

Review

# What about the Chief Digital Officer? A Literature Review

Lazar Raković <sup>1</sup> , Slobodan Marić <sup>1,\*</sup> , Lena Đorđević Milutinović <sup>2</sup> , Marton Sakal <sup>1</sup>  and Slobodan Antić <sup>2</sup>

<sup>1</sup> Faculty of Economics in Subotica, University of Novi Sad, 24000 Subotica, Serbia; lazar.rakovic@ef.uns.ac.rs (L.R.); marton.sakal@ef.uns.ac.rs (M.S.)

<sup>2</sup> Faculty of Organizational Sciences, University of Belgrade, 11000 Belgrade, Serbia; lena.djordjevic.milutinovic@fon.bg.ac.rs (L.Đ.M.); antic.slobodan@fon.bg.ac.rs (S.A.)

\* Correspondence: slobodan.marić@ef.uns.ac.rs; Tel.: +381-24-628-144

**Abstract:** Digital transformation is becoming more ingrained into everyday life and is a talking point among researchers today. It has been evident from the growing number of publications that have focused on various aspects of digital transformation in the last few years. Based on the number of papers published, one of them is of much less interest to researchers: the managerial role of Chief Digital Officer (CDO) inherent in digital transformation. Having this in mind, a systematic literature review was conducted to elucidate the CDO's role, duties, and required competencies. In this paper, the results and conclusions of 22 papers are presented based on the search criteria outlined by the Web of Science and Scopus index databases. It is obvious that managing digital transformation is becoming more important as digital transformation affects almost every sector of business. The purpose of this study is to examine the position of Chief Digital Officer in terms of its position, role, and responsibilities as well as its necessary competencies. The results of this study could serve as the basis for future research in this area, which judging by the relevance of the topic, will certainly be more intensive.

**Keywords:** chief digital officer; digital transformation; systematic literature review



**Citation:** Raković, L.; Marić, S.; Đorđević Milutinović, L.; Sakal, M.; Antić, S. What about the Chief Digital Officer? A Literature Review. *Sustainability* **2022**, *14*, 4696. <https://doi.org/10.3390/su14084696>

Academic Editor: José Antonio Marín-Marín

Received: 19 March 2022

Accepted: 12 April 2022

Published: 14 April 2022

**Publisher's Note:** MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



**Copyright:** © 2022 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

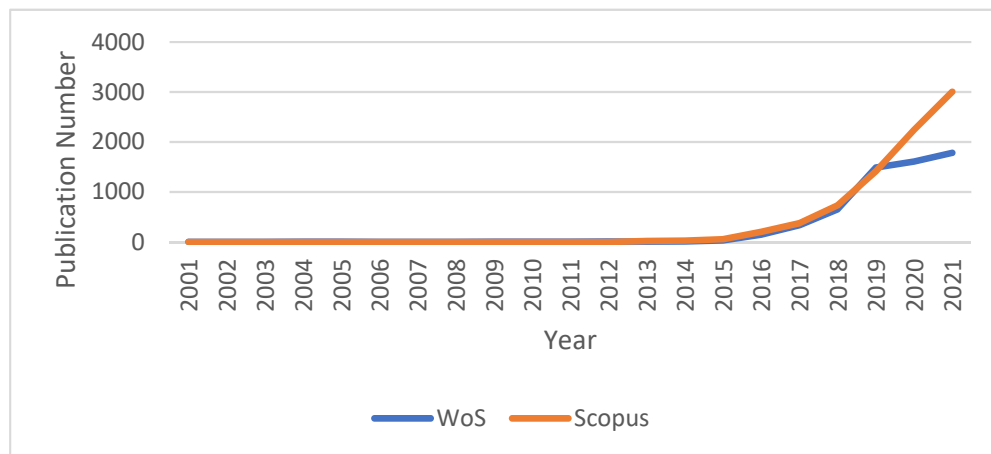
## 1. Introduction

The term “digital transformation” has become a buzzword in recent years in reference to the lasting and sometimes revolutionising impacts that digital transformations can have on both business entities and society as a whole [1–3]. Despite its widespread use, it is difficult to formulate a comprehensive and precise definition of “digital transformation” given its varied and context-sensitive interpretations [4,5]. Gray and Rumpel [4] for example, view this issue through the lens of the way the words transformation and digital are interpreted, expressing doubts about the appropriateness of the former. In order to explain this, they argue that transformation is a process that starts with an initial situation that leads to another (better) situation but “may never meet a stable end” [4] (p. 307). They also believe that since the transformations that occur on that path involve information technology, it is correct to use the term “digital”, since it pertains to the digital nature of transformations. Li [6] maintains that the transformation of organisations toward new technologies is a critical success factor, whereas Morze and Strutynska [3] do so in the context of fundamental changes taking place through the integration of traditional processes and digital technologies across a company's organisational structure. According to Schallmo and Williams [7], continuity and integration also play important roles in interpreting the concept of digital transformation. They believe that business strategies should include digital transformation as an integral and continuous component.

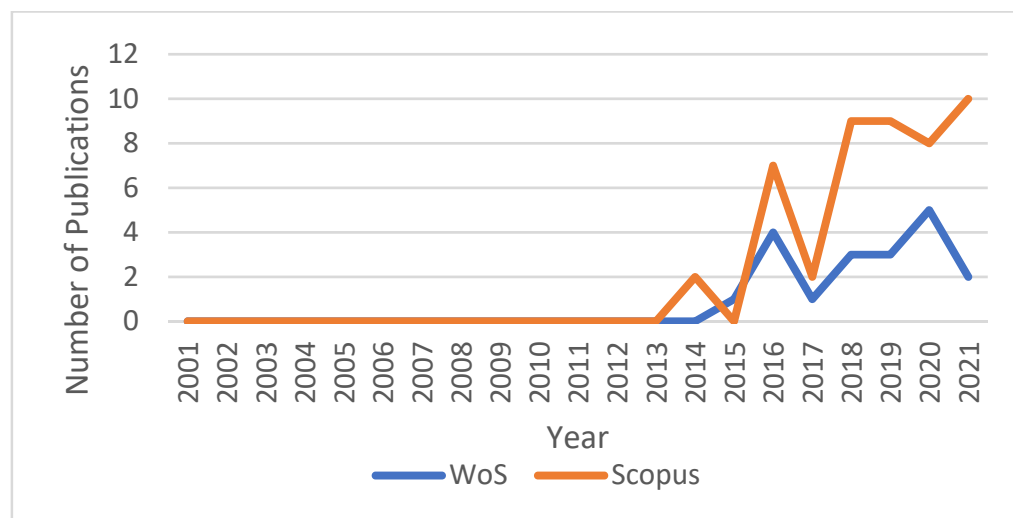
In the context of human factors and leadership, the term Chief Digital Officer (CDO) refers to the perception of digital transformation. For instance, Artemenko [8] points out that digital transformation is not a replacement for business processes but rather their digital upgrade, of which success is largely determined by the human factor. A

