent on digital" (Interviewee 19).

Heterogeneous enterprise architecture

As some CDOs develop independently from the IT function, aligning with and integrating into the enterprise architecture is another challenge in the CIO-CDO relationship. A CDO drawing on an external IT solution provider summarized: "That did not work so well, because the technology base that was used [in the externally developed application] was just different from the one in our IT" (Interviewee 3). A CIO illustrated the challenges of a poorly aligned system landscape: "Everyone has their own system. This means we have an incredibly high number of legacy systems that must be maintained. When we add something new, one of the biggest challenges is understanding how many interfaces are now affected. And that is a thousand very quickly, because we see they have so many links. (…) That's insanely complex" (Interviewee 10). Another CIO explained that a precise alignment can mitigate and avoid conflicts: "You need both; you need to choose common architecture APIs and data models to reduce the points of friction" (Interviewee 22). Lastly, a CIO pointed out that heterogeneous enterprise architecture is a source of conflict: "So, I am wondering, from a CDO perspective, how can you be successful if there is not just one order [ID] or not one [ID of] this? It's tough. And that is why most CDO roles in traditional companies do not succeed.

Because if you do not have the fundamentals right, CDOs cannot deliver … absolutely not" (Interviewee 2).

Discussion

Our study responds to recent calls for research (Bendig et al., 2022; Kratzer et al., forthcoming) to investigate the structural ambidexterity of the co-existence of both CIO and CDO roles. Even though various recommendations lay out how to delineate and coordinate roles and responsibilities, our dyadic study of CIOs and CDOs from the *same* organization reveals that the vast majority of relationships feature role and resource conflicts, pointing to more fundamental challenges and reaching beyond established conceptualizations. We identify contingency factors that help explain a complementary or conflictual relationship. Unless the CIO-CDO relationship resembles a perfect match, a unified Chief Digital and Information Officer (CDIO) role may better resolve the challenges we identify in our sample's dyads.

The CIO-CDO relationship is often less complementary and symbiotic than proposed

To identify how to manage and sustain digital transformation, we took stock of these salient executive leaders to analyze whether the CIO-CDO relationship is a perfect match or resembles an arranged marriage. Previous research suggests that a shared understanding of the goals of digital transformation, as well as specialization, trust, and coordination with regard to specific collaboration, may lead to a complementary and symbiotic CIO-CDO relationship (Horlacher, 2016; Singh et al., 2017). These success determinants for a working CIO-CDO relationship apply to our sample's few "perfect matches." However, translating these generic recommendations into the practice of CIO-CDO relationships seems challenging, as most of these relationships in our sample resemble "arranged marriages" that do not seem reparable through these recommendations.

We structure the following section around resource conflicts and role conflicts of the structurally ambidextrous CIO-CDO relationship.

Many business activities pursued to achieve competitive differentiation "are often inseparable from IT" (Pavlou & El Sawy, 2010, p. 456), and the digital and IT functions are naturally interdependent. Our findings indicate that this natural interdependence does not necessarily translate into a shared leadership structure by the CIO and the CDO but often into a dependency situation. Our results suggest a fragile CDO role, owing to limited financial and human resources. Although we observed that many CDOs are dependent on CIOs' resources, we also recognized that some CDOs break free from this dependency by building their organizational unit with significant IT resources – which we call resource duplication. In these cases, the CDO has sufficient technical resources but faces the challenge of integrating with the established core IT systems. The extent of shadow IT (e.g., Kopper, Westner, & Strahringer, 2020) that some CDOs in our study develop goes beyond what Haffke et al. (2016) call micro IT units and partly overlaps with what Tumbas et al. (2018) refer to as decoupling. In the decoupling approach, CDOs are isolated from the rest of the organization and are thus not obliged to comply with technical standards and architectures. However, our interviewees stressed that much of a CDO's project success depends on the CIO and the IT function. Our sample CIOs enforced compliance with a specific platform as well as policy and infrastructure standards as a prerequisite for access and integration. Without scaling proofs of concept based on the integration in core IT systems, it is hard for a CDO to create a measurable and sustainable impact in the organization, hampering their ability to claim their jurisdiction (e.g., Tumbas et al., 2018).

Focusing on the role conflict of the structurally ambidextrous CIO-CDO relationship, a prerequisite for building trust in the counterpart and establishing coordination – despite specialization

(Horlacher, 2016; Singh et al., 2017) – is that the other role is accepted and not fundamentally challenged. This behavior may be rooted in biased perceptions of each other's roles, significantly influencing the interaction and relationship. This seems to be typical for similar TMT role relationships (Benlian & Haffke, 2016; Denford & Schobel, 2021; Hess, Matt, Wiesböck, & Benlian, 2016; Schobel & Denford, 2013; Whitler et al., 2017). What is more, we see an adverse framing between the two roles, contrasting the two speeds and decoupled units to drive digital innovation (Tumbas et al., 2018). While a biased perception of each other's roles can be found in other TMT relationships, such adverse framing of the other role and its work goes beyond the extent of previous insights on similar TMT relationships. However, the separation behavior aspect in our results differs in that, in most CIO-CDO relationships, the two partners did not collaborate despite their high interdependence and distanced themselves from each other. While Park et al. (2020) as well as Benlian and Haffke (2016) emphasize the value of gaining the unique perspective of individuals in a relationship and not viewing a relationship as a universal feature, almost all previous studies on the CIO-CDO relationship interviewed only CDOs (Horlacher & Hess, 2016; Singh & Hess, 2017; Tumbas et al., 2018; Tumbas et al., 2017). We found that this single-informant approach provides an incomplete picture. While in our dyadic data from the *same* organization, the CDO side – in line with the aforementioned previous research – mostly confirms this view, the corresponding CIOs painted a different picture, challenging the existing knowledge about the CIO-CDO relationship. Our results show a significant legitimation denial, suggesting that most CIOs challenge the CDO's *raison d'être*. As Tumbas et al. (2018) have already highlighted the importance of CDOs gaining legitimacy and asserting their jurisdiction several years ago, the seemingly ongoing CIO's denial of legitimacy also contributes to the fragile role of CDOs. In summary, whereas Haffke et al. (2016) stress the need for tight alignment between the structurally ambidextrous CIO and CDO roles, we conclude from the majority of our dyadic relationships that

there are many diverging orientations, prioritizations, and interests – too many to achieve tight alignment.

Toward contingency factors indicating a complementary or conflictual CIO-CDO relationship

Given that previous research emphasizes the complementary and symbiotic nature of the CIO-CDO relationship, and that the vast majority of our dyadic CIO-CDO relationships are conflictual, it would seem that the CIO-CDO relationship quality does not depend on the leadership structure per se, but more on additional contingencies. Based on our data, we identified three factors that influence the CIO-CDO relationship toward a complementary or conflictual path: 1) involvement in the introduction of the other role, 2) CIO demand-side orientation, and 3) CDO supply-side orientation.

