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International Journal of Information Systems and Project Management (IJISPM)
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EDITORIAL

It is our great pleasure to bring you the second issue of the 14th volume of IJISPM. In this issue, readers will find important contributions on ethical considerations in digital ethics, digital transformation, career sustainability and satisfaction, coordination technology, collaborative culture, artificial intelligence, and risk management.

Navigating the digital frontier: Unveiling the dimensions of corporate digital responsibility practice

Anna Wannhoff, Markus Westner

This paper conducts an in-depth review of the last five years of Corporate Digital Responsibility (CDR) research, aiming to define CDR practices through a systematic literature review and grounded theory. The study identifies six aggregate dimensions of CDR practices: organisational culture, stakeholder engagement, ethical and responsible use of technology, governance and compliance, digital literacy and education, and innovation and future readiness. These dimensions are derived from 52 selected studies, yielding 180 coded insights. The paper highlights the importance of these dimensions in assessing and understanding companies' CDR practices and proposes a research agenda to address existing gaps in the literature. The findings provide a foundational framework for both researchers and practitioners to evaluate and enhance CDR dimensions, contributing in the long term to the development of a framework or model to measure and assess CDR practices. This framework or model aims to guide strategic CDR initiatives and foster responsible digital practices in the evolving digital landscape.

Fostering retention among project managers through career sustainability

Beatriz Jacob, Pilar Mosquera

Given the high turnover in project management due to limited development opportunities, this paper examines the role of career sustainability in addressing this organizational challenge. Career sustainability is defined as the opportunity and capability of individuals to remain in productive and meaningful work over time, across the lifespan, and in changing career contexts. Drawing on sustainable career theory, a conceptual model was tested using partial least squares structural equation modelling (PLS-SEM) with data from 224 project managers. The model incorporates four dimensions of career sustainability – resourcefulness, renewability, flexibility, and integrativeness – as predictors of career satisfaction, well-being, and both organisational and career turnover intentions. Results indicate that resourcefulness and renewability are the strongest predictors of positive outcomes. Socio-demographic analyses suggest that resourcefulness plays a greater role in reducing career turnover among senior professionals, while renewability more strongly enhances well-being for participants without children. These findings provide empirical evidence on the relevance of career sustainability in project-based contexts and offer practical insights for organisations aiming to retain and support their project management workforce.

Enhancing client controls and information systems development project outcomes: Roles of team collaborative culture and coordination technology

Weidong Xia, Mingyu Zhang, Shekhar Rathor

Effective client controls, both behavioral and outcome-based, are essential to the success of Information Systems Development (ISD) projects. Yet, the role of project team collaborative culture and coordination technology in enabling these controls remains insufficiently examined. The authors propose and test a research model about these relationships using structural equation modeling with survey responses from 218 ISD projects. The results show that collaborative culture and coordination technology both significantly increase clients' use of behavior and outcome controls. In turn, these controls are positively associated with project outcomes, underscoring the importance of aligning project culture and tools with management practices. The findings contribute to the IS project management literature by highlighting how fostering a collaborative culture and leveraging coordination technology can lead to more successful project outcomes. This study provides practical guidance for ISD practitioners by demonstrating how collaborative culture and

coordination technology can be leveraged alongside client behavioral and outcome controls to reduce coordination costs, manage task dependencies, and improve project assessment and adaptive management, thereby enhancing project success.

Leveraging artificial intelligence for project risk management: Insights from evidence-based analyses and case studies

Afef Saihi

Artificial Intelligence (AI) has emerged as a transformative force in project risk management (PRM), transitioning traditional methods into dynamic, proactive frameworks capable of addressing modern project complexities. This evolution enables PRM to align more effectively with strategic goals while addressing uncertainties across diverse industries. Despite its promise, AI adoption in PRM varies significantly across sectors, presenting gaps in application and understanding. This study explores AI's role in enhancing PRM, focusing on its impact on risk management elements, emerging trends, and real-world applications. Using a qualitative and evidence-based methodology, the research integrates insights from academic literature, industry reports, and consulting publications, supplemented by case studies of leading organizations. Findings reveal substantial advancements in PRM through AI, highlighting improved decision-making, operational efficiency, and enhanced resilience. Case studies from Siemens, JPMorgan Chase, and Turner Construction demonstrate AI's effectiveness in tackling challenges, optimizing processes, and achieving objectives. This study expands academic discourse on AI adoption in PRM and provides actionable insights for organizations, offering guidance to overcome barriers and maximize technological investments.

We want to take this opportunity to express our gratitude to the distinguished members of the Editorial Board for their commitment and for sharing their knowledge and experience in supporting the IJISPM.

Finally, we would like to express our gratitude to all the authors who submitted their work for their insightful visions and valuable contributions.

We hope that you, the readers, find the International Journal of Information Systems and Project Management an interesting and valuable resource for your continued work.

The Editor-in-Chief,

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RESEARCH ARTICLE

Navigating the digital frontier: Unveiling the dimensions of corporate digital responsibility practice

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Abstract

This paper conducts an in-depth review of the last five years of Corporate Digital Responsibility (CDR) research, aiming to define CDR practices through a systematic literature review and grounded theory. The study identifies six aggregate dimensions of CDR practices: organisational culture, stakeholder engagement, ethical and responsible use of technology, governance and compliance, digital literacy and education, and innovation and future readiness. These dimensions are derived from 52 selected studies, yielding 180 coded insights. The paper highlights the importance of these dimensions in assessing and understanding companies' CDR practices and proposes a research agenda to address existing gaps in the literature. The findings provide a foundational framework for both researchers and practitioners to evaluate and enhance CDR dimensions, contributing long-term to the development of a framework or model to measure and evaluate CDR practices. This framework or model aims to guide strategic CDR initiatives and foster responsible digital practices in the evolving digital landscape.

Keywords

corporate digital responsibility; digital ethics; data ethics; data protection; digital transformation.

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1. Introduction

The rapid advancement of digitalization has profoundly reshaped business operations and strategic orientations - a phenomenon widely known as digital transformation (Ngereja et al., 2024). However, these advancements are accompanied by emerging challenges, particularly ethical concerns related to data governance and privacy, which extend beyond individual organisations to impact a broad range of stakeholders (Xu et al., 2018). Addressing these complexities requires a comprehensive approach to managing digital transformation in a responsible, ethical, and sustainable manner (Saeed et al., 2023).

In this context, Corporate Digital Responsibility (CDR) has emerged as a management concept, building upon the foundation of Corporate Social Responsibility (CSR) (Herden et al., 2021). CDR refers to a company's responsibility in the digital society (Mueller, 2022). It involves voluntary commitments to sustainable business practices that consider the societal and economic changes brought about by digital transformation (Lobschat et al., 2021). CDR aims to balance the benefits of digital transformation with ethical practices, ensuring transparency in data processing, responsible use of artificial intelligence, and sustainable digital operations (Esselmann et al., 2020). It is an extension of CSR, focusing specifically on digital aspects, such as data privacy, cybersecurity, and governance (Doerr, 2021).

As organizations increasingly navigate the complexities of digital transformation, CDR has become a critical concept for guiding responsible business practices in the digital age (Doerr, 2021). This concept addresses the ethical, social, and environmental challenges posed by digital technology in a corporate context, ensuring that companies act responsibly while harnessing the power of technology (Lobschat et al., 2021). The growing relevance of CDR makes it a timely and essential area of research, as companies must balance technological advancement with the broader values of transparency, accountability, and sustainability (Herden et al., 2021).