similar position is taken up by the authors Shaughnessy [9], Li [6], Kontić and Vidicki [10], and Klein [11], who believe that digital leadership skills, proactivity, and appropriate competencies are a sine qua non for success, not only with the digital transformation process but also with the management of a newly created or at least a nascent digital organisation. Digital transformation has always been accompanied by the question of who should lead it. Westerman, Bonnet, and McAfee [12] discuss the CDO in relation to its responsibility for defining digital strategies and “driving an organization through the digital transformation of its business”, while Matt, Hess, and Benlian [13], in a paper published a year later, added the role of a CDO to those of the Chief Information Officer (CIO) and the Chief Executive Officer (CEO) as potential leaders in digital transformation and described the role as a new one.

As evidenced by the search results of the major index databases, WoS and Scopus, CDO is a topic that is significantly less researched than digital transformation (Figures 1 and 2). In the query we performed, we used the period 2001–2021 as the time parameter. Sources (largely reports and industry analysts) suggest that the process of digital transformation, in a way, began in the late 1990s and early or mid-2000s and that the first CDOs appeared in 2003 [14]. As query results indicate, researchers’ interest was not awakened until about a decade and a half after the beginning of digital transformation.



**Figure 1.** Number of publications—“Digital Transformation”.



**Figure 2.** Number of publications—“Chief Digital Officer”.

There has been a significant increase in academic interest in the topic of digital transformation between 2016 and 2021, as reflected in the hits in these index databases (Figure 1 shows the number of publications in the initial search of the WoS and Scopus index databases by keywords in the string “Digital Transformation” for the period 2001–2021): it increased from 146 and 204 in 2006 to 1784 and 3006 in 2021 in WoS and Scopus, respectively.

As for “Chief Digital Officer”, the number of hits is significantly lower (Figure 2 shows the number of publications in the initial search of the WoS and Scopus index databases by keywords in the string “Chief Digital Officer” for the period 2001–2021) and ranges between 17 and 45 publications in WoS and Scopus, respectively, during that period.

The data suggest that further research is needed on CDO, which was the motivation for writing this paper. Through a systematic literature review, this paper aims to explore the views regarding the role and tasks of a CDO as well as the competencies necessary to accomplish these tasks.

The Web of Science (WoS, Clarivate) and SCOPUS databases were first searched to obtain a list of papers needed to define research questions, and then, the final keywords of the study were determined. Due to the intention of using only peer-reviewed scientific papers in the research, the search was limited to the mentioned databases. Table 1 provides the research questions as well as the motivations.

**Table 1.** Research questions.

No.	Research Question	Motivation
RQ1	What are the CDO’s position, role, and tasks?	A Chief Digital Officer’s tasks need to be identified to differentiate its position from similar ones (e.g., CIO and CEO).
RQ3	What are the CDO’s necessary competencies?	A CDO needs a mix of specific competencies to successfully deal with IT, leadership, and economic challenges.

This paper is structured in the following manner: after the Introduction, Section 2 describes the methodology used while Section 3 summarises the process of conducting a systematic review of the literature. Section 4 presents the findings, followed by concluding remarks and practical implications. The last section of the paper lists the limitations and future research, followed by a review of the literature used.

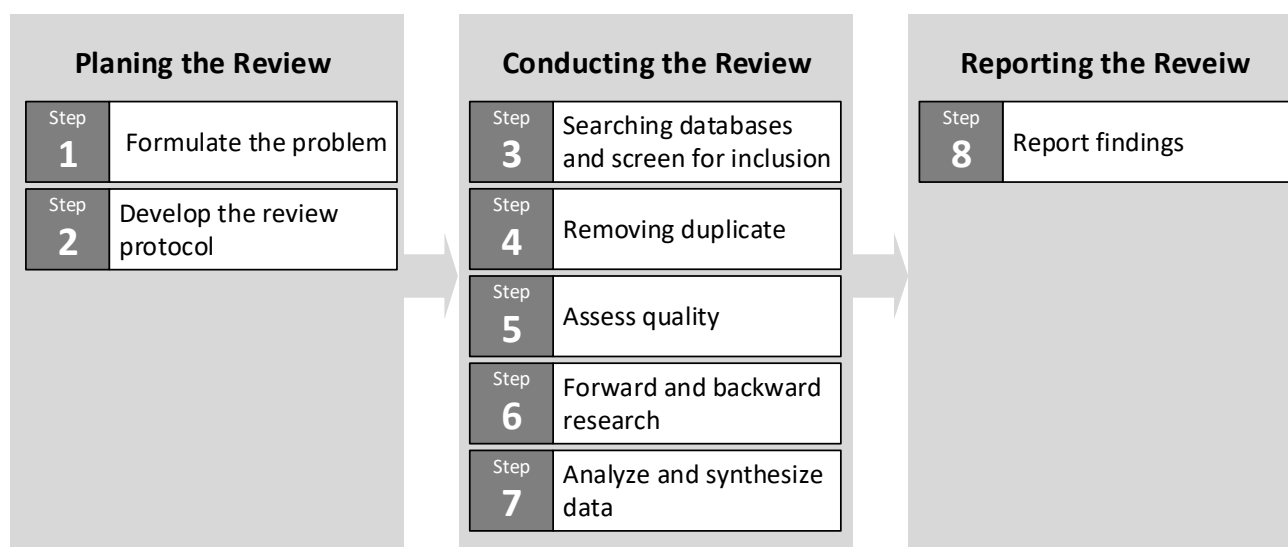
## 2. Materials and Methods

In the literature review process, descriptive methodologies were used, such as textual narrative synthesis, as defined by Xiao and Watson [15] and by Barbara Kitchenham et al. [16–19]. The systematic review of the literature involved eight steps that Xiao and Watson [15] categorised into three parts (Figure 3). The first two steps are part of review planning and include problem formulation and the review protocol development. The second part is dedicated to conducting the review, which begins with a database search and ends with the data analysis and synthesis. The last part reports the findings.

The review protocol by Xiao and Watson [15] helped identify the research questions, define the search strategy, and determine the quality assembly criteria and screening procedures.

The keywords and primary databases used for the search were identified after the research questions were defined. “Chief Digital Officer” was chosen as a keyword, and Web of Science (WoS, Clarivate) and SCOPUS were selected as the databases searched, as they are the two largest citation databases and include only high-quality peer-reviewed publications.