Knowledge from similar TMT role relationships, such as CIO-CFO (Schobel & Denford, 2013) or CIO-CMO (Sleep & Hulland, 2019; Whitler et al., 2017) proposes structural relationship and engagement to be a determinant. While this relates mostly to reporting structure and organizational design, we find that how the other role was enacted seems to influence the complementary or conflictual nature of the CIO-CDO relationship. In our data, we identified two modes: In most of the dyads we investigated, the decision to install another (typically the CDO) role was made top-down without the involvement of the already existing other role. In fact, it is the opposite of what Firk et al. (2022) call an integrative CEO, leaving it mostly to the new CDO role to claim its jurisdiction (Tumbas et al., 2018) and potentially not be accepted by other TMT members (e.g., the CIO). In only two of the dyadic relationships in our sample, the counterpart was installed in a participatory way, i.e., the existing role was actively involved in the general decision to create another role and in selecting the candidate for it. In light of the success determinants – among others, shared understanding and trust between the roles (Horlacher, 2016; Singh et al., 2017) – it

is not surprising that our few "perfect matches" on their own in our individual interviews highlighted that they were able to develop the shared understanding and the trustful relationship with the person they chose, in line with the previous suggestion that a CIO-CDO relationship is complementary and symbiotic.

Our second and third contingency factors concern the CIO and the CDO roles' ambidextrous orientations. Chen et al. (2010) focus on the CIO role and distinguish between the supply-side orientation, which centers on the cost-efficient exploitation of IT competencies, and the demand-side orientation, which centers on the exploration of new IT-enabled innovations. Schumann and Döring (2022) build on this distinction, suggesting that the more a CIO develops in their orientation from a supply-side one to a demand-side one (i.e., IT exploration for digital innovation), the more likely tensions are to arise in the CIO-CDO relationship owing to overlaps and struggles with the CDO and their natural focus on demand-side leadership. In contrast to their proposition, our data provide mixed results regarding the CIO demand-side orientation. In our dyadic relationships, we see that a high CIO demand-side orientation may lead to power struggles with the CDO, but this outcome is not inevitable. In other words, we also saw CIOs with medium to high demand-side orientation levels collaborating well with their counterparts. It seems that CIO demand-side orientation above a medium level, together with respect for and acceptance of the counterpart role, pave the way for a shared understanding in the CIO-CDO relationship. Whereas previous literature suggests that a low level of CIO demand-side orientation (i.e., a clear CIO supply-side focus) leads to a complementary CIO-CDO relationship (e.g., Back et al., 2022; Haffke et al., 2016), we find that such strong focus on technologies and processes comes at the cost of a limited understanding of the more flexible, agile demands and work of the CDO, or what Chen et al. (2010, p. 237) refer to as an inability to "keep up with the changing business environment". Our third contingency

factor focuses on the CDO role's orientation. While Schumann and Döring (2022) assume that a CDO only plays a demand-side role, our empirical dyads revealed that some CDOs not only have their natural demand-side orientation, but also a supply-side one. In particular, our results allow us to distinguish different CDO supply-side orientation levels, by which CDOs one-sidedly crossed into the CIO role's terrain. In CIO-CDO relationships with high CDO supply-side orientation levels, CDOs for instance installed their own IT infrastructures, hired staff that traditionally would have been assigned to the CIO and the IT department, or made IT governance or IT architecture decisions for digital innovation projects that were difficult to change after the fact. Our data indicate that the higher a CDO's supply-side orientation level, the more a CIO-CDO relationship was impaired. Whereas medium to high CIO demand-side orientation levels may be beneficial in certain conditions (as outlined above), the inverse orientation (a CDO's supply-side orientation) is not desirable, because the accountability for core IT systems rests with the IT organization. The CIO-CDO relationship is challenged in some cases once the CIO or the CDO displays what we called an inverse ambidextrous leadership orientation and both roles tend to act beyond the scope of their role and limit the influence of the other role.

The convergence of the CIO and the CDO in a CDIO role

Digital transformation design and implementation are a substantial organizational change challenge (Hanelt et al., 2020; Vial, 2019). Previous research shows that both the CDO (Tumbas et al., 2017) and the CIO (Bendig et al., 2022) as functional TMT members want to leverage this opportunity and lead this organizational change. As both seek strategic impact, this can be a complementary organizational setup in case of tight alignment (Haffke et al., 2016). In the few of our dyads with seemingly perfect CIO-CDO matches, there is no need to revise this structure. However, in our various relationships that resemble arranged marriages, the issues that impair the

CIO-CDO relationship deserve further attention. While this study focused on the investigation of the CIO-CDO relationship quality and the suggestion to unite the separate roles only surfaced through our interviewees, we attached a follow-up study with four CDIOs in Appendix D to underline our proposition for the merged CDIO role.

We set out to investigate the relationship quality in the shared leadership structure of the CIO and CDO roles in organizations in order to help identify ways to manage and sustain digital transformation. Previous research (Haffke et al., 2016) proposes a structurally ambidextrous design, originating from the (contextually) ambidextrous CIO role, which was supposed to master both the traditional supply-side leadership and the business-oriented demand-side leadership equally well, to structurally separate CIO and CDO roles as the next evolutionary step. In this evolutionary step, the CIO role would be relegated to the traditional supply side and be less involved in strategic aspects; the demand side would in turn be taken over by the complementary CDO role (Haffke et al., 2016). However, as our empirical data from several dyadic relationships clearly show at best a neglect and more often a separation behavior between the roles, we propose that structural ambidexterity of both the CIO and CDO roles is not always a sustainable way to manage digital transformation. In fact, as the legitimation of the CDO role is still fundamentally challenged several years after its first emergence, it seems that in several organizations the CDO role has not achieved the institutionalized profession envisioned by Tumbas et al. (2018), reiterating the questions about whether the structural approach to achieving ambidexterity always reflects an efficient and sustainable organizational structure to facilitate digital transformation. Recently, first voices have emerged suggesting that CDO positions complementary to an existing CIO would no longer be appointed (Brenner & Brenner, 2022).