Research on CDR has grown rapidly since 2019, particularly in information systems (IS) literature (Bednárová & Serpeninova, 2023). Current research focuses on defining CDR concepts and theoretical foundations, with increasing interest in practical implementation (Angermann, 2023). Studies examine how companies incorporate digital ethics into their strategies (Lobschat et al., 2021; Altmeppen & Filipović, 2019; Jones & Comfort, 2021; Kunz et al., 2024). However, there is limited research on the fundamental dimensions of CDR practices, crucial for analysing long-term impacts.

This paper presents an in-depth review of the last five years of CDR research. It categorises existing literature reviews into three phases (pre-adoption, adoption, and post-adoption) to identify initial research gaps (RQ1). Building on this, a systematic literature review (SLR) was conducted, reviewing 52 studies on CDR from 2020 to 2024 using an inductive method to define relevant dimensions of CDR practices (RQ2). The findings were synthesised, identifying further research gaps and summarising them in a research agenda (RQ3).

This research paper has three main outcomes and contributions: first, this research paper provides an in-depth overview of the current state of knowledge on CDR by building upon prior studies that primarily defined the terminology for CDR (Mueller, 2022; Wynn & Jones, 2023; Carl & Hinz, 2024; Cheng & Zhang, 2023; Herden et al., 2021; Jones & Comfort, 2021; Kempkes et al., 2022; Knopf & Pick, 2023; Lobschat et al., 2021; Londoño-Cardozo & Paz, 2021) and emphasized its conceptual differences from CSR (Van der Merwe & Al Achkar, 2022; Orbik & Zozuľaková, 2019; Covucci et al., 2024). Second, it uses grounded theory to build a thematic map that inductively classifies and describes relevant dimensions of CDR practices, based on a systematic and structured analysis. The analysis of these dimensions uncovers six aggregate dimensions and 23 second order themes across current literature that shed light on the scope, contextualisation and measurability and of each dimension. Both researchers and practitioners can leverage these aggregate dimensions and second order themes to facilitate a culture of accountability and ongoing enhancement, while also gaining a deeper understanding of CDR in general and the challenges associated with implementing CDR in practice. Third, by summarizing

the central papers and providing a thorough overview of CDR research in its entirety, emerging trends and promising further avenues in the research field of CDR are identified and summarized in a research agenda.

The paper is organised as follows: Chapter 2 gives an overview of prior research on CDR research. Chapter 3 details the study's methodology. Chapter 4 summarises data collection and analysis, presenting research results and identifying CDR practice dimensions. Chapter 5 discusses findings and proposes a research agenda, with Chapter 6 concluding the paper.

2. Background and related work

2.1. Conceptual foundations of CDR

CDR as a concept is grounded in several theoretical foundations that intersect business ethics, corporate governance, and information and communication technologies (ICT) (Herden et al., 2021). Initially rooted in the broader framework of CSR, which emerged prominently in the 1970s to address social and environmental issues arising from globalization, industrialization, and consumerism, CDR has evolved to address the specific ethical and societal challenges posed by the pervasive digital transformation in contemporary business environments (Munro, 2020; Kaidalova et al., 2018). While CSR and CDR partly overlap in the sense of joint goals and addressing social and environmental issues, CDR concentrates on the particular risks and intricacies presented by a digital environment, as well as the significantly more intricate responsibilities that arise from the use of digital technologies (Lobschat et al., 2021).

Over the past few years, the idea of CDR has significantly advanced and garnered considerable attention in the corporate world. It is now viewed as a critical factor for all economic stakeholders when formulating their sustainable development strategies (Rugeviciute, 2023). However, academic research on this concept is still in its infancy. Compared to CSR, CDR is less universally embraced and lacks the same level of standardization through frameworks and regulations, necessitating ongoing introspection and innovation (Marengo, 2023). The primary reason for this is that CDR is often perceived as a voluntary obligation, encompassing adherence to legal mandates and reflecting the core values that guide an organization's conduct (Merbecks, 2024). As a result, the level of awareness for and development of CDR strategies varies between countries.

One of the countries that has been actively promoting and implementing CDR strategies is Germany, which is currently considered as a leader in this field (Bednárová & Serpeninova, 2023). The German CDR Initiative, which was initiated by the German Federal Ministry of Justice (BMJ) in May 2018, represents a proactive and comprehensive approach to managing the ethical challenges posed by digital transformation (CDR Initiative, 2023). The initiative encourages companies to voluntarily commit to nine guiding principles in their digital practices to foster a collaborative environment where businesses, policymakers, and other stakeholders work together to create a more responsible digital economy (CDR Initiative, 2023).

2.2. Previous literature reviews of CDR research

To understand the constraints of current academic discourse on CDR, this paper examines previous literature reviews on CDR. Using the methodology of Ribeiro et al. (2021) and Rugeviciute (2023), 28 literature reviews from Scopus and Google Scholar (2019-2024) were classified by discussion topics and adoption phases (see Table 1). The dataset, which can be accessed in Appendix A, focuses on business, management, and economics articles. Categorising research by adoption phase helps researchers and practitioners monitor CDR development and identify gaps in the discourse. This approach is particularly useful for emerging research fields, providing insights into how companies integrate CDR into their operations.

Table 1. Categorisation of previous CDR literature review findings by adoption phases and discussion topics

Phase	Discussion topics	Representative literature review contributions from sample
(1) Pre-adoption	1.1 CDR conceptualization	1.1 (Bednárová & Serpeninova, 2023; Mueller, 2022; Carl & Hinz, 2024; Cheng & Zhang, 2023; Herden et al., 2021; Jones & Comfort, 2021; Knopf & Pick, 2023; Lobschat et al., 2021; Londoño-Cardozo & Paz, 2021)
	1.2 CSR vs. CDR	1.2 (Van der Merwe & Al Achkar, 2022; Orbik & Zozuľaková, 2019; Covucci et al., 2024)
	1.3 CDR dimensions	1.3 (Herden et al., 2021; Lobschat et al., 2021; Ivancic & Giermindl, 2023, Mihale-Wilson et al., 2022; Wynn & Jones, 2023)
	1.4 Motivating factors	1.4 (Altmeppen & Filipović, 2019; Ivancic & Giermindl, 2023)
	1.5 Risk assessment and management	1.5 (Carl, 2023)
	1.6 CDR readiness and organisational mindset	1.6 (Lobschat et al., 2021; Wynn & Jones, 2023)
	1.7 CDR awareness and understanding	1.7 (Lobschat et al., 2021; Mueller, 2022)
(2) Adoption	2.1 CDR implementation strategies	2.1 (Jones & Comfort, 2021; Wirtz et al., 2023)
	2.2 Digital governance and accountability	2.2 (Jelovac et al., 2022)
	2.3 Data privacy and security	2.3 (Carl, 2021; Carl, 2023; Volkov & Sidorenko, 2022)
	2.4 Sustainability and environmental impact	2.4 (Wilkinson, 2023)
	2.5 Data and AI	2.5 (Aldboush & Ferdous, 2023; Elliott et al., 2021; Kunz & Wirtz, 2023; Wagener, 2022)
	2.6 Governance and frameworks	2.6 (Breivogel, 2024)
(3) Post-adoption	3.1 Monitoring and evaluation	3.1 (Carl, 2021; Wirtz et al., 2023)
	3.2 Impacts and benefits	3.2 (Herden et al., 2021)
	3.3 Reporting and communication	3.3 (Lobschat et al., 2021)

2.2.1 Pre-adoption phase of CDR research

During the pre-adoption stage of CDR, literature reviews focus on raising awareness and establishing a foundational understanding within organisations. Most reviews concentrate on conceptualising CDR (1.1), comparing it with CSR (1.2), and defining its dimensions (1.3) (see Table 1).