The search was performed in three steps. First, the identified keywords were searched in the SCOPUS and WoS citation databases. The titles, keywords, and abstracts of the papers that appeared on the list of query hits were reviewed. The papers that had the potential to contribute to finding answers to research questions were placed on the list of papers that need more in-depth analysis. According to Xiao and Watson [15], this list also includes articles in which the titles, keywords, and abstracts led researchers to doubt their inclusion in the further processing.



**Figure 3.** Process of systematic literature review (adapted from [15]).

The next step involves merging the lists found by searching the citation databases. Duplicates are removed from the merged list. The papers that remained on the list were downloaded and evaluated in terms of research objectives.

Finally, forward and backward analyses were performed in the third step. Articles containing references to papers from the list (forward) as well as articles referenced in papers from the list (backward) were added to the list.

### 3. Conducting the Review

As already mentioned, the Web of Science and SCOPUS citation databases were searched by keywords “Chief Digital Officer”. The period from 2001 to January 2022 was included. The Introduction of this paper described the reason for choosing the initial year of the time period. This review was performed on papers written in English. There were 18 initial hits in WoS and 47 in SCOPUS (Table 2). Based on titles, abstracts, and keywords analysis, 36 papers (12 from WoS and 24 from Scopus) were identified as having the potential for further analysis (Table 2). A total of 26 papers were left after removing any duplicates.

**Table 2.** Search results of electronic databases.

Data Source	Keywords	Number of Hits	Number of Papers Included after Analysing Titles, Abstracts, and Keywords
Web of Science	“Chief Digital Officer”	18	12
Scopus	“Chief Digital Officer”	47	24

The papers were downloaded, while quality was assessed in accordance with the research questions. Five papers were removed from the list for the following reasons: two papers only announced their research results but failed to present them, while three papers primarily focused on Chief Information Officers, Chief Data Officers, and digital transformation. The forward and backward analyses resulted in adding 1 paper to the list, bringing the total number of researched papers to 22 (Table 3).

**Table 3.** List of papers.

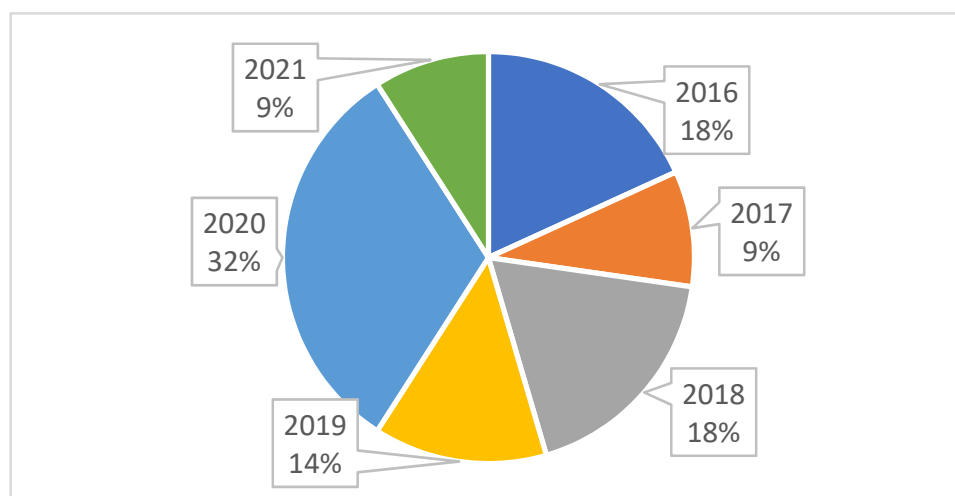
No	Year	Authors	Publication Type	Aim	Methodology	Theoretical Framework
1	2020	Artemenko [8]	Proceedings Paper	<ul style="list-style-type: none"> <li>Defining the cause of introducing the CDO</li> <li>Identifying the challenges facing the CDO</li> <li>Clarifying cooperation between CIOs and CDOs</li> <li>Determining the necessary requirements for the CDO position</li> </ul>	Reviewing existing literature	Not explicitly stated
2	2018	Becker, Schmid, & Botzkowski [20]	Proceedings Paper	<ul style="list-style-type: none"> <li>Identifying challenges for a CDO's integration into both small and medium, and large organisations</li> <li>Identifying the CDO's responsibilities</li> <li>Recognition of the CDO's responsibilities</li> </ul>	Multiple Case study	Based on Rhole theory
3	2020	Berman, Baird, Eagan, & Marshall [21]	Journal Paper	<ul style="list-style-type: none"> <li>Identifying whether the CDO's engagement in digital transformation is correlated with financial performance</li> <li>Identifying whether the CDO's role should be narrowly focused on digital business or include an overall digital transformation strategy</li> <li>Determining where a CDO should be positioned to perform their job most efficiently as well as to whom the CDO should report and who should report to the CDO</li> <li>Identifying which background, skills, and traits the CDO should possess</li> </ul>	Survey	Not explicitly stated
4	2020	Buchwald & Lorenz [22]	Proceedings Paper	<ul style="list-style-type: none"> <li>Identifying the role of CIOs and CDOs and their interrelationships</li> <li>Conceptualising the role split and the emergence of the CDO</li> </ul>	Reviewing existing literature	Concepts of organisational ambidexterity, transactive memory systems (TMS), and shared understanding
5	2016	Chhachhi et al. [23]	Journal Paper	<ul style="list-style-type: none"> <li>Identifying the factors that make digital transformation successful and the common pitfalls to avoid</li> </ul>	Exploratory Research	Not explicitly stated
6	2018	Ctarino, Rosa, & Da Silvi [24]	Journal Paper	<ul style="list-style-type: none"> <li>Defining CDO</li> </ul>	Survey	Using the Responsible, Accountable, Consulted and Informed (RACI) matrix from COBIT 5
7	2019	Drechsler, Wagner, & Reibenspiess [25]	Proceedings Paper	<ul style="list-style-type: none"> <li>Identifying investors' reactions to announcements of a CDO's introduction in organisations</li> <li>Identifying whether the title CDO has an impact on stock return</li> <li>Identifying whether the coexistence of CDOs and CIOs has a negative effect on stock return</li> <li>Identifying whether a CDO's STEAM background and experience have an impact on stock return</li> </ul>	Event study	Signaling theory
8	2021	Firk, Hanelt, Oehmichen, & Wolff [26]	Journal Paper	<ul style="list-style-type: none"> <li>Identifying whether the decision to introduce a CDO depends on the urgency of the digital transformation and the need to coordinate the digital transformation launch and implementation</li> </ul>	Quantitative Research	Hypotheses created on the basis of existing literature
9	2016	Haffke, Kalgovas, & Benlian [27]	Proceedings Paper	<ul style="list-style-type: none"> <li>Identifying how the CDO's role is defined</li> <li>Identifying the types of CDO roles</li> <li>Identifying factors that affect the need for CDOs in organisations</li> <li>Identifying the implications for the CIO as a role</li> </ul>	Qualitative Research	Not explicitly stated
10	2016	Horlacher & Hess [28]	Proceedings Paper	<ul style="list-style-type: none"> <li>Identifying the managerial tasks and roles of CDOs</li> <li>Exploring the nature of CDOs</li> </ul>	Multiple Case study	Adapted phenomenon-based research approach
11	2016	Horlacher, Klarner, & Hess [29]	Proceedings Paper	<ul style="list-style-type: none"> <li>Developing "a holistic understanding of real-life organization design parameters surrounding CDOs and their digital transformation activities" (p. 3)</li> </ul>	Multiple Case study	Not explicitly stated