To help resolve the resource conflicts and role conflicts in a structurally ambidextrous design of an arranged marriage of CIO and CDO, we propose a united CDIO role as a way forward that must ongoingly balance supply and demand side leadership, because a digital transformation can only be sustainable if this interdependence is closely considered and managed. Analogous to the argument for the centralization of digital transformation responsibility (Firk et al., 2021), this unified role will be responsible for all IT and digital responsibilities and resources and will lead the digital transformation efforts more efficiently. While Kunisch et al. (2022) refer to adding competencies to the TMT by introducing a CDO, a unified leadership role will meet the expectations of transformation urgency and orchestration need as it will bundle both competencies. Collapsing and merging the CIO and CDO roles resolves or at least mitigates the various role and resource conflicts we described in detail and increases the importance of IT and digital in organizations. Drawing on TMT research on the positive correlation between TMT functional diversity and performance outcomes (Bunderson & Sutcliffe, 2002; Buyl et al., 2011; Certo et al., 2006), the often-conflicting CIO-CDO relationship challenges this finding. Our results showed that when TMT functional diversity is low, i.e., the CIO and CDO roles are too similar, this can be detrimental to the common digital transformation mission. While we cannot make immediate inferences about performance and innovation implications, we found that low TMT functional diversity challenges the quality of the collaboration between two functional TMT members. Ma, Kor, et al. (2021) highlight the difference between formal roles' functions compared to the informal structure in practice, as both roles tend to act beyond the initial role scope and run the risk of interfering with the scope of responsibilities of the other role. If both act within their formal roles, there may be not a low TMT functional diversity and may well be no conflict. To mitigate the reality found in the vast majority of our dyads, a unified role may solve the challenges of low TMT functional diversity and formal roles' functions compared to the informal structure in practice. It

will reflect shared values and shared understanding disseminating to both domains that were once required by the separate roles (Horlacher, 2016; Singh et al., 2017). While both separate departments and functions fight over influence and resources (Sleep & Hulland, 2019), we conclude that a unified role would pull together these competing interests and will lead to swifter decision-making processes and a more robust mandate within the organization to efficiently create, facilitate, and execute digital transformation projects.

Conclusion

Practical implications

Our analysis has practical implications for companies and leaders, particularly CIOs and CDOs. Organizations need to know how to design and implement their organizational structure to efficiently manage and sustain digital transformation, particularly the introduction of the other counterpart role and the design of that role. To pave the way toward a complementary relationship, we identified three contingency factors. Organizations should actively involve the existing TMT role in the decision on whether and how to appoint a prospective TMT counterpart. In contrast, if the organization's need and particular choice of the counterpart are not apparent to the existing TMT role, legitimation denial is a serious threat, not seldomly leading to role friction and separation behavior in the CIO-CDO relationship. Considering the potentially inverse ambidextrous leadership orientation of these TMT roles, a CDO with an additional high supply-side orientation is very likely to damage the CIO-CDO relationship. In turn, a CIO with high levels of demand-side orientation may cause either power struggles due to the growing role overlap or complementarity due to an increasingly shared understanding and common goals in the CIO-CDO relationship. However, a CIO with low levels of demand-side orientation (i.e., with a strong focus on technologies and processes) has a limited understanding of the various demands of the CDO

role, thus impairing their relationship. Lastly, in the cases of conflictual CIO-CDO relationships, we anticipate that the two roles will ultimately be merged. As this profile requires different capabilities and experiences, organizations must carefully select and develop their CDIO to fulfill this leadership role's various demands, as the current CIO may not necessarily meet all of these requirements.

Limitations and future research directions

The limitations and future research opportunities focus on four aspects: First, we focused on the CIO and CDO perspectives but excluded the views of other colleagues below, next to, or above them in the reporting line. Notably, the supervisor of both roles could offer complementary accounts that should be explored in a multiple case study setting. Second, we interviewed the two roles separately and did not confront them with each other's perspectives. Thus, researchers could triangulate the data by extending the timeframe or the perspectives to provide a dynamic or processual understanding. Third, our sample might not appear large, but the high-quality, independent sampling of elite IT and digital leader pairs allowed us to reveal, next to complementary and symbiotic relationships, the conflictual relationship between these roles and contingency factors. Thus, future research may extend the empirical base by quantitative methods to provide a more extensive contingency perspective to explain how, when, and why the CIO-CDO relationship fails. As we anticipate that these roles will merge in the case of a conflictual relationship, we invite researchers to explore and measure this business-oriented and strategically contributing CDIO role. This includes measuring antecedents, presence, and configuration, and exploring tasks, scope, and responsibilities. If a unified IT and digital role is the way forward for some organizations in digital transformation leadership, it would be interesting to examine the

legitimation of this new role in further detail toward other TMT members, business unit leaders, and the organization as a whole.

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FIGURES AND TABLES

Table 1. Anonymized List of Interviewees

Interviewee	Role	Gender	Years in the position (rounded)	Interview wave 1 – length (min.)	Interview wave 2 – length (min.)	Industry	No. of employees (rounded)	Country of headquarters	Resource allocation	Involvement in the introduction of the other role	CIO demand-side orientation	CDO supply-side orientation
1	CDO	Male	4	51		Industrial & manufacturing	> 100,000	Switzerland	Dependency	Top-down	Medium	Low
2	CIO	Male	3	57								
3	CDO	Male	3	31	41	Real estate	20,000	Germany	Dependency	Top-down	Medium	Low
4	CIO	Male	5	51								
5	CDO	Female	3	41	40	Industrial & manufacturing	10,000	Germany	Dependency	Participatory	Medium	Low
6	CIO	Female	1	53	25							
7	CDO	Male	5	24		Tourism, transportation, & logistics	> 100,000	Germany	Dependency	Top-down	High	High
8	CIO	Female	4	59	47							
9	CDO	Male	6	50	56	Financial services	30,000	Germany	Duplication	Top-down	Medium	High
10	CIO	Male	1	54	53							
11	CDO	Male	2	38		Financial services	5,000	Germany	Dependency	Top-down	Medium	Low
12	CIO	Male	6	41	50							
13	CDO	Male	6	42		Media	10,000	Germany	Duplication	Top-down	Low	High
14	CIO	Male	17	61	42							
15	CDO	Male	5	50		Chemicals & energy	15,000	Germany	Dependency	Top-down	Low	Low
16	CIO	Male	7	63								
17	CDO	Male	4	31		Industrial & manufacturing	10,000	Germany	Dependency	Top-down	Medium	Low
18	CIO	Male	24	65	50							
19	CDO	Male	2	57	34	Consumer goods & retail	35,000	Switzerland	Duplication	Top-down	Low	High
20	CIO	Male	23	57								
21	CDO	Male	6	26		Automotive	> 100,000	France	Dependency	Participatory	High	Low
22	CIO	Male	4	54	35							

Figure 1. Data Structure

1st Order Categories	2nd Order Themes	Aggregate Dimensions

- A CDO cannot do anything without CIO and IT. (…) What the added value of a CDO really is, he did not make it clear (…) which is the basis for conflict. (# 8)
- Neither the CTO nor the CIO was pleased when my role was created. Because they said, 'Look, this is partly what we should be doing' (# 1)

→ **Legitimation denial**

- One must ask oneself whether separating the areas makes sense. If you ask me, my answer is no. I think it is simply because we are two very different personalities and, accordingly, have two different strategies (#10)
- When we created the unified CDIO (…) things got fixed faster. (…) One head means that the shared values are disseminated to both sides (#22)