Researchers have contributed to understanding CDR by aiding its conceptualisation (1.1) (Bednárová & Serpeninova, 2023; Mueller, 2022; Carl & Hinz, 2024; Cheng & Zhang, 2023; Herden et al., 2021; Jones & Comfort, 2021; Knopf & Pick, 2023; Lobschat et al., 2021; Londoño-Cardozo & Paz, 2021). Although the conceptual framework is developing, a clear and consistent definition is still needed. Appendix B presents selected definitions and conceptualisations from current literature, adapted from Mueller (2022) and Knopf and Pick (2023).

Current CDR definitions highlight two main areas: digital ethics, ensuring accountability in social, economic, technological, and environmental aspects (Lobschat et al., 2021; Cheng & Zhang, 2023; Herden et al., 2021), and governance, establishing a framework for adhering to norms and values at various organisational levels (Carl & Hinz, 2024; Mueller, 2022; Lobschat et al., 2021). Most definitions are generic, often lacking specific activity scopes. They agree that CDR extends beyond legal regulations, rooted in corporate culture, which may need further clarification (Knopf & Pick, 2023); (Mueller, 2022). This study will define CDR by focusing on concrete actions like ensuring data transparency during processing, differentiating it from CSR.

> *CDR refers to a company's responsibility in the digital society. It involves voluntary commitments to sustainable business practices that consider the societal and economic changes brought about by digitalization. CDR aims to balance the benefits of digital innovation with ethical practices, ensuring transparency in data processing, responsible use of artificial intelligence, and sustainable digital operations. It is an extension of CSR, focusing specifically on digital aspects.*

Literature reviews differentiate CDR from CSR, highlighting unique aspects and overlaps (1.2). Van Der Merwe and Al Achkar (2022) argue that while CSR addresses broader societal and environmental responsibilities, CDR focuses on the ethical use of digital technologies and data. They emphasize the need for a comprehensive approach to manage data responsibly. Orbik and Zozuľaková (2019) link CSR and digital transformation, highlighting CDR's importance. Covucci et al. (2024) propose combining Digital Sustainability (DS) and CDR into Corporate Digital Sustainability (CDS) to manage digital sustainability and promote responsible advancement.

Moreover, owing to its novelty, many researchers dedicated considerable effort and resources to exploring the various dimensions of CDR (1.3) (Lobschat et al., 2021; Ivancic & Giermindl, 2023; Mihale-Wilson et al., 2022; Wynn & Jones, 2023). Herden et al. (2021) categorise CDR into digital ethics and governance. Ivancic and Giermindl (2023) emphasize the need for proper governance, risk management, and compliance frameworks for digital technologies and AI. They suggest that CDR encompasses economic, ecological, social and technical dimensions, extending the traditional triple-bottom line to a quadruple-bottom line.

Altmeppen and Filipović(2019) highlight factors motivating stakeholders to adopt CDR strategies (1.4), including ethical considerations, regulatory compliance, reputation management, corporate governance, and competitive advantage. Other researchers focus on risk assessment methods for companies adopting CDR strategies (1.5), identifying risks related to data privacy, cybersecurity, ethical AI usage, and digital governance (Carl, 2023). Few studies systematically structure and identify these specific risks (Wynn & Jones, 2023).

Additionally, research on frameworks to assess companies' readiness (1.6) and awareness (1.7) for CDR is limited. Some frameworks evaluate readiness for digital transformation, closely related to CDR (1.6), covering dimensions like people, technology, processes, customers, and strategy (Lobschat et al., 2021). Wynn and Jones (2023) suggest using qualitative and quantitative metrics, such as employees' digital skills, digital infrastructure, governance policies, and stakeholder involvement. Customizing assessment approaches for each industry is essential due to varying CDR readiness (Lobschat et al., 2021).

Conceptual frameworks for CDR awareness (1.7) include ethical awareness, data privacy, cybersecurity, and responsible digital technology use (Lobschat et al., 2021). Surveys and questionnaires gauge employees' and management's knowledge and attitudes towards CDR principles. However, self-assessment questionnaires' subjective nature and inconsistent data quality pose challenges, prompting calls for standardized and objective measurement tools (Mueller, 2022).

2.2.2 Adoption phase of CDR research

The adoption phase of CDR research primarily focuses on how to implement and integrate responsible digital practices within corporations. Researchers have examined CDR implementation (2.1) across various industries and technological contexts, including digital governance (2.2) (Jelovac et al., 2022), data privacy (2.3) (Carl, 2021; Carl, 2023; Volkov & Sidorenko, 2022), sustainability (2.4) (Wilkinson, 2023), and AI (2.5) (Aldboush & Ferdous, 2023; Elliott et al., 2021; Kunz & Wirtz, 2023; Wagener, 2022). However, there is a notable deficiency in empirical studies and methodologies that support decision-making and governance concerning CDR (2.6) during the adoption phase. The core of this problem lies in the lack of a shared comprehension regarding the extent of CDR (Kunz & Wirtz, 2023), as discussed in the prior chapter.

While many frameworks emphasize conceptual understanding over practical application, Jones and Comfort (2021) offer recommendations for effectively implementing CDR (2.1). These include integrating CDR into corporate strategy, engaging stakeholders, ensuring transparency and accountability, providing ongoing education and training, and maintaining diligent monitoring and reporting. Effective CDR implementation often requires an interdisciplinary approach, combining insights from business ethics, IS, and corporate governance (Wirtz et al., 2023). This holistic perspective helps organisations navigate the multifaceted nature of CDR. Additionally, current literature reviews emphasize the need to cultivate distinct competencies for CDR, encompassing digital ethics, data governance, and stakeholder engagement skills (Breivogel, 2024). Challenges in implementing CDR include the absence of unified metrics, the complexity of digital ecosystems, and organizational reluctance to change. Overcoming these hurdles necessitates regulatory support, organizational dedication, and continuous learning (Breivogel, 2024).

There remains a scarcity of empirical research offering specific data on how companies are adopting CDR practices. This is due to the theoretical nature of much current literature, the broad scope of issues encompassed by CDR, and the underdevelopment of reliable measurement tools, making it challenging to evaluate the effectiveness of CDR initiatives.

2.2.3 Post-adoption phase of CDR research

The post-adoption phase of CDR research primarily focuses on how corporations integrate and sustain responsible digital practices after initial implementation. Research for this phase is limited, with few scholars delving into them, thereby restricting the understanding of the long-term success of implemented CDR strategies. Some literature reviews have proposed first guidelines for monitoring CDR activities and evaluate their effectiveness (3.1) (Carl, 2021; Wirtz et al., 2023). While Carl (2021) identified eight dimensions of CDR and associated sub-dimensions, emphasizing the need for a strategic approach to CDR implementation, Wirtz et al. (2023) highlighted the impact of AI for CDR and the benefits of building a strong CDR culture.

However, only a limited number of literature reviews have proposed specific guidelines for evaluating the impact and benefits of CDR strategies (3.2) (Herden et al., 2021), as well as concrete reporting mechanisms and communication strategies for different stakeholders (3.3) (Lobschat et al., 2021). The literature review of Herden et al. (2021) firstly emphasized the need for a strategic approach to CDR implementation, based on the perceived opportunities and threats associated with digitalisation. Lobschat et al. (2021) examined how to convert CDR into practical guidelines for organizations and various stakeholders, initiating first CDR-related communication mechanisms within an organisational framework.

2.2.4 Identified research gaps in CDR research

While CDR research has sparked significant discussion, several gaps and challenges remain. In the pre-adoption phase, there is a lack of frameworks to assess companies' readiness and awareness for CDR, with current research relying on subjective self-assessment questionnaires. During the adoption phase, empirical studies and methodologies to support decision-making and governance are deficient, with a need for more interdisciplinary approaches and concrete strategies.