Table 3. Cont.

No	Year	Authors	Publication Type	Aim	Methodology	Theoretical Framework
12	2021	Kessel & Graf-Vlachy [30]	Journal Paper	<ul style="list-style-type: none"> <li>Identifying antecedents of the CDO's presence</li> <li>Identifying the CDO's role</li> <li>Identifying the consequences of the presence of a CDO</li> </ul>	Systematic literature review	Based on the available literature, a framework was developed and organised into three sections: antecedents of the CDO's presence, the CDO's role, and consequences of the CDO's presence
13	2020	Kossowski, Heumuller, & Richter [31]	Proceedings Paper	<ul style="list-style-type: none"> <li>Developing guidance for the CDO</li> </ul>	Qualitative Research	Digital Fitness (DF) as target state for the CDO
14	2020	Kunisch, Menz, & Langan [14]	Journal Paper	<ul style="list-style-type: none"> <li>Identifying the presence of CDOs in organisations</li> <li>Identifying factors that could affect the occurrence of CDOs in organisations</li> <li>Providing a comprehensive understanding of CDOs</li> </ul>	Quantitative Research	Not explicitly stated
15	2019	Kutnjak, Križanić, & Pihir [32]	Proceedings Paper	<ul style="list-style-type: none"> <li>Identifying the knowledge and skills needed for CDOs</li> <li>Identifying the required practical experience of the CDO</li> </ul>	Literature review	Not explicitly stated
16	2019	Locoro & Ravarini [33]	Proceedings Paper	<ul style="list-style-type: none"> <li>Identifying the differences between CIOs and CDOs within digital transformation</li> <li>Identifying whether technological trends affect CIOs/CDOs in terms of digital business transformation and strategy</li> <li>Identifying whether CIOs and CDOs can coexist and cooperate as well as whether their roles are complementary, overlapping, or redundant</li> </ul>	Qualitative Research	The use of the Socio-technical Model
17	2020	Moker [34]	Proceedings Paper	<ul style="list-style-type: none"> <li>Identifying the specifics of the CDO's position, person, and environment</li> </ul>	Systematic literature review	Not explicitly stated
18	2017	Singh & Hess [35]	Journal Paper	<ul style="list-style-type: none"> <li>Identifying the factors that encourage the presence of CDOs in organisations</li> <li>Identifying CDO's roles in organisations</li> <li>Identifying the skills and competencies that a CDO should possess</li> </ul>	Multiple Case study	Not explicitly stated
19	2020	Singh, Klarner, & Hess [36]	Journal Paper	<ul style="list-style-type: none"> <li>Identifying how CDOs could pursue digital transformation activities</li> </ul>	Multiple Case study	Developing a holistic understanding of the real-life organisation design parameters regarding CDOs
20	2018	Tahvanainen & Luoma [37]	Proceedings Paper	<ul style="list-style-type: none"> <li>Identifying the CDO's role in digitisation</li> <li>Identifying and analysing the necessary competencies for CDOs</li> </ul>	Systematic literature review	Not explicitly stated
21	2018	Tumbas, Berente, & Brocke [38]	Journal Paper	<ul style="list-style-type: none"> <li>Identifying how CDOs establish relationships with other well-established IT roles in terms of IT innovation</li> <li>Identifying how CDOs perceive their role and how they describe and enact their role in relation to others</li> </ul>	Qualitative Research	Not explicitly stated
22	2017	Tumbas, Berente, & vom Brocke [39]	Journal Paper	<ul style="list-style-type: none"> <li>Identifying domains where CDOs build digital capabilities</li> <li>Identifying CDO types</li> </ul>	Qualitative Research	Not explicitly stated

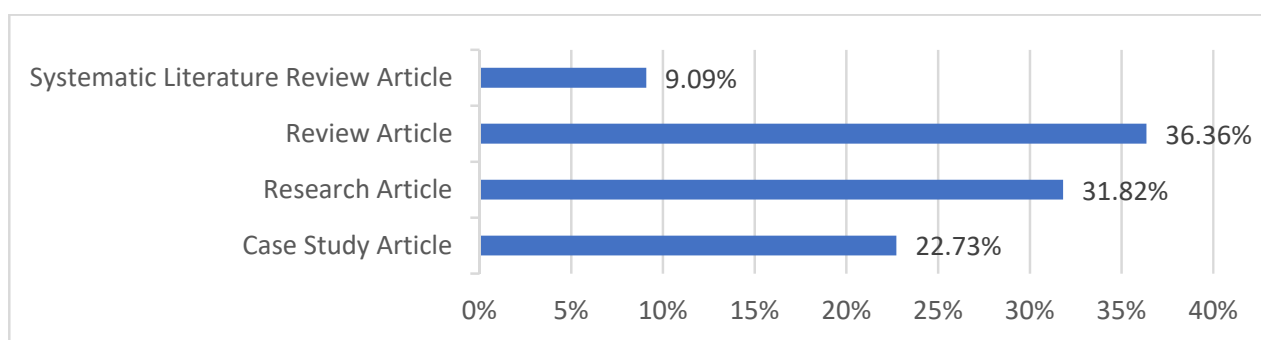
The papers from the final list dated back to the last six years, with nearly a third published in 2020 (Figure 4 presents the structure of the final list of papers by year of publication). Considering that the search was conducted in January 2022, it would be reasonable to assume that a number of papers published in journals or presented at conferences during the last quarter of 2021 are not indexed in these databases. Therefore, the number of papers

published during 2021 should be regarded with a certain amount of caution—it is likely higher than what was obtained by our query.