→ **CIO claim to merge IT/digital leadership**

⟶ **Role friction**

- The interaction with the CDO was not clearly defined (…). there is no clear separation; there are always misunderstandings about whose decisions lie in which area. (# 3)
- My strategy is to not talk about it but just to do what I think is right. And then either the other part [CDO] contributes, or I do it myself.. (# 10)

→ **Mutual avoidance**

- The CDO role has the advantage, that it allows you to (…) keep launching little hot air balloons that look fancy at first, but then fizzle out. (# 8)
- Understaffed, not up to speed skills-wise, and conservative (# 11)
- Understaffed, overworked, and undermanaged (# 3)

→ **Adverse framing**

⟶ **Separation behavior**

- Then they [the executive board/CEO] said: 'Do you have a problem with us installing a CDO there? I said: ,No, it is all good. (# 4)
- At some point, our CEO was with us (…) and (…) he asked me what I thought of the CDO, and I said: not much. Then he said: Oh, we decided on this yesterday in the Group Executive Board. (# 8)

→ **Top-down decision-making**

- Yes absolutely. So we always do it like this. I am on the board with us and when other board colleagues or important functions of other board colleagues have to be filled by their teams, then we are part of the hiring process (# 5)
- Yes. But also, I was very involved in the departure of the previous CIO. And I was, I was not emotional about that. (# 21)

→ **Participatory involvement**

⟶ **Involvement in introduction of the other role**

- The CDO showed me what they do. And then she introduced me to the digitalization team (…). Of course, there were things that I see [rather] in IT. (#6)
- As a CIO, you have to keep pushing that business and IT work very closely together and that IT is not seen as a cost factor but as a value creator. (#8)

→ **CIO demand-side orientation**

- I did not want to get computers from the CIO; we did everything independently. (# 13).
- So I am happy to make recommendations with my team (…, but) ultimately, the complete platform infrastructure (…), I see that as the clear responsibility of the CIO. (# 5)

→ **CDO supply-side orientation**

⟶ **Inverse ambidextrous leadership orientation**

- He [the CDO] does not have the legacy systems that he must connect to (#4)
- I agreed with him [the CDO] that all architecture and system decisions would be made in my area because I can't let anyone touch the systems. (# 8)

→ **Implicit CIO decision power over systems**

- I do not try to implement every wish (…) because, otherwise, that would tear my IT apart. It is something in between steering and braking. (#4)
- Blockchain, for example. (…) And as long as I do not see any added value in the company, I will not do Blockchain. And that was the kind of discussion that went through the CDO. (# 18)

→ **Diverging prioritization of IT resources**

⟶ **Resource dependency**

- Now the CIO could have said, I do not want that. (…) If he said, 'I am not going to build it for you', the CDO starts to build shadow IT. (#9)
- And that is why we tried to create our unit, that is, own technical resources (…) to have independence. Success for us means acting a bit like a startup that focuses one-hundred percent on digital (#19).

→ **CDO developing shadow IT**

- (…) most CDO roles in traditional companies do not succeed. Because if you do not have the fundamentals right, CIOs cannot deliver...absolutely not. (# 2)
- When we add something new, one of the biggest challenges is to understand how many interfaces are now affected. And that is a thousand very quickly because we see they have so many links (…). That's insanely complex (# 10)

→ **Heterogenous enterprise architecture**
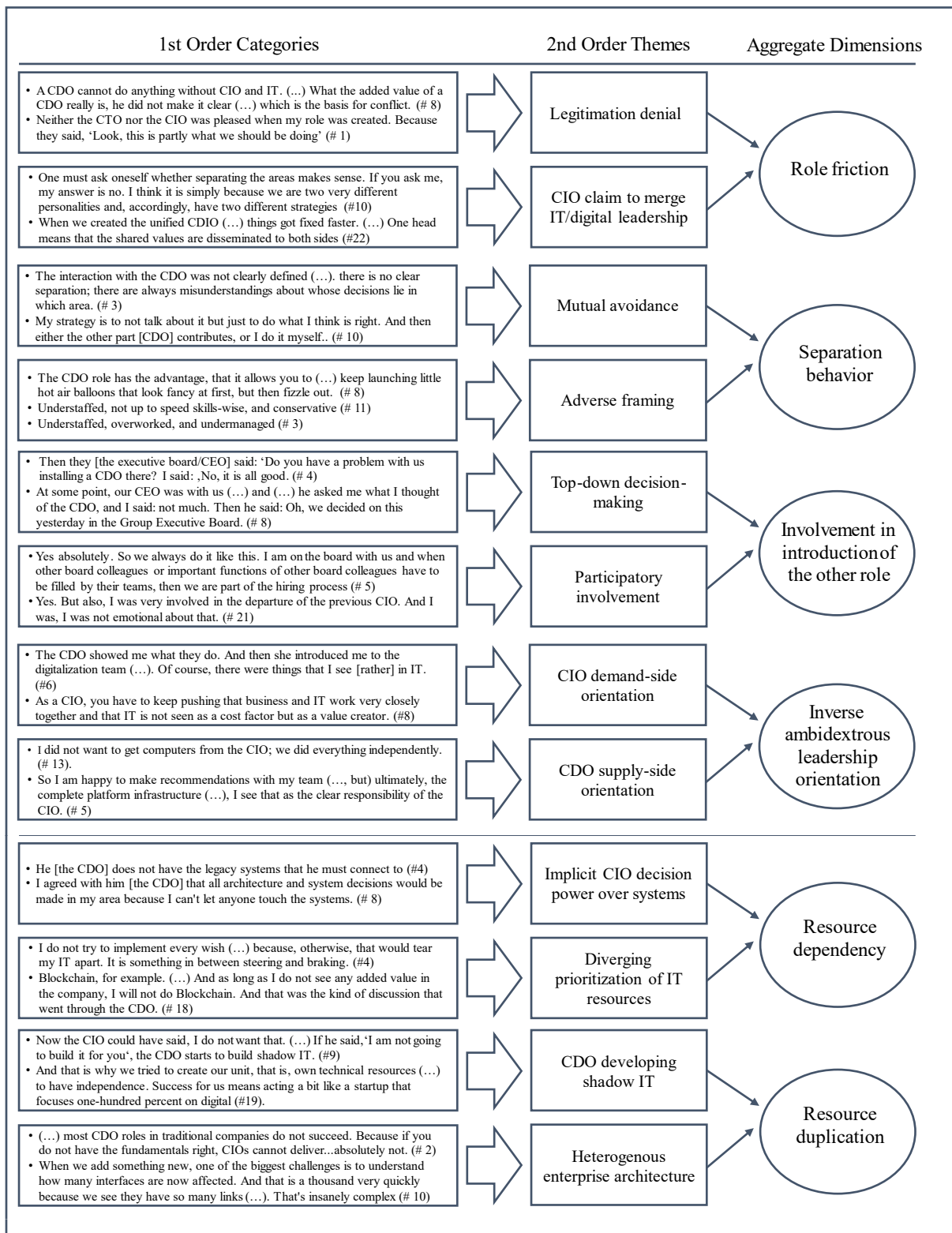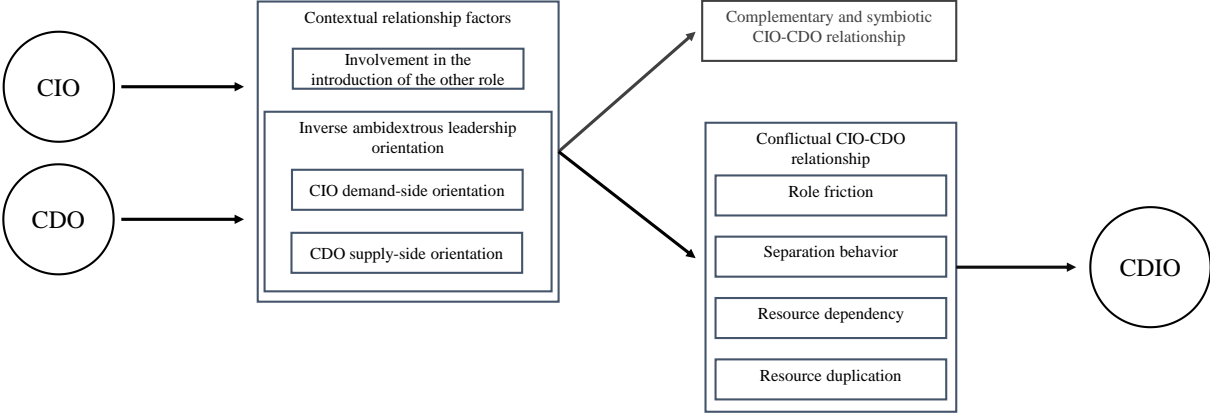
⟶ **Resource duplication**