In the post-adoption phase, research is limited in exploring the long-term success and sustainability of CDR strategies, with few studies offering guidelines for monitoring, evaluating impact, and developing standardized reporting mechanisms.

Over the past decade, most research has focused on the pre-adoption and adoption phases, understandable given CDR's nascent nature. This diversity complicates creating a cohesive framework for post-adoption research. Rapid technological advancements also pose challenges for longitudinal studies and consistent data collection. Future studies should focus on the post-adoption phase to understand the long-term impacts of CDR practices and identify standardized indicators and metrics.

Before assessing long-term impacts, it is essential to understand CDR dimensions within an organisational context. Although various perspectives have been explored in the pre-adoption phase, research on specific CDR dimensions remains limited. RQ2 aims to address this gap by conducting a systematic literature review (SLR) to identify relevant concepts, themes, and dimensions of CDR practices in an organisational setting.

3. Methodology

SLRs are widely used in evidence-based practice, policy making, and academic research for their comprehensive and objective overview of current knowledge (Fisch & Block, 2018). This is particularly advantageous for identifying gaps within the dynamic and heterogenous body of CDR literature. The SLR was conducted in adherence to Okoli and Schabram's (2015) SLR guidelines, using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework for data selection, and incorporating the recommendations of Fisch and Block (2018) and Booth et al. (2021) to guarantee the review's high quality.

This SLR uses a scoping and descriptive method to evaluate existing CDR literature, aiming to develop an overview of dimensions of CDR practices, and establish a research agenda for future investigations to address remaining research gaps. For the purpose of data collection, three different electronic databases were used to run the preselected search query: Business Source Premier (EBSCO), Google Scholar, and Scopus. Acknowledging that CDR research is still in its early stages, the researcher has chosen to incorporate various journals and source types (e.g. journals, books, and conference proceedings) while intentionally excluding ongoing studies to provide a comprehensive overview of the subject. The dataset encompassed the timeframe of 2020 to 2024 and specifically concentrated on articles pertinent to business, management, or economics to eliminate unrelated publications.

Concerning the construction of search parameters, a variety of keyword combinations were selected that included “Corporate Digital Responsibility”, “Digital Responsibility”, and the combined terms “Digital Responsibility” AND “Corporate”. As recommended by Knopf and Pick (2023), using queries such as “Digital Responsibility” and “Digital Responsibility AND Corporate” helps to overcome the constraints of sentence construction in abstracts while also encompassing literature on Digital Responsibility beyond the corporate sphere. The search parameters were designed to be broad to cover all aspects of CDR that could be pertinent to understanding the various dimensions of CDR practices. Narrowing the search to keywords like "Corporate Digital Responsibility Practices" would have limited the scope and produced fewer results. In order to account for publications where the full text was not accessible, the search was limited to publication titles and the “include citations” search feature was deactivated. In addition to executing search queries across the three electronic databases, the researcher conducted a manual examination of CDR literature within the top management and IS journals, specifically the AIS Basket of Eight, which refers to a collection of the top academic journals in the field of IS, curated by the Association for Information Systems (AIS) (Mazaheri et al., 2020).

The initial search in July 2024 yielded 950 publications. After review, only a small portion was relevant. The final selection of pertinent articles was based on their relevance to CDR practices, following a structured, multi-step process in line with PRISMA guidelines to ensure transparency and comprehensiveness. The procedure and its related samples are illustrated in Figure 1.

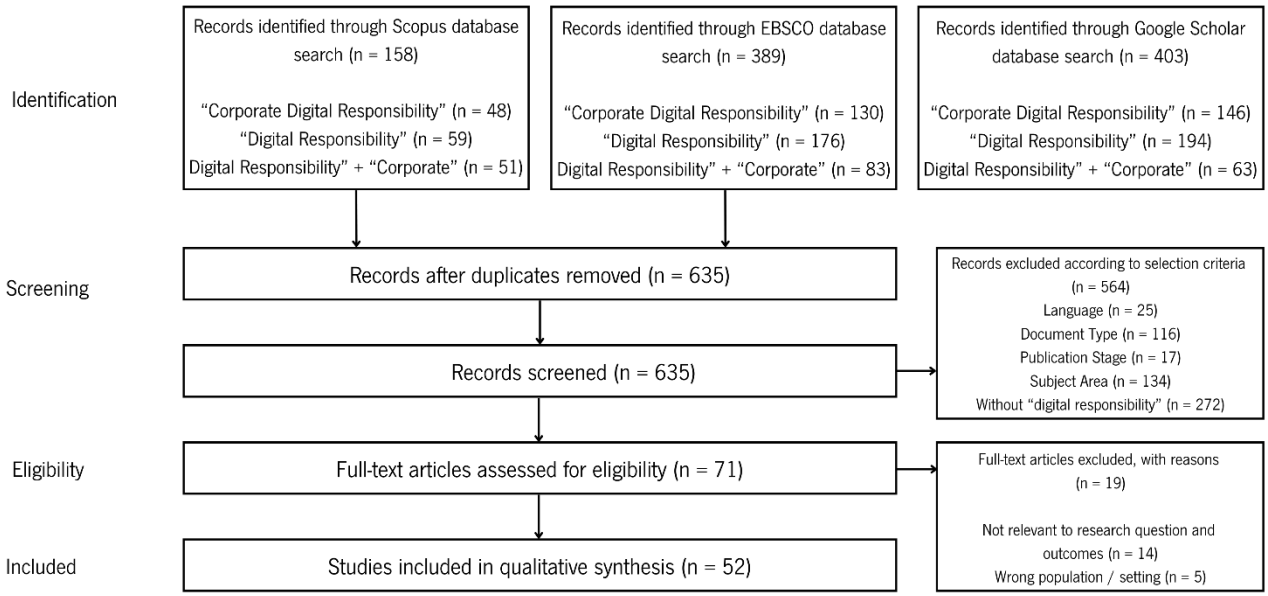


Fig. 1. PRISMA Flow Diagram (own illustration adapted from Moher et al. (2009)).

Following the exclusion of duplicates, a screening of titles, abstracts, and keywords was performed to assess suitability. Utilizing predefined selection criteria, 564 publications were excluded, resulting in a refined sample set of 71 studies. Subsequent to these procedures, the remaining publications were thoroughly reviewed and categorized. Only studies that explicitly focused on CDR and were pertinent to the research outcomes of RQ2, with the aim of defining relevant dimensions of CDR practices, were considered for the final selection. Any study that did not directly relate to "Digital Responsibility" was not included. Employing this criterion, 52 papers met all the necessary conditions and were incorporated into the final sample.

Based on the guidance of Nadkarni and Pruegl (2021), along with Webster and Watson (2002), the literature categorisation and analysis were centred around concepts, themes and dimensions. Hence, to lay the groundwork for the preliminary coding process, every paper chosen underwent review to ascertain specific details including authors, publishing year, article title, outlet, research methodology, geographic region, and key insights (see full database in Appendix C). Subsequently, the coding process commenced, entailing multiple phases to methodically examine and decipher the data. First, the data was segmented into distinct elements (first order concepts) to meticulously scrutinize it for recurring themes, patterns, and classifications (open coding) (Hernandez, 2009).

Second, the data was reorganized in second order themes to establish links between the categories that emerged from open coding, a process known as axial coding. Third, the second order themes are assigned to aggregate dimensions (selective coding), which serve as the main anchors for all related categories and enhance theory development, signifying the apex of abstraction in the overall coding process (Nadkarni & Pruegl, 2021). The coding process is visualized in Appendix D.