**Figure 4.** Papers by year.

Slightly more than 36% of papers were categorised as review articles. The proportion of research articles made up almost 32%, while case studies represented about 23% (Figure 5 presents the structure of the final list of papers by publication type)—thus, more than 50% of papers were empirical in nature. Systematic review articles accounted for about 9%.



**Figure 5.** Papers by publication type.

The final list of studied publications, systematic literature review sample on Chief Digital Officers, is given in Table 3. The table shows information about the type of publication, the aim or aims identified by the authors, the methodology they employed, and whether and which theoretical framework was used.

#### 4. Findings

The position and significance of a CDO are acknowledged [34,36]. Its tasks are not, however, unambiguously and definitively defined.

##### 4.1. CDO's Position, Role, and Tasks

According to some authors [27], setting up the CDO's position does not have to be motivated solely by internal factors, such as a recognised need, requirement, or pressure for digital transformation, but could also be motivated by the implementation of a similar position by competing organisations [14]. The authors generally agree that CDO is “strategic management role” [31] responsible for developing the digital strategy [28,32] and “orchestrates the digital transformation of a company” [35].



Creating the CDO position necessarily involves identifying its position in a company's hierarchy. According to their research, Singh et al. [36] concluded that CDOs can be in C-suite positions or decentralised units, depending on whether a company uses a centralised or decentralised digital strategy. Thus, multiple CDOs can exist within different business units if different digital transformation strategies are implemented. Kutnjak et al. [32] emphasised the fact that the position of CDO is highly complex, as digital organisational change often involves balancing between two "worlds" that may not be aligned: managers (economic and domain experts) and IT experts (technology experts). A CDO should be a bridge/buffer between IT and the business [24,39], which means interactions between the CIO and the CDO are crucial. There is, however, a lack of clarity in the manner in which a CIO and a CDO cooperate [24], and the complexity of their relationship is further accentuated by the fact that both are at the same level of hierarchy and report directly to CEO [21,28]. While some authors [38] argue that CDOs often oppose their role to IT executives (CIOs), Buchwald and Lorenz [22] contend that, in the ideal scenario, CDOs work with IT (CIOs) to deliver the support needed to implement a digital strategy. Furthermore, they emphasise that the complementarity of these two roles can lead to a fruitful relationship. The CDO's function appears to be broader than that of CIO, as CIO is a strategic IT expert, while a CDO is a digital transformation expert [35], responsible for communicating with employees, understanding the business processes, etc. CDOs are responsible for the strategic and communication aspects of digital transformation, while CIOs are responsible for the technical aspects [28], so the CIO is the CDO's right-hand person [8].

Companies' stock exchange listing can be affected by the existence of both the CIO and CDO positions. Drechsler et al. [25] argued that the existence of a CDO in parallel with a CIO may send a negative signal to investors due to the possibility of overlaps or even conflicts of authority.

Only a few CDOs can confidently state that their tasks, as well as expectations and responsibilities, which are assigned to them in order to fulfil those tasks, are clearly defined [8,14,23,24,27,33]. Even though the CDO's tasks are determined, they are subject to change due to the very nature of digital transformation: this process is continuous and changes constantly, which means the CDO's role has to be continuously updated [20,23].

In the opinion of most authors, the CDO role involves defining and implementing a digital transformation strategy [21,24,27,28,31,32,35] and is not just about implementing new technologies to digitalise the business [8]. Becker et al. [20] examined the scope of a CDO's work from the perspective of the size of an organisation: in SMEs, CDOs are mostly involved with digitalisation and strategic management, but in large organisations, their role is primarily concerned with strategic management and IT.

CDOs are primarily responsible for developing, iterating, and implementing digital strategies [21,22]. This involves restructuring a business, developing a vision, and creating a comprehensive plan for digital transformation of business processes [8].

To implement digital initiatives [21] and to successfully restructure a company [8], it is essential that the CDO encourages cross-functional cooperation [35] while promoting cultural change in the implementation of digital initiatives [21,28]. If digital transformation is to proceed according to the adopted plan, then the CDO must eliminate or at least mitigate differences between previously created silos (vertical functional areas of the organisation) that often arise because managers are too focused on their departments and unwilling to work closely together [28]. To accomplish this goal, a CDO will need to manage tensions among various parties [33,38]. Therefore, Horlacher and Hess [28] state that the CDO's job is cross-functional and interdisciplinary. One of the CDO's tasks is to train and motivate employees for the changes that will be caused by the digital transformation. A CDO's role is to serve as a digital evangelist, dealing with organisational interdependencies [28] and connecting key stakeholders within organisations throughout the digital transformation process [36].



Table 4 contains quotations related to the roles, responsibilities, and tasks of CDOs from selected authors.

**Table 4.** Selected quotes.

Source	Quotes
Horlacher & Hess, 2016 [28]	“CDO is responsible for developing the digital strategy, executing the digital transformation across the company and taking the entire company along on the journey” (p. 5133)
Haffke et al., 2016 [27]	“The CDO role is a business role with the mandate to understand the industry-specific aspects of digitization, determine the implications for the company, develop and communicate a holistic digital strategy across the firm, and lead the required change efforts. The CDO is a digital business strategist who holistically understands and communicates the implications of digitization across the organization” (p. 5133)
Singh & Hess, 2017 [35]	“The CDO orchestrates the digital transformation of a company. The CDO role thus includes supporting top management in formulating and executing a dedicated digital transformation strategy. . . . CDOs have a wider role than heads of individual digital business units; CDOs assume cross-department authority for digital initiatives and aim to transform the company as a whole” (p. 8)
Ctarino et al., 2018 [24]	“CDO define the digital strategy/vision, align/converge the digital strategy with the corporate strategy, create a digital culture in the enterprise, disrupt, transform to digital, change management” (p. 46)
Kutnjak et al., 2019 [32]	“Chief Digital Officer, by developing a digital strategy, begins the path of transformation in the organization. Using digital technology, he/she finds new business opportunities and focuses on continuous innovation in business by targeting customer needs. Along with the foregoing, CDOs knowledge must be also fulfilled with business model analysis and business model transformation methods to success in DT in accordance with the new business model” (p. 5717)
Kossowski et al., 2020 [31]	“Chief Digital Officer (CDO) as a strategic management role, to control the journey of DT” (p. 1)
Berman et al., 2020 [21]	“CDOs are business executives responsible for creating and executing strategies for digital solutions across their enterprise. The scope of their role can vary from one organization to the next, but CDOs typically work horizontally across functions and lines of business” (p. 32)

The CDO’s main responsibilities are always linked to digital transformation. A study conducted by Becker et al. [20] revealed that more than half of the surveyed CDOs are the sole person responsible for digital transformation and receive support from other C-level managers. The responsibilities and roles of the CDO are not static. In fact, they are constantly changing because digital transformation never stops [23]. On the other hand, CDOs themselves are catalysts for change in organisations because they establish and implement a digital strategy through digital initiatives, stimulating change throughout the company [21,28,32,33].