Figure 2. Research Framework of the CIO-CDO Relationship

Online Appendix A: CIO/CDO Semi-Structured Interview Guide: Waves 1 & 2

Table 1: Semi-Structured Interview Guide: Wave 1

General information about the current role	1. What can you tell me about your role as [CIO|CDO]? 2. What roles do digital technologies play for your current (dominant) business model? 3. What does your role comprise? Is it externally or internally oriented? 4. What is the reporting hierarchy in your organization? Are you next to the [CIO|CDO]? 5. How are your resources structured? How many conceptual and technical employees do you have?
Reflection: Inside vs. outside view	6. How is the perception of the [IT|digital] function? 7. How did the board members evaluate the [IT|digital] function before you joined? 8. How do the other board members assess the success of the [IT|digital] function? 9. How do you assess the other board members' IT savviness/digital literacy?
The CIO-CDO relationship and conflicts	10. What is the nature of your relationship with your [CIO|CDO]? 11. Why do you think was a CDO appointed in your company? 12. If you don't support the CDO appointment, why didn't you claim the demand side toward the CEO? 13. To what extent are the CDO and CIO role descriptions and responsibilities delineated? 14. How do you delineate the CDO and CIO role descriptions? 15. What are the core issues of your CIO and CDO relationship? 16. If you think the other department does not support you, why do you think this is the case? 17. How do you feel about these conflicts?
The CIO-CDO relationship: Practices	18. How do you address the potentially conflicting goals of the CIO and CDO? 19. How do you build relationships with the other role? How did you create a common base for collaboration?

Table 2: Semi-Structured Interview Guide: Wave 2

Building on CIO-CDO research…	1. The research describes the CIO-CDO as symbiotic and complementary. How do you see this? Why is this (not) the case for you? 2. The literature suggests that, for good CIO-CDO collaboration, four factors must be met: specialization on sub-issues, trust in each other, coordination despite division of labor, and shared goals. How do you feel about this? How do you see it? What does this look like in practice for you? 3. How do you deal with intersections? How do you agree on what is included? What is unique to you or your counterpart?
Building on TMT/role conflict research…	4. If you compare other executives' roles (e.g., a CFO-COO relationship or a CMO-COO relationship) to the CIO-CDO relationship, to what extent do they differ in your view?
Coping mechanisms	5. What have you tried to do regarding differentiation? In practice, how do you see the following suggestions in the research: shared understanding, transactive memory system, specialization, trust, coordination, and organizational ambidexterity? Why did the demarcation not work? Why is it dysfunctional? 6. At what level is IT and digital brought together? At the team level under a shared CIDO role, or together with the CEO at the CIO/CDO level?

Online Appendix B: Literature Summary: Role Theory, TMT Cooperation and Conflict, and Role Relationships between TMT Members

The subsequent table provides an extensive overview of relevant previous literature related to role theory, TMT cooperation and conflict, and role relationships between TMT members. Role relationships between TMT members focus on TMT relationships other than CIO-CDO; the latter are extensively discussed in our literature review chapter.

Study	Journal	Keywords	Research context	Summary findings	Implications	Condensed implications
Role theory						
Firk et al. (2022)	Long Range Planning	TMT, TMT interface	Panel data regressions of a longitudinal dataset of U.S. industrial firms.	According to the authors, companies may gain from TMT digital expertise. Second, they contend that efficient usage of TMT digital information may be encouraged via internal TMT interfaces, such as those between the CEO, or CDO, and other senior managers. Finally, integrative CEOs and CDOs see the TMT hierarchical structure as a contextual aspect in the stimulation of TMT integration processes. The authors discover a favorable relationship between TMT digital expertise and digital innovation. They also discover evidence for CEOs' and CDOs' integrative functions. However, their data suggest that the CDO's integrating function may be impeded by the TMT's strong hierarchical structure.	This study adds knowledge to TMT role and behavioral integration by exploring the TMT competencies and the interfaces to engage in digital innovation. It confirms the understanding that functionally diverse top managers lead to increased innovation outcomes and proposes that TMT digital knowledge helps organizations to accelerate digital transformation. This is contested by the high proximity and significant overlap of the CIO and CDO. Also, this study does not clarify how CIO and CDO should engage for that matter. Lastly, this study suggests that the CDO is an integrating TMT member. In the CIO-CDO relationship, this means that our results indicate that some CDOs remain excluded from the organization and build up significant IT resources.	These perspectives are valuable for understanding the CIO-CDO relationship, because they provide an understanding of the functions of both roles compared to the informal structure in practice. Also, we find some evidence against the notions that functional diversity leads to beneficial outcomes and that the CDO has an integrative function.
Georgakakis et al. (2022)	The Leadership Quarterly	CEO-TMT interface	Literature review.	The authors analyze existing CEO-TMT interface research in several fields, drawing on role theory, and systematically arrange the numerous CEO-TMT role assumptions into three role theory specifications: functionalism, social interactionism, and structuralism. In taking stock of the three role specifications, they assess each's strengths and limitations.	Especially the functionalism perspective, proposing that TMT members are hired for a specific function, is valuable because, to some degree, a CIO and CDO are hired for the same function. In the CIO-CDO relationship, this means that the CIO and CDO functions are potentially too close, constituting a source of conflict.	
Ma et al. (2022)	Strategic Management Journal	TMT role structure	Conceptual.	In this conceptual work, the authors create a framework outlining its primary themes, highlight significant contributions from strategic journals and beyond, and indicate interesting future paths. They illustrate crucial aspects of how formal and informal structures complement or compete with one another in an organization's strategic leadership.	Particularly the role of informal structure may play a role in the CIO-CDO relationship, as both roles tend to act beyond the initial role scope, i.e., when the CIO displays demand-side leadership and the CDO supply-side leadership.	