4. Results

While CDR is an evolving field that integrates responsible digital practices into corporate strategies, the 52 studies incorporated in the final sample of this SLR provide initial insights and evidence regarding the practical application of CDR within an organisational context. Some of the key insights on how to apply CDR in practice include a holistic approach, as CDR spans social, economic, technological, and environmental areas. Integrating these aspects under the organisational umbrella ensures a consistent and complementary approach. Using the previously outlined coding process, the different characteristics and application areas of CDR practices were systematically analysed and condensed into 23 second order themes, and six aggregate dimensions. Within the scope of this research, we define dimensions as overarching thematic categories that group related practices, principles, or organizational activities under a common conceptual umbrella (Jelovac et al., 2022). Each dimension represents a distinct but interrelated area of CDR that captures specific aspects of how organizations approach, implement, and sustain responsible digital practices across different phases of adoption.

4.1. Descriptive statistics of sample

Prior to delving into the coding process results, a brief description of the sample's study characteristics will be provided (see full database in Appendix C). In this dataset, the majority of research originates from Germany (18 studies), with a substantial number coming from the United Kingdom (6 studies) (see Figure 2).

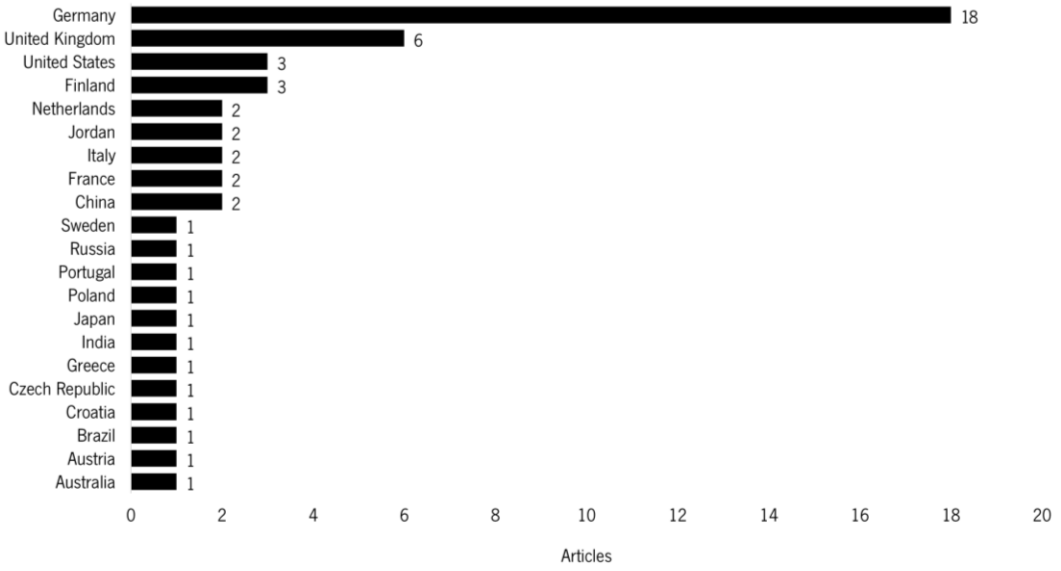


Fig. 2. Number of published articles by region in CDR literature sample

Around three-quarters (75%) of these publications pertain to IS research, whereas the remaining quarter (25%) provides a wider managerial outlook on CDR. The evaluated studies cover a time frame from 2020 to 2024, with about 75% of papers emerging in the past two years, reflecting the novelty of the CDR concept (see Figure 3).

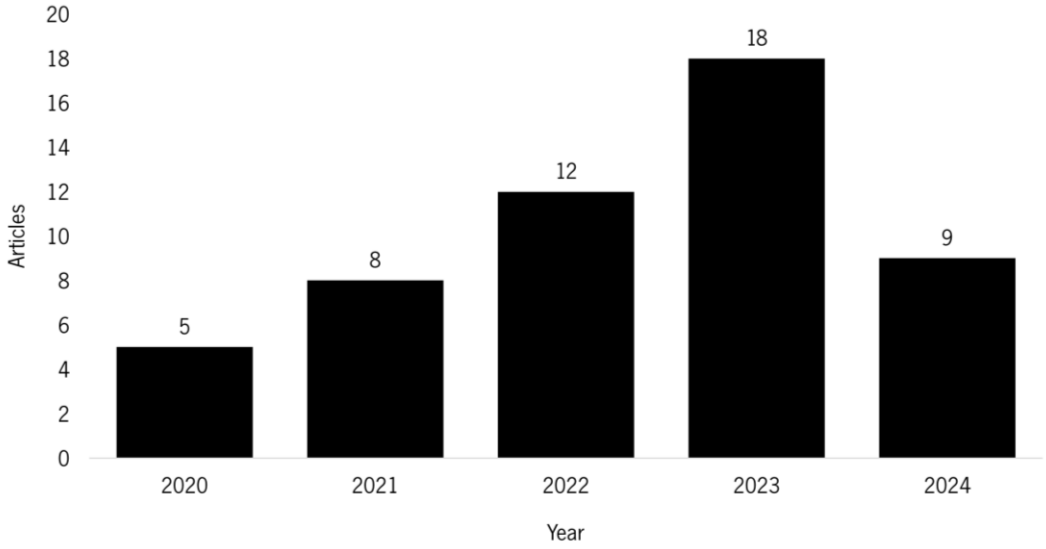


Fig. 3. Number of published articles by year in CDR literature sample

Most of the studies were published as journal articles (29), followed by conference papers (15), university publications (6) and book chapters (2). Among the most frequently cited researchers in CDR research are Carl, K.V., Doerr, S., Herden, C. J., Lobschat, L., Mueller B., and Wirtz, J., listed alphabetically. The analysis of the research methodologies reveals that the majority of the studies employed a qualitative research methodology (22), followed by conceptual papers (12). Although a few researchers adopted the mixed methods approach (10) and quantitative methods (5), case studies constituted the smallest portion of the research (3) (see Figure 4).

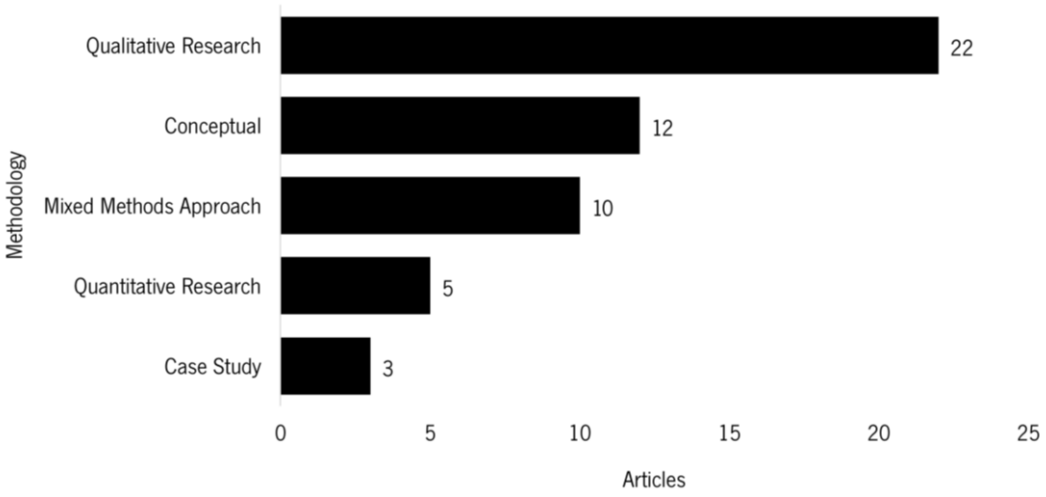


Fig. 4. Number of published articles by methodology in CDR literature sample

In the qualitative research block, many studies utilised focus group interviews and scientific questionnaires, alongside scenario techniques, content and text analysis, and hermeneutical investigations. The primary reasons for the abundance of qualitative research and scarcity of case studies are twofold: firstly, CDR encompasses a wide range of topics, including data privacy, ethical AI practices, and digital sustainability, making it challenging to execute thorough case studies. Secondly, CDR frequently demands cooperation across diverse fields like business ethics, information technology, and law. Orchestrating these cross-disciplinary endeavours can be challenging and time-intensive.