Although CDOs do not have a functional IT responsibility, they still have a great responsibility in establishing a bridge between IT and business (priorities of which should be clearly defined) [24,32]. A CDO should identify new business opportunities, focus on innovation, and utilise the appropriate digital technologies [32]. Table 5 provides an overview of the most important tasks/activities performed by CDOs.

#### 4.2. CDO’s Competencies

In the previous section, it was mentioned that Drechsler et al. [25] believed that the existence of a CDO in parallel with a CIO may send a negative signal to investors and unfavourably affect companies’ stock exchange listing. According to the same authors, a similar effect can be achieved through the educational background of the CDO and the competencies they have acquired based on that education: a CDO’s business-related education

is better accepted by (potential) investors than a STEAM (Science, Technology, Engineering, the Arts and Mathematics) background because the company's digital transformation is more of a business than an IT challenge [25].

**Table 5.** CDO's job/activities.

Job/Activities	Sources
Building/developing digital strategy	[21]
Implementing digital transformation	[29]
Coordinating key stakeholders within an organisation	[36]
Analysing market of technologies and new digital solutions	[8]
Restructuring a company	[8]
Forming a vision	[8]
Encouraging cross-functional cooperation	[28,35]
Creating a comprehensive plan for digital transformation of business process	[8]
Executing digital initiatives	[21]
Focusing on clients with the goal of creating a personalised user experience	[28]
Managing conflicts	[33,38]

Besides stating that the CDO should have a degree in economics, ICT engineering, or business administration, Kutnjak et al. [32] also noted that a CDO should have multidisciplinary professional skills (some of them provided in Table 6). This refers not only to skills in the fields of business and IT but also to various soft skills (e.g., problem solving, critical thinking, teamwork, digital literacy, etc.) [30,32] that other senior managers may lack [14].

**Table 6.** CDO's competencies.

Competencies	Sources
Communication and cooperation skills	[22,28]
Change management skills	[22,28,32]
Leadership skills	[32]
Soft Skills (communication, motivation, and teamwork)	[30]
Strategy development skills	[22]
Conflict management skills/negotiation skills	[32,33]
Digital Pioneering Skills	[35]

CDOs are expected to possess strong communication skills as well as change management skills [28]. A leader who will introduce changes within an organisation [32] is inevitably required to possess knowledge of business processes [8]. CDOs should have a combination of the knowledge of technical specialists, market analysts and managers; have experience with e-commerce and Internet marketing; and be able to work with data [8].

The complexity of digital transformation naturally requires a broad range of competencies for CDOs [32]. The results of the research conducted by Berman et al. [21] indicated that three main skills are required of CDOs: innovation, technology, and business strategy development. As a rule of thumb, IT knowledge is a requirement, but it may not be sufficient for the CDO's position: in addition, a CDO should possess skills in strategy development, change management, and communication [28]. Communication is also the focus of the authors Buchwald and Lorenz [22], who point out that communication and cooperation skills are important in digital transformation, since it involves most business processes in which the participants require efficient information exchange and cooperation. Communication skills are crucial for implementing digital vision across all organisational

silos [28] and for promoting cross-functional cooperation [35]. Proper communication is the only way to inspire those involved in the digital transformation. A CDO should also have digital pioneering skills, so they can create a “cohesive digital vision for the company” [35] (p. 12).

These competencies are not necessarily acquired through formal or non-formal education [32] but are often the result of experience.

## 5. Limitations and Future Research

This study has some limitations: only two, albeit the largest and most comprehensive, citation databases were searched, and all papers were in English. Additionally, we consider the limited number of empirical and theoretical papers published on the topic of Chief Digital Officer to be a limitation. The same conclusion can be reached from the quantitative analysis of previous publications.

Inadequate knowledge in this area of research is a significant limitation for the adequate implementation of a digital transformation process, as it is directly correlated to the position of Chief Digital Officer.

Future research can be focused on the tasks and responsibilities of CDOs as well as on improving their competencies. Future research should focus on the analysis of academic and professional study programs, mainly in the field of business informatics, in which the outcomes are aligned with the requirements of the CDO's position. As the differences in the description of the position, roles, tasks, and competencies when it comes to centralised and decentralised strategies of digital transformation have not been sufficiently researched in the literature, this could also be one of the directions of further research. Furthermore, there are two more identified directions of research that would provide answers to the following questions: Are there any differences in the CDO's position, role, or task when the CDO is in the C-suite or not? Are there differences in the CDO's position, role, and tasks when there are several CDOs in a company?

## 6. Concluding Remarks and Practical Implications

In many organisations, business processes and jobs have undergone digital transformation [40]. In terms of corporate strategy, digital transformation is not an isolated, one-time event [28] but has a long-term and critical role [24]. The Chief Digital Officer is often cited as the person who should lead the digital transformation. In some sources, the position of CDO has been the subject of interest in business literature since 2013 [41,42], but in 2016, it became the focus of scientific publications [23,27–29]. This is a position that appears more frequently in companies, but it has been associated with many questions that neither practice nor academia having been able to answer them definitively. Several of them served as the basis for defining the research issues that were explored in this paper through a systematic literature review: What are a CDO's position, role, and tasks? What are a CDO's necessary competencies?

Many positions, such as the Chief Internet Officer, emerged and quickly disappeared [42]. The question is whether the CDO will have the same fate [41]. Digital disruptions are expected to continue shaking modern companies for a long time to come, and a CDO's role is expected to be even more important in the future and to continue to exist in organisations for a long time. Moreover, there are views that the CDO is becoming an increasingly important executive director [34] and could become the most powerful role in the organisation [42]. In order to have the credibility [43] to manage digital transformation and to execute demanding tasks, a CDO must have a wide range of competencies. Competence and skills in the field of IT, management, innovation, communication, pioneering, etc. are considered imperative in the studied literature.

Diverse competencies and skills enable a CDO to define a flexible, tailor-made approach to digital transformation, which takes into account the company's specifics, the complexity of its working environment, and its business trajectories. Digital transformation cannot be unified. It is unique in every company. However, some sources point out that,

based on the way CDOs approach it, it is possible to identify different types of CDOs, which differ both within the business and within the academic literature. Furthermore, Reck and Fliaster [44] identified various types of CDOs: networker and catalyser, insider expert, innovation evangelist, and lone icebreaker. Sharma et al. [45] divided CDOs into the following categories: disrupter, innovative integrator, market-minded maven, and technology integrator. Haffke et al. [27] identified the following categories: evangelist, coordinator, innovator, and advocate. One of the future directions of research would be to study the specifics of each type; to create a CDO taxonomy; and as a consequence, to define the roles, tasks, and competencies.