TMT cooperation and conflict						
Jehn (1995)	Administrative Science Quarterly	TMT conflict	Empirical. Mixed methods: survey data combined with interviews.	The study results show that whether the conflict was beneficial depended on the conflict type and the group structure in terms of task type, task interdependence, and group norms. In groups performing very routine tasks, disagreements about the tasks were detrimental to group functioning. In contrast, disagreements about the tasks did not hurt groups performing nonroutine tasks; in some cases, such disagreements were beneficial.	The conflict type and the group structure – task type, task interdependence, and group norms – determine the quality of the conflict. This helps us understand that specific features of the CIO-CDO relationship can lead to different degrees of relationship quality. Particularly, the extent of the task interdependence inspires our analysis of the potential overlap and conflict between CIO and CDO.	
Wall & Callister (1995)	Journal of Management	Conflict, management	Literature review.	This article examines the conflict literature, beginning with the origins of the conflict, its basic process, and its consequences. The authors then investigate conflict (de-)escalation, settings, and conflict management. The disputants, managers, or other third parties can manage the conflict.	This review provides an overview over conflict and its management. It provides a foundational overview over causes that can(not) lead to a conflict in the CIO-CDO relationship. Causes of conflict can be divided into individual characteristics and interpersonal factors such as perceptual interface, communication, behavior, structure, and previous interactions.	
Amason (1996)	Academy of Management Journal	TMT conflict	Empirical. Case study combined with survey approach.	This study proposes that different conflict types can impact on outcomes, such as decision-making. Cognitive conflict is helpful since it is task-oriented and focuses on members debating and criticizing each other's different points of view. On the other hand, affective conflict is dysfunctional since it is more emotive and concentrates on disputing matters unrelated to the decision context. The impact of conflict on strategic decision-making is inconclusive. Conflict can improve decision quality. To improve decision-making, teams should encourage cognitive conflict while also discouraging affective conflict.	The conflict type determines the outcome, such as decision-making. It informs that conflict can have beneficial and detrimental implications for a relationship, depending on the nature of the conflict. Regarding the CIO-CDO relationship, this informs that the conundrum around tasks and responsibilities can spur conflict, but that a relationship-related aspect must lead to the detrimental nature of many CIO-CDO relationships.	In sum, this section informs that the conflict type and the group structure can influence outcomes, such as decision-making. Further, leaders play a significant role in team conflict. Lastly, conflict is experienced uniquely by every participant.
De Wit et al. (2013)	Organizational Behavior and Human Decision Processes	Conflict	Empirical. Quantitative method.	This study proposes that task conflict exacerbates the influence of relationship conflict on decision-making. When there is a disagreement in a relationship, information processing becomes skewed, which renders decision-making inflexible.	In turn, relationship and task conflict can mutually influence decision-making. The fact that both types of conflict have mutual influence is relevant for the CIO-CDO relationship because once the relationship breaks, they no longer tend not to collaborate on the joint digital transformation project.	
Thatcher & Patel (2014)	Handbook of Conflict Management Research	Team conflict	Literature review.	Although TMT research has traditionally focused on behavioral integration and espoused the positive aspects of cognitive, task-focused conflict, there has been very little research into how cognitive conflict is generated in a TMT. Elsewhere, studies in the TMT literature find negative effects of affective (or relationship) conflict on performance. This book chapter proposes that strong informational faultlines could lead to beneficial cognitive conflict in TMTs.	Informational faultlines can lead to productive cognitive conflict. Alluding to diversity in the TMT, informational faultlines can be productive. However, the CIO-CDO relationship is reflected by similar roles working on the same challenge, withdrawing information from each other.	
Zhao et al. (2019)	Academy of Management Annals	Team conflict	Literature review.	The conflict literature often overlooks leaders' important role in workgroup conflict. In this review, the authors focus on the group's formal, designated, and organizationally-appointed leader. Leader conflict instigation is defined as leader behaviors that start or initiate disagreements or perceived disagreements in groups. Thus, the authors see that dispositions, social constructions, structural positions, and intentions influence how leaders instigate conflict (unintentional, intentional-constructive, and intentional-destructive). The authors highlight three ways that leaders	Continuing the question how conflicts emerge, this study emphasizes leaders' role. It proposes three ways that leaders can engage in conflict: as active engagers, entangled engagers, and strategic observers. In the CIO-CDO relationship, this means that social construction and structural position immediately allude to the mutual perception and reporting and reporting challenges of the CIO-CDO relationship. Also, it highlights that a potential conflict between both roles does not necessarily have to be intentional, but unintentional through the circumstances.	