4.2. Coding process results of CDR practices

Upon reviewing and analysing the sample using the grounded theory coding process, the research field of CDR yielded 180 coded insights: 93 first-order concepts, 23 second order themes, and six aggregate dimensions (see full database in Appendix E). The coding process yields a high-level inductive map that highlights the core themes and dimensions of CDR practices, as shown in Figure 5. In the following, the most important findings of each aggregate dimension, including the second order themes, are presented and discussed (clockwise).

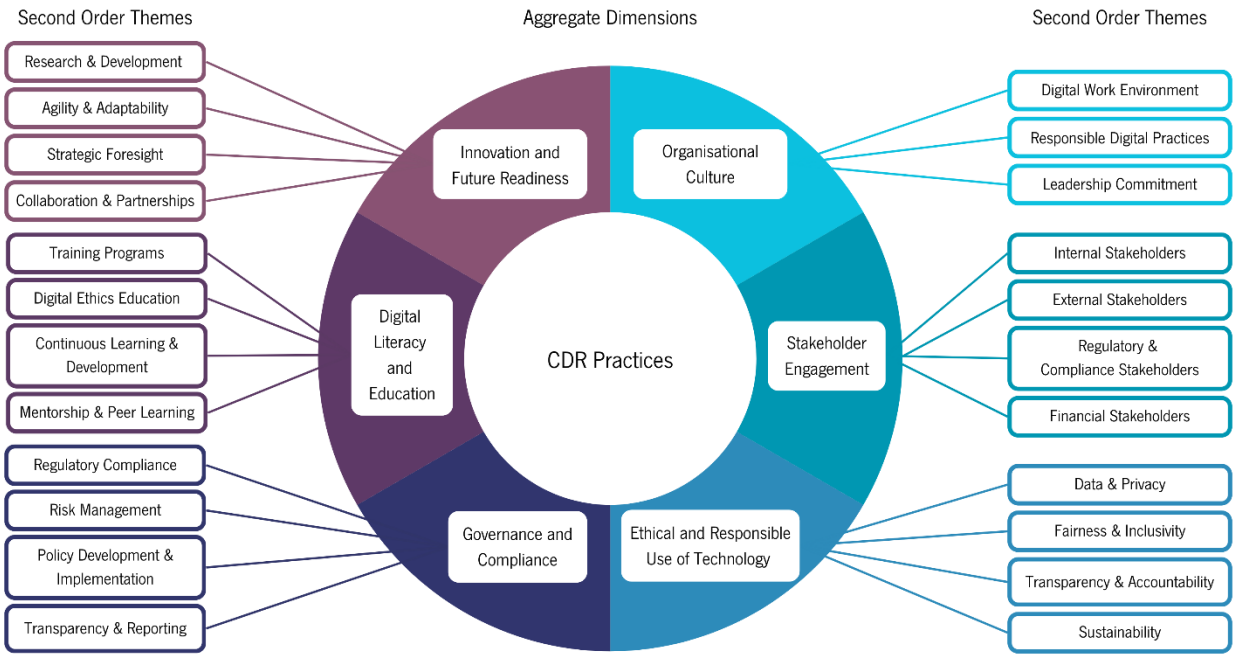


Fig. 5. CDR practices high level thematic map emerging from sample analysis

4.2.1 Organisational culture

Based on the sample analysis, it is evident that a company's organisational culture is essential for effectively implementing CDR practices in an organisational context. Developing an organisational culture that involves employees in the digital transformation process and prepares and supports them during change is crucial for the long-term success of CDR practices (Broers, 2023). In the course of the coding process, three second-order themes were identified (see Figure 6). These themes will be elaborated upon in the subsequent paragraphs.

First, a robust digital work environment fosters a culture where employees are equipped with the necessary tools and training to navigate digital landscapes responsibly. This includes ensuring data privacy, promoting digital literacy, and

creating an inclusive digital workspace that supports collaboration and innovation (Mueller, 2022). The digital work environment must also address the ergonomic and psychological well-being of employees, ensuring that digital tools enhance productivity without causing undue stress or health issues (Herden et al., 2021). Organisations must ensure that office layouts and digital workspaces demonstrate a dedication to digital responsibility. For instance, they can create collaborative spaces that encourage ethical discussions about technology use. Moreover, engaging employees in CDR initiatives through training and awareness programs fosters a sense of ownership and accountability, and transparent communication channels enable employees to voice concerns and share ideas related to CDR, promoting a culture of continuous improvement (Elliott & Copilah-Ali, 2024).

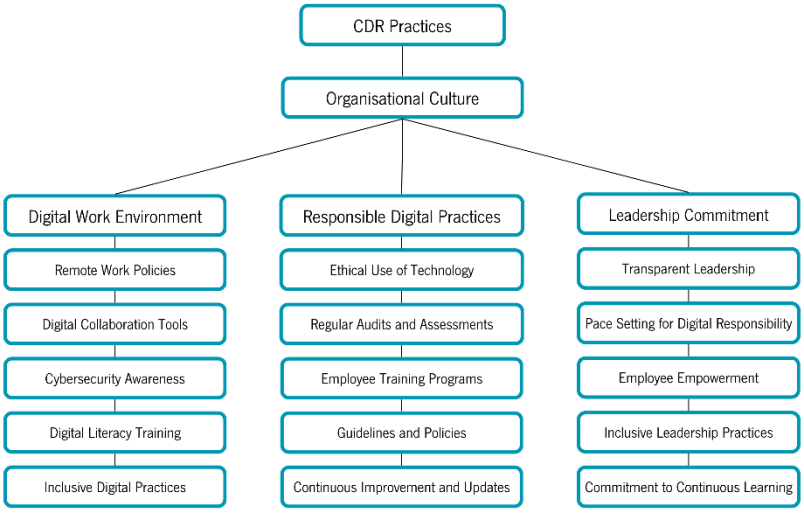


Fig. 6. Aggregate dimension of CDR practices: organisational culture

Second, responsible digital practices involve the ethical use of digital technologies, emphasizing transparency, accountability, and the minimization of digital risks such as data breaches and misinformation (Herden et al., 2021). These practices are integral to maintaining trust and integrity within the organisation and with external stakeholders, including customers and partners (Aldboush & Ferdous, 2023). Implementing responsible digital practices necessitates a comprehensive strategy that encompasses regular audits, employee training, and the establishment of clear guidelines, and policies (Lobschat et al., 2021). Moreover, organisations must stay abreast of evolving digital threats and continuously update their practices to mitigate potential risks (Broers, 2023).

Third, leadership commitment is crucial for embedding CDR into the organisational culture. Leaders play a vital role in setting the tone for CDR by demonstrating a clear commitment to a culture of digital responsibility through policies, actions, and communication (Kunz et al., 2024). This includes setting up governance frameworks, such as digital ethics boards, and advocating for responsible digital transformation. Leadership commitment also involves fostering a culture of openness and accountability, where ethical considerations are integrated into decision-making processes at all levels of the organisation (Hamadi & Manzo, 2021). By championing digital responsibility, leaders can inspire employees to adopt and uphold these values, ensuring that the organisational culture aligns with the principles of CDR (Mihale-Wilson et al., 2022).