The viewpoints expressed in the studied literature can be summarised as follows: a CDO is a C-level manager in charge of defining and operationalising the digital transformation strategy. Aside from a formal business and IT background, a CDO should have a substantial number of skills (communication, leadership, conflict management, etc.) that are often developed through extensive practical experience. CDOs and CIOs may overlap in their competencies, and stock market trends confirm that those companies that have both positions are listed lower, as are those with CDOs who have only a STEAM education.

The views presented in this paper can be useful for both theory and practice. The information gathered from the publications studied can be used to formulate further theoretical and empirical research. There is potential practical implementation in not only business entities but also in institutions of higher education. Business entities can gain insight into (to some extent) or can supplement/change their existing views on the CDO's responsibilities, knowledge, and competencies. When (planning) the next generation of the curriculum for existing or new study programs, academic institutions may consider other aspects of the paper. These are probably mostly related to programs in business informatics, which emphasise the synergistic unification of IT and management knowledge, which is why they can be considered a "hatchery" for future CDOs.

**Author Contributions:** Conceptualization, L.R.; original draft preparation, review, and editing, L.R., S.M. and M.S.; data analysis and methodology, L.R., S.M., L.D.M., M.S. and S.A. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research received no external funding.

**Institutional Review Board Statement:** Not applicable.

**Informed Consent Statement:** Not applicable.

**Data Availability Statement:** The data are available upon request from the author.

**Conflicts of Interest:** The authors declare no conflict of interest.

## References

1. Krivokuća, M.; Čočkalović, D.; Bakator, M. The Potential of Digital Entrepreneurship in Serbia. *Anal. Ekon. Fak. U Subotici* **2021**, *57*, 97–115. [\[CrossRef\]](#)
2. Reddy, S.K.; Reinartz, W. Digital Transformation and Value Creation: Sea Change Ahead. *Value Digit. Era* **2017**, *9*, 10–17. [\[CrossRef\]](#)
3. Morze, N.V.; Strutynska, O.V. Digital Transformation in Society: Key Aspects for Model Development. *J. Phys. Conf. Ser.* **2021**, *1946*, 012021. [\[CrossRef\]](#)
4. Gray, J.; Rumpe, B. Models for the Digital Transformation. *Softw. Syst. Model.* **2017**, *16*, 307–308. [\[CrossRef\]](#)
5. Van Veldhoven, Z.; Vanthienen, J. Designing a Comprehensive Understanding of Digital Transformation and Its Impact. In *Proceedings of the Humanizing Technology for a Sustainable Society, Bled, Slovenia, 16–19 June 2019*; University of Maribor Press: Maribor, Slovenia, 2019; pp. 745–763.
6. Li, F. Leading Digital Transformation: Three Emerging Approaches for Managing the Transition. *Int. J. Oper. Prod. Manag.* **2020**, *40*, 809–817. [\[CrossRef\]](#)
7. Schallmo, D.R.A.; Williams, C.A. History of Digital Transformation. In *Digital Transformation Now!* Springer: Cham, Germany, 2018; pp. 3–8.
8. Artemenko, E. The Roles of Top Management in Digital Transformation. *IOP Conf. Ser. Mater. Sci. Eng.* **2020**, *940*, 012014. [\[CrossRef\]](#)
9. Shaughnessy, H. Creating Digital Transformation: Strategies and Steps. *Strateg. Leadersh.* **2018**, *46*, 19–25. [\[CrossRef\]](#)