				can engage in conflict: as active engagers, entangled engagers, and strategic observers.		
Park et al. (2020)	Academy of Management Review	Team conflict	Literature review.	Most work has implicitly treated conflict as a shared team property. Yet each team member may perceive or experience varying degrees of conflict with other team members. This review suggests that individuals may have unique conflict experiences. The literature on team conflict has produced a limited view of the phenomenon, since it has implicitly assumed that members have uniform levels of competition with others and that the task flow is consistent across teams. Given that every relationship between members may be shaped by different conflict and task flow relationships in teams, a comprehensive theory of conflict should account for those variabilities among members.	This work extends the existing view of conflict as a shared team property and proposes considering unique conflict experiences based on different conflict and task flow relationships in teams. This helps us understand that the CIO and CDO may evaluate the relationship similarly but for different reasons because of the unique perspective. In the CIO-CDO relationship, this means that both roles can have a similar perception of the relationship, but their reasons differ because of the resource allocation or other contextual factors.	
TMT role relationships						
Schobel & Denford (2013)	Journal of Information Systems	CFO, CIO	Empirical. Multiple case studies.	The study identifies an unsuccessful CIO-CFO partnership based on low levels of trust, a lack of shared knowledge, and considerable harmful influence practices. An unproductive connection was primarily caused by a lack of informal communication within the structural engagement framework and physical separation. While the CIO-CFO connection is comparable in many respects to other TMT partnerships, their opinions of each other's strategic function within the business is a fundamental distinction that can lead to productive or antagonistic interactions with individual and firm-level outcomes.	Trust, knowledge-sharing, and harmful influence practices characterize an unsuccessful partnership. Lack of informal communication and physical separation cause unsuccessful collaboration. Lacking personal congruence sets both parties further apart, and their opinion of each other's strategic function determines the quality of their interaction. In the CIO-CDO relationship, the mutual perception, information-sharing and communication inspire the contextual factors that determine the relationship quality.	In sum, some common determinants of a functioning TMT relationship emerged from this section. The structural engagement, the perceptions of the other's strategic role, some information type.
Benlian & Haffke (2016)	The Journal of Strategic Information Systems	CEO, CIO	Empirical. Paired survey data.	The study proposes that both executives' perceptions of each other's opinions are skewed away from their true opinions. By fleshing out a fresh viewpoint on CEO-CIO knowledge that permits separation between bidirectional impacts on their relationship, the authors stress intra- and interpersonal differences and the bidirectional character of understanding.	This study emphasizes the role of opinions on each other and the individual perspective of both parties in the relationship. The opinion of each other is a main driver of conflict in the CIO-CDO relationship.	
Whitler et al. (2017)	Business Horizons	CMO, CIO	N/A.	The study's findings indicate the nature and origins of the conflict between the two jobs and management-related mechanisms for resolving them, highlighting the need for CEOs to focus on four critical areas of CMO-CIO conflict: viewpoints, goals, accountability, and structural conflict.	This study highlights viewpoints, goals, accountability, and structural conflict as determinants of relationship alignment. Viewpoints, goals, and structural conflict are also determinants of the quality of the CIO-CDO relationship. In particular, the notion of viewpoints on each other inspire the dyadic approach of analyzing the CIO-CDO relationship. The structural conflict inspires some contextual aspects around the resource allocation.	
Deans et al. (2018)	Journal of Organizational Computing and Electronic Commerce	CIO, CMO	Empirical. Panel data regressions of a longitudinal dataset of U.S.	The findings support the thesis that the CMO function has developed to match the marketing unit's technological demands, and that the relationship between the CMO and CIO has grown in importance. In most Fortune 100 businesses in 2016, social media was taken over by the marketing department, and the CMO is in charge of social media strategy while collaborating closely with the CIO.	This relationship is another example of the IT function no longer being an isolated area serving or enabling the organization's technology needs. The function has become an integrated part of the business and a strategic partner with the business unit. Further, it highlights that the CIO needs to coordinate with other C-level executives as technologies continue to evolve. In the CIO-CDO relationship, this means that, while the CMO and CIO	

			industrial firms.		move closer together because of technology, the CIO and CDO may be too close. While CMO and CIO do not question their legitimation, the CIO and CDO may.
Sleep & Hulland (2019)	Journal of Strategic Marketing	CMO, CIO	Conceptual.	This study introduces a conceptual framework to analyze the dynamics of the CMO-CIO relationship: interdependence, meaning that one party does not control all the resources required to achieve an action or outcome desired by the action, CMO-CIO relationship structure (i.e., reporting) and CMO-CIO diversity (i.e., the (dis)similarity between TMT members) and generally focuses on demographic characteristics such as education and tenure.	This study highlights interdependence, relationship structure, and diversity as determinants of relationship alignment. In the CIO-CDO relationship, this means that we often observe a dependence instead of an interdependence, as well as an unbalanced reporting structure and too little diversity.
Denford & Schobel (2021)	Journal of Accounting & Organizational Change	CFO, CIO	Empirical. Paired survey data, fuzzy-set qualitative comparative analysis.	The study proposes that the proximity of the CFO and CIO can often boost the likelihood of a productive partnership. Individually, an ambidextrous approach to strategic value and cost-effectiveness is critical to the success of both the CFO and the CIO.	This study highlights physical work proximity and role perceptions as determinants of relationship alignment. In the CIO-CDO relationship, we do not see physical work proximity emerging as a determinant, but we do see that proximity of roles is a factor that influences the CIO-CDO relationship.

Online Appendix C: Data Codes: Inverse Ambidextrous Leadership Orientation

Category	Exemplary quotes
CIO demand side Low orientation.	• [I deal with] IT security, (...) So how do we manage to make our IT infrastructure, we still do everything ourselves, so robust and so resilient that we at least have a good feeling when we go to sleep at night. The second big topic is the ERP migration (#20) • My role is essentially what you can expect from a CIO, which is essentially to make sure that the information, information flows and the business units are appropriately supplied with IT and that is, by and large, once about how you want to operate IT infrastructure. (...) Moreover, also, if you are now CIO in a larger company, then you have to [establish] governance and order to a certain extent. You have to ensure that certain security levels are established, that risk management is carried out, and that certain synergistic effects are leveraged in a group, for example, by ensuring that joint [IT] purchasing is organized. (#14)
CIO demand side Medium orientation.	• My strategy is to not talk about [digital transformation] but to do what I think is right. And then either the other part [CDO] contributes, or I do it myself. (#10) • The CDO showed me what they do. And then she introduced me to the entire digitalization team (…). Of course, there were things that I [rather] see [rather] in IT (#6) • The importance of IT has changed massively in the last five years. That doesn't mean that IT now somehow dictates everything to the business units. We see ourselves as partners at eye level, but with our own expertise. In other words, we have topics where we let the business departments take the lead in their business decisions, which we then try to enable technologically. But of course, we also take our own decisions. (#12)
CIO demand side High orientation.	• There were no real conflicts because I did my job, coordinated with him as best I could, and tried to help. Because I don't care, he is welcome to join in and sell some of the issues for himself for all I care. We did not have much daily contact because I had a defined area (…). You imagine the collaboration wrong. Because I had my area of responsibility and he had his. So, cooperation is all relative. (#8) • [Digital innovation is just with the CDO role], I am not a believer of that. (...) You cannot be good at digital if you do not understand your IT infrastructure and your technology. (…) if IT becomes synonym of legacy that do not evolve that is hard to use, it is not a proper environment and you would be slowing things down. (…) both sides [IT and digital unit] should inform innovation, user satisfaction and constant improvement of UI and UX based on customer feedback (#22)
CDO supply side Low orientation.	• Which then tries to make the processes in the company more efficient with the help of technology. And of course, I depend on excellent collegial cooperation from the CIO because, for me, the apparent tech stack is the CIO's responsibility. So I am happy to make recommendations with my team. It is also quite reasonable in different areas, because I have also worked with an incredible number of systems. Still, ultimately, the complete platform infrastructure that a company needs, from the ERP systems to, I do not know, the CRM system and everything else that goes with it, I see that as the clear responsibility of the CIO. And in this respect, it is essential that these two functions work exceptionally well together. (#5) • [Digitalization of] internal processes and internal process improvements are the responsibility of the CIO, as are knowledge management and collaboration. And the digital customer solutions lie with the CDO. From the business side, I work with my team to identify the appropriate solutions we need in the business, analyze the requirements, and then decide whether we should create them ourselves or buy them in and then integrate them. This is the area of responsibility for digital customer solutions. It must be said that we are also responsible for the selection, requirements analysis, and so on. If we then decide to program or operate something ourselves, we do it together with the CIO area. That means that development and operation are either in the CIO area or we do it [together] with partners. (#3)
CDO supply side Medium orientation.	• N/A
CDO supply side High orientation.	• I did not want to get computers from the CIO; we did everything independently. The only thing we did was to have the same [IT wholesaler shopping] basket. (…) It is relative that IT decides everything, but in a group like this, you can develop freely in your area. And you can also set up your own IT structures (#13) • And that is why we tried to create our unit, that is, own technical resources (…) to have independence. Success for us means acting a bit like a startup that focuses one-hundred percent on digital (#19)