4.2.2 Stakeholder engagement

Stakeholder engagement is the second aggregate dimension of CDR practices, emphasizing the importance of involving various stakeholder groups to ensure ethical, transparent, and sustainable digital operations. Based on the sample analysis and coding process, four key stakeholder groups can be identified: internal stakeholders, external stakeholders, regulatory and compliance stakeholders, and financial stakeholders. For each stakeholder group, the main actors or acting groups are listed, with connecting lines used to clearly associate them with the respective stakeholder group in the onion diagram in Figure 7.

Internal stakeholders, particularly employees, are crucial for carrying out and adhering to CDR guidelines within the organisation. Employees need to be well-informed and trained on digital responsibility practices to foster a culture of ethical digital behaviour within the organisation. This includes understanding data privacy, cybersecurity measures, and the ethical implications of digital technologies (Broers, 2023). Management plays a crucial role in setting the tone from the top, ensuring that digital responsibility is integrated into the company's strategic objectives and daily operations. Regular internal communications, workshops, and training sessions can help reinforce these values and practices among employees (Altmeppen & Filipović, 2019). Additionally, involving employees in the planning and implementation of CDR initiatives fosters a sense of ownership and commitment (Angermann, 2023) and creating opportunities for cross-departmental collaboration on CDR projects can lead to innovative solutions and a stronger sense of community (Aitken et al., 2021).

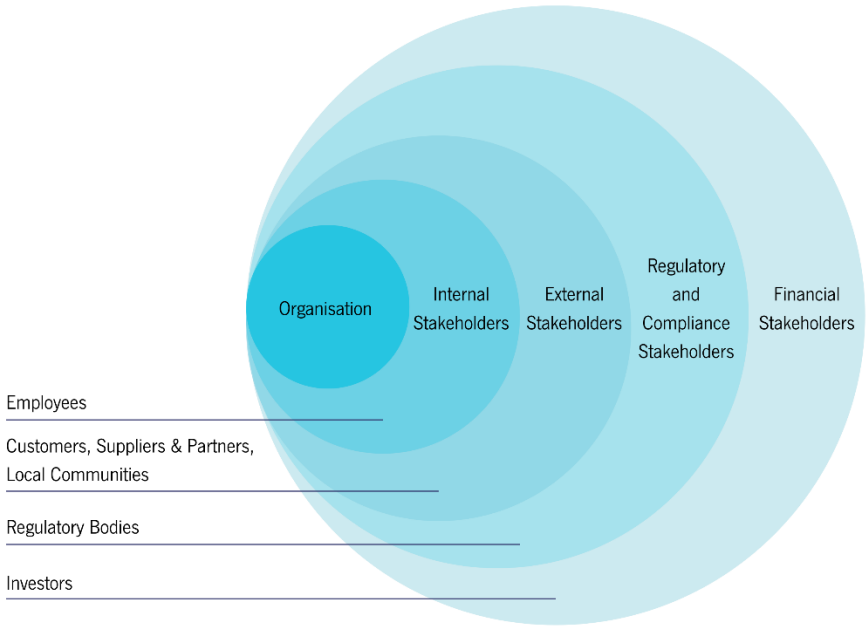


Fig. 7. Aggregate dimension of CDR practices: stakeholder engagement

External stakeholders, including customers, suppliers, partners, and local communities, play a vital role as their expectations and needs drive the ethical standards and practices of an organisation. Ensuring data privacy and security for customers, and promoting responsible digital practices among suppliers and partners, can enhance trust and reputation (Al-Omoush et al., 2024). Collaborative efforts with suppliers to uphold high standards of digital ethics and sustainability can enhance the entire supply chain's integrity (Aldboush & Ferdous, 2023). Additionally, engaging with the

broader community through CDR initiatives and digital literacy programs can further demonstrate the organisation's commitment to ethical digital practices (Schneider, 2022).

Regulatory and compliance stakeholders, such as regulatory bodies, provide the legal framework and guidelines that shape CDR strategies, ensuring organisations comply with relevant laws and ethical standards (Schneider, 2022). This proactive engagement can involve participating in industry forums, providing feedback on proposed regulations, and staying informed about changes in the regulatory landscape (Esselmann et al., 2020). Compliance with data protection laws, such as the General Data Protection Regulation (GDPR), and adherence to industry standards are essential components of CDR. By maintaining open lines of communication with regulatory bodies, companies can better navigate the complexities of digital compliance and demonstrate their commitment to legal and ethical standards (Carl, 2022). Additionally, regular internal audits and assessments help identify and address compliance gaps proactively.

Financial stakeholders, including investors, view CDR as a component of the organisation's broader sustainability and governance commitments, influencing their confidence and investment decisions (Marengo, 2023). For instance, transparent reporting on digital responsibility initiatives, such as sustainability reports and disclosures on data privacy practices, can enhance investor confidence (Kivistoe, 2024). Organisations that prioritize digital responsibility are often seen as lower-risk investments, as they are better prepared to handle regulatory changes and potential digital crises (Mueller, 2022). Engaging with financial stakeholders through regular updates, investor meetings, and sustainability reports can help align their interests with the organisation's long-term CDR practices and goals.

4.2.3 Ethical and responsible use of technology

The ethical and responsible use of technology is the third aggregate dimension of CDR practices, encompassing four secondary themes: data and privacy (DP), fairness and inclusivity (FI), sustainability (S), and transparency and accountability (TA) (see Figure 8).

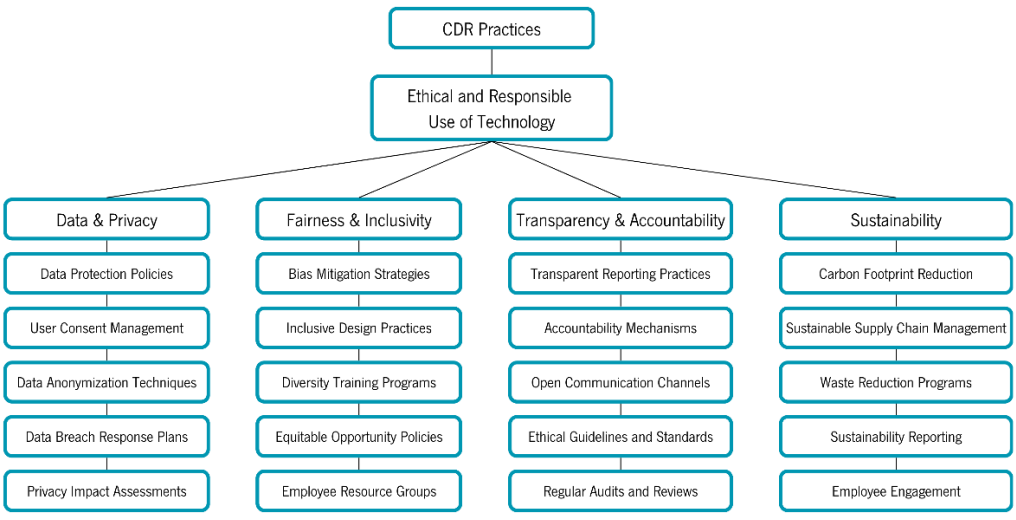


Fig. 8. Aggregate dimension of CDR practices: ethical and responsible use of technology

Data and privacy (DP) focuses on safeguarding personal information and ensuring that data collection, storage, and processing are conducted transparently and securely, respecting individuals' rights and comply with legal standards (Cheng & Zhang, 2023). This involves adopting practices such as data minimization and encryption, as well as implementing robust data protection measures and adhering to regulations such as the General Data Protection Regulation

(GDPR) to prevent data breaches and misuse (Kaerpaenen, 2022). According to Van Der Merwe and Al Achkar (2022), the integration of data responsibility within CDR frameworks is essential for managing the ethical implications of data-driven technologies.