10. Kontić, L.; Vidicki, Đ. Strategy for Digital Organization: Testing a Measurement Tool for Digital Transformation. *Strateg. Manag.* **2018**, *23*, 29–35. [\[CrossRef\]](#)
11. Klein, M. Leadership Characteristics in the Era of Digital Transformation. *Bus. Manag. Stud. An. Int. J.* **2020**, *8*, 883–902. [\[CrossRef\]](#)
12. Westerman, G.; Bonnet, D.; McAfee, A. *Leading Digital: Turning Technology into Business Transformation*; Harvard Business Review Press: Brighton, MA, USA, 2014.
13. Matt, C.; Hess, T.; Benlian, A. Digital Transformation Strategies. *Bus. Inf. Syst. Eng.* **2015**, *57*, 339–343. [\[CrossRef\]](#)
14. Kunisch, S.; Menz, M.; Langan, R. Chief Digital Officers: An Exploratory Analysis of Their Emergence, Nature, and Determinants. *Long Range Plan.* **2020**, *55*, 101999. [\[CrossRef\]](#)
15. Xiao, Y.; Watson, M. Guidance on Conducting a Systematic Literature Review. *J. Plan. Educ. Res.* **2019**, *39*, 93–112. [\[CrossRef\]](#)
16. Brereton, P.; Kitchenham, B.A.; Budgen, D.; Turner, M.; Khalil, M. Lessons from Applying the Systematic Literature Review Process within the Software Engineering Domain. *J. Syst. Softw.* **2007**, *80*, 571–583. [\[CrossRef\]](#)
17. Kitchenham, B. *Procedures for Performing Systematic Reviews*; Keele University: Keele, UK, 2004; ISBN 1353-7776.
18. Kitchenham, B.; Pretorius, R.; Budgen, D.; Brereton, O.P.; Turner, M.; Niazi, M.; Linkman, S. Systematic Literature Reviews in Software Engineering—A Tertiary Study. *Inf. Softw. Technol.* **2010**, *52*, 792–805. [\[CrossRef\]](#)
19. Kitchenham, B.; Brereton, O.P.; Budgen, D.; Turner, M.; Bailey, J.; Linkman, S. Systematic Literature Reviews in Software Engineering—A Systematic Literature Review. *Inf. Softw. Technol.* **2013**, *51*, 7–15. [\[CrossRef\]](#)
20. Becker, W.; Schmid, O.; Botzkowski, T. Role of CDOs in the Digital Transformation of SMEs and LSEs—An Empirical Analysis. In Proceedings of the Annual Hawaii International Conference on System Sciences, Honolulu, HI, USA, 3–6 January 2018; University of Hawai‘i at Mānoa: Honolulu, HI, USA, 2018; pp. 4534–4543.
21. Berman, S.; Baird, C.H.; Eagan, K.; Marshall, A. What Makes a Chief Digital Officer Successful? *Strateg. Leadersh.* **2020**, *48*, 32–38. [\[CrossRef\]](#)
22. Buchwald, A.; Lorenz, F. Who Is in Charge of Digital Transformation? The Birth and Rise of the Chief Digital Officer. *Acad. Manag. Proc.* **2020**, *2020*, 14317. [\[CrossRef\]](#)
23. Chhachhi, V.; Fifer, K.; Kim, M.S.; Yeonho Kim, Y.H.; Stead, V.; Stryker, J.G. How Effective Chief Digital Officers Navigate Digital Transformations. *China Bus. Rev.* **2016**, *2016*. Available online: <https://www.chinabusinessreview.com/how-effective-chief-digital-officers-navigate-digital-transformations/> (accessed on 1 January 2022).
24. Ctarino, J.; Rosa, I.; Da Silvi, M.M. Defining the Chief Digital Officer Using COBIT5. *ISACA J.* **2018**, *6*, 41–48.
25. Drechsler, K.; Wagner, H.; Reibenspiess, V. Risk and Return of Chief Digital Officers’ Appointment—An Event Study. In Proceedings of the 40th International Conference on Information Systems, ICIS 2019, Munich, Germany, 15–18 December 2019.
26. Firk, S.; Hanelt, A.; Oehmichen, J.; Wolff, M. Chief Digital Officers: An Analysis of the Presence of a Centralized Digital Transformation Role. *J. Manag. Stud.* **2021**, *58*, 1800–1831. [\[CrossRef\]](#)
27. Haffke, I.; Kalgovas, B.; Benlian, A. The Role of the CIO and the CDO in an Organization’s Digital Transformation. In Proceedings of the 2016 International Conference on Information Systems, ICIS 2016, Dublin, Ireland, 11–14 December 2016.
28. Horlacher, A.; Hess, T. What Does a Chief Digital Officer Do? In Managerial Tasks and Roles of a New C-Level Position in the Context of Digital Transformation. In Proceedings of the 2016 49th Hawaii International Conference on System Sciences (HICSS), Kauai, Hawaii, 5–8 January 2016; pp. 5126–5135.
29. Horlacher, A.; Klarner, P.; Hess, T. Crossing Boundaries: Organization Design Parameters Surrounding CDOs and Their Digital Transformation Activities. In Proceedings of the 22nd Americas Conference on Information Systems (AMCIS), San Diego, CA, USA, 11–14 August 2016.
30. Kessel, L.; Graf-Vlachy, L. Chief Digital Officers: The State of the Art and the Road Ahead. *Manag. Rev. Q.* **2021**, *2021*, 1–38. [\[CrossRef\]](#)
31. Kossowski, J.; Heumuller, E.; Richter, S. Digital Fitness—Goal for the Chief Digital Officer. In Proceedings of the 2020 IEEE International Conference on Engineering, Technology and Innovation (ICE/ITMC), Cardiff, UK, 15–17 June 2020; pp. 1–7.
32. Kutnjak, A.; Križanić, S.; Pihir, I. Educational and Practical View of Knowledge, Skills and Experience Needed by a Chief Digital Officer. In Proceedings of the EDULEARN19: 11th International Conference on Education and New Learning Technologies, Palma, Spain, 1–3 July 2019; IATED-INT ASSOC TECHNOLOGY EDUCATION & DEVELOPMENT: Valencia, Spain, 2019; pp. 5711–5718.
33. Locoro, A.; Ravarini, A. The CIO and CDO Socio-Technical Roles in the Age of Digital Business Transformation: An Interpretive Study. In *Lecture Notes in Information Systems and Organisation*; Cabitza, F., Batini, C., Magni, M., Eds.; Springer: Berlin/Heidelberg, Germany, 2019; pp. 235–245.
34. Moker, A. What Do We Know about the Chief Digital Officer? A Literature Review. In Proceedings of the Conference of the Association-for-Information-Systems (AMCIS), Virtual Conference, 15–17 August 2020; Association for Information Systems (AIS): Atlanta, GA, USA, 2020.
35. Singh, A.; Hess, T. How Chief Digital Officers Promote the Digital Transformation of Their Companies. *MIS Q. Exec.* **2017**, *16*, 1–17.
36. Singh, A.; Klarner, P.; Hess, T. How Do Chief Digital Officers Pursue Digital Transformation Activities? The Role of Organization Design Parameters. *Long Range Plan.* **2020**, *53*, 101890. [\[CrossRef\]](#)
37. Tahvanainen, S.; Luoma, E. Examining the Competencies of the Chief Digital Officer Completed Research. In Proceedings of the 24th Americas Conference on Information Systems (AMCIS)—Digital Disruption, New Orleans, LA, USA, 16–18 August 2018.



38. Tumbas, S.; Berente, N.; Brocke, J. vom Digital Innovation and Institutional Entrepreneurship: Chief Digital Officer Perspectives of Their Emerging Role. *J. Inf. Technol.* **2018**, *33*, 188–202. [[CrossRef](#)]
39. Tumbas, S.; Berente, N.; vom Brocke, J. Three Types of Chief Digital Officers and the Reasons Organizations Adopt the Role. *MIS Q. Exec.* **2017**, *16*, 121–134.
40. Mičić, L.; Khamooshi, H.; Raković, L.; Matković, P. Defining the Digital Workplace: A Systematic Literature Review. *Strateg. Manag.* **2022**. Online-first. [[CrossRef](#)]
41. Westerman, G. Should Your CIO Be Chief Digital Officer? Available online: <https://hbr.org/2013/08/should-your-cio-be-chief-digit> (accessed on 2 April 2022).
42. Berkman, R. The Emergence of Chief Digital Officers. Available online: <https://sloanreview.mit.edu/article/social-business-helps-usher-in-new-executive-the-cdo/> (accessed on 2 April 2022).
43. Wade, M.; Obwegeser, N. How to Choose the Right Digital Leader for Your Company. Available online: <https://sloanreview.mit.edu/article/how-to-choose-the-right-digital-leader-for-your-company/> (accessed on 2 April 2022).
44. Reck, F.; Fliaster, A. Four Profiles of Successful Digital Executives. Available online: <https://sloanreview.mit.edu/article/four-profiles-of-successful-digital-executives/> (accessed on 1 January 2022).
45. Sharma, D.; Muratovic, F.; Schroeck, M.; Kwan, A. Designing the Modern Digital Function—How a CDO Can Help Orchestrate the Digital Transformation Journey. Available online: <https://www2.deloitte.com/us/en/insights/focus/industry-4-0/chief-digital-officer-digital-transformation-journey.html> (accessed on 2 April 2022).