Online Appendix D: Follow-Up Study on CDIO Roles

Next to the few complementary CIO-CDO relationships that we observed in our sample, we propose that those organizations with a conflictual CIO-CDO relationship may better merge the separate roles into a united CDIO role. To better understand how a united CDIO role may

resolve the challenges we identified in our study of the separate TMT members CIO and CDO, we carried out four additional expert interviews with CDIOs.

Method

We conducted interviews with four CDIOs who currently explicitly hold this position. In this small sample, we achieved some variance regarding the industry, company size concerning revenue and number of employees, and the country of the company headquarters (see Table 1). We asked them, supported by a semi-structured interview guide, to compare their experience as CDO or CIO, respectively, to their current CDIO role. Inspired by CDO and CIO research and our findings, we asked them to what extent the outlined CIO-CDO relationship challenges are resolved in the CDIO role. We attach the semi-structured interview guide in Table 2.

Findings

Interviewee 1, a CDIO who has been a CDO and a CIO, stated that he would prefer the CDIO role. He says that two roles make it more difficult. He explained that there is no conflict in the CDIO: "If you staff this with two people, then you have to make sure that they work together and not against each other. If you staff it with one person, it is difficult to work against yourself." He stated that a CDO can achieve nothing without interacting with the business units and that a CIO does not like the CDO entering the CIO's territory. He explains: "I can give myself the resources I need. So if I have to deal with someone else, he can also say 'I have no resources' or push back the prioritization. If I agree on this with myself, I usually get it." He concluded that time for coordination is critical for successful collaboration, and as a CDIO, time is saved since there is no conflict.

Interviewee 2, who was a CIO before, outlines the fundamental difference that the CIO is traditionally perceived as a cost center. At the same time, the CDO has no execution power: "The CDO can have the greatest ideas, however, but in the end, he or she is dependent on a CIO either for the complete implementation or integration into the core systems or for access

to core systems." Based on his experience, he stated that the CIO-CDO relationship could work if there is equal accountability and the CIO and the CDO have personal chemistry. He insists that the CIO and CDO must act with one voice. In the end, he concludes: "I do not think that works with the traditional CIO. If you now have someone in parallel who is digital, someone with great visions. He has no execution power because the CIO has to do it. On the other hand, he says I have to cut costs, and should I also give you people who do digital?"

Interviewee 3, a CDIO who has been a CDO and a CIO, outlined two advantages of the CDIO role: better cross-functional cooperation and prioritization of working approaches and technologies; he said: "I think there are two important differences. The first is better cross-functional cooperation between the teams. People today work in silos and are relatively hierarchically organized, still, unfortunately. But if they know that there is someone who looks after all these areas, then there is much more will and opportunity for cooperation. The second is the issue of prioritization. Everyone has their ideas about priorities and their favorite topics. And, of course, it is not easy for people if they don't get a uniform prioritization." He provided more details on the traditional and often-experienced CIO and CDO constellation. In his view, the CIO is concerned with system stability. He said that CIO-CDO collaboration can but does not have to work well. In a favorable constellation, the CIO and the CDO understand and adapt to each other. In a negative constellation, the CIO has more political capital than the CDO, bringing the CDO into a dependency situation. Thus, many CDOs revert to building shadow IT to achieve the digital objectives for customers. This increases technical debt for further development, as integration must be revised. To mitigate these differences, he proposed a different structuring of teams to break silos, much communication to bring together employees, and hard and swift IT architectural decisions and changes to unify the IT legacy.

Interviewee 4, a CDIO who has been a CDIO for more than five years and a CIO before, says that CIOs need sparring partners from the business units as they give the order. Alluding to the

differentiation between the supply and demand side, he says that it is difficult to differentiate between a supply-side or demand-side project with some projects. Therefore, a CIO runs the risk of stepping on the toes of the CDO, as he explains: "The question is exactly where one would draw the line. If you are a CIO, nowadays, you need a sparring partner in the line, who is the client of the technical product order. If you say I am building a takeaway app that is not a digital business model but a digital distribution channel. Is that now a CDO, or is it now the CIO with the line of business?" He continues to elaborate that separating CIO and CDO makes no sense: "It would only make sense if the CIO cannot do it, but then the CIO may be the wrong person. If the CIO is not a board member, they have no chance. Suppose the CDO is stuck in a dependency situation and has no impact. In that case, they run the risk of focusing on projects such as venture capital investment that is foreign to the core business and isolates the CDO. Resource duplication is also challenging because if the CDO cares for the supply side, they could lead the IT as well." He believes no intimate, trustworthy collaboration is possible for the CIO-CDO relationship. He says that a CDIO has to be able to lead IT and digital responsibilities. This means taking care of the details and having IT competencies but also being able to think the big picture.

Conclusion

The interviewees with CIO or CDO experience compared the differences between a CIO-CDO relationship and a unified CDIO role on an organizational and individual level. The findings of these CDIO interviews indicate that a unified CDIO can compensate for the shortcomings of a CIO-CDO relationship.

Table 1. Anonymized List of Interviewees

	Gender	Years in the position (rounded)	Interview length (min.)	Industry	No. of employees (rounded)	Country of headquarter
1	Male	1	37	Financial services	1,000	Germany
2	Male	2	47	Consumer goods & retail	3,000	Belgium
3	Male	1	42	Consumer goods & retail	1,000	Germany
4	Male	2	44	Real estate	> 100,000	Denmark

Table 2. CDIO Semi-Structured Interview Guide

Basics	1. What are the critical differences between an organization with a joint CDIO role versus two standalone CIO and CDO roles? What can be solved better as a result? 2. What is different for you as a CDIO compared to a structure if you were either CIO or CDO and had a corresponding counterpart? 3. How does your CDIO role differ from your previous CIO/CDO role?
Building on recent research insights...	4. Under what conditions could a separate CIO and CDO role work successfully/'complementary, symbiotic relationship'? 5. How do you ensure that your joint IT and digital unit does not repeat exactly what we have observed with separate CIO-CDO roles? Has it always been this way in each case? What evolution has there been? 6. What would be different about the CDIO role compared to the previous ambidextrous CIO role?