Fairness and inclusivity (FI) aim to eliminate biases in technology deployment and promote equal access and opportunities for all users. This second order theme ensures that digital advancements benefit diverse populations without discrimination (Wagener, 2022). This involves actively working to eliminate algorithmic biases, ensuring accessibility for people with disabilities, and fostering a diverse and inclusive digital environment that reflects the varied needs and perspectives of society (Altmeppen & Filipović 2019). Doerr and Lautermann (2024) highlight the importance of creating a fair and inclusive digital society that goes beyond the legal minimum to address the needs of all stakeholders.

Sustainability (S) integrates environmental considerations into digital practices, emphasizing the reduction of carbon footprints, responsible resource use, and the development of eco-friendly technologies to support long-term ecological balance (Nagano, 2023). This involves adopting energy-efficient data centres, promoting the use of renewable energy sources, and designing products with a focus on recyclability and minimal environmental impact. By aligning technological advancements with ecological responsibilities, companies can contribute to a more sustainable future while also enhancing their reputation and competitiveness (Napoli, 2023). Herden et al. (2021) discuss the emerging responsibilities of organisations in relation to their digitalisation-related impacts, emphasizing the need for sustainable digital practices.

Transparency and accountability (TA) are critical for organisations to maintain public trust and demonstrate corporate integrity. It involves clear communication about how technologies are used and governed, ensuring that organisations are answerable for their digital actions and decisions (Wirtz et al., 2023). This includes providing users with understandable privacy policies, obtaining informed consent, and being responsive to user inquiries and concerns (Carl & Hinz, 2024). Additionally, organisations should establish mechanisms for accountability, such as independent audits and transparent reporting, to ensure that they are held responsible for their digital actions (Schneider, 2022).

Overall, these four second order themes are interconnected; they overlap, reinforce one another, and collectively establish an approach that ensures technology serves society in a responsible and ethical manner within the framework of CDR practices. Figure 9 demonstrates the interconnections and mutual influences among these themes.

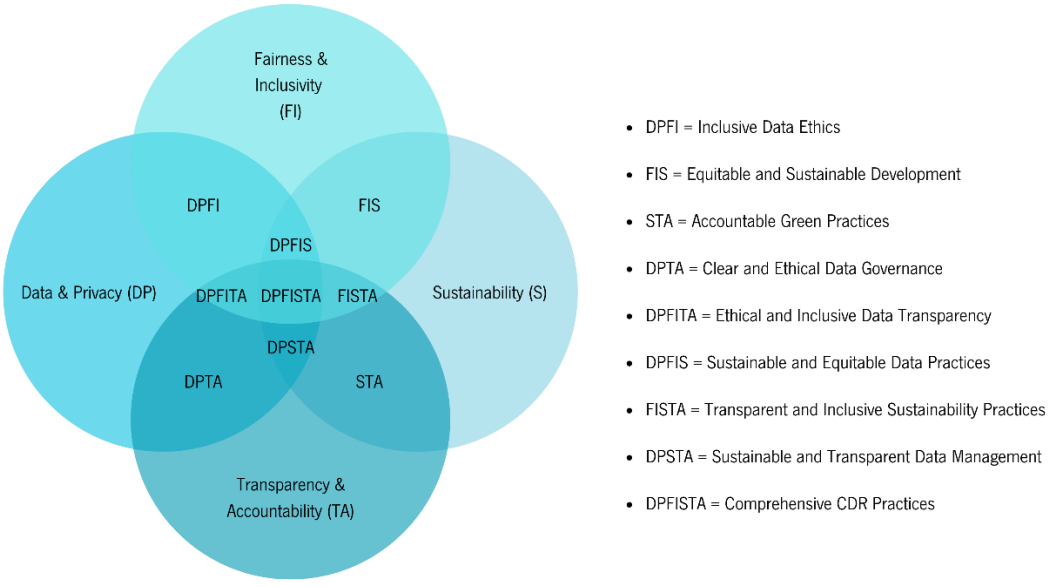


Fig. 9. Ethical and responsible use of technology - interconnection of second order themes

For instance, ethical data practices must be transparent and inclusive to build trust and ensure fairness. When organisations are transparent about their data practices and hold themselves accountable, they foster a culture of trust and responsibility, which is essential for maintaining user confidence and compliance with regulations. Similarly, sustainable practices should be accountable and inclusive, ensuring that environmental benefits are equitably distributed and do not disproportionately impact any group.

4.2.4 Governance and compliance

Governance and compliance is the fourth aggregate dimension of CDR practices, that ensures organisations adhere to ethical standards and legal requirements while leveraging digital technologies (Elliott & Copilah-Ali, 2024). Analysis of the sample data indicates the necessity for digital activities to align with legal, ethical, and societal expectations (Angermann, 2023; Broers, 2023; Lobschat et al., 2021). This results in the identification of four second order themes: regulatory compliance, risk management, policy development, and transparency and reporting (see Figure 10).

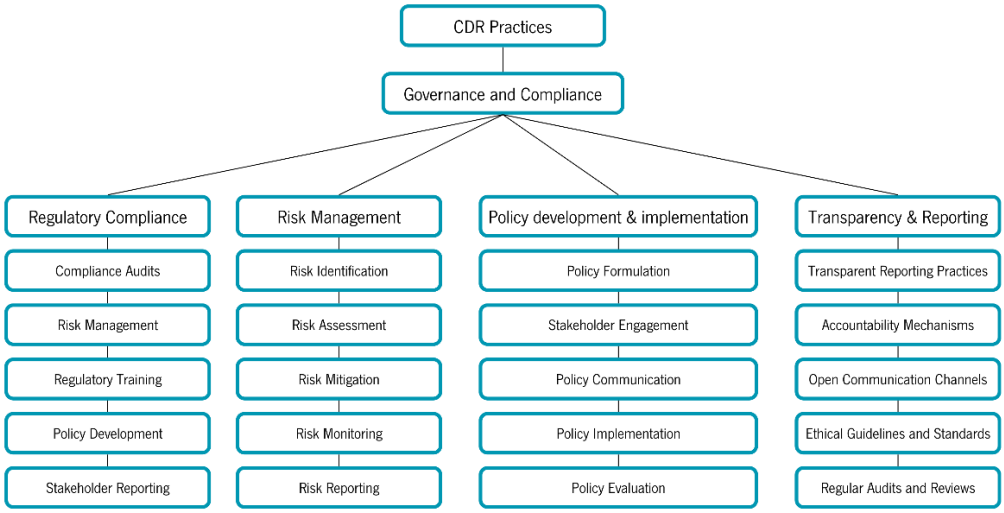


Fig. 10. Aggregate dimension of CDR practices: governance and compliance

Risk management in a CDR context focuses on identifying, assessing, and mitigating risks associated with digital operations (Weber-Lewerenz, 2022). This includes cybersecurity threats, data breaches, and other digital vulnerabilities that could impact the organisation. A proactive risk management approach involves conducting thorough risk assessments, developing and implementing risk mitigation strategies, and continuously monitoring risk exposure (Aldboush & Ferdous, 2023). By developing a comprehensive risk management strategy, organisations can effectively respond to digital threats, reducing potential damage and preserving operational integrity (Carl, 2022).

For effective implementation of CDR practices within an organisation, it is essential to have clear policies and procedures (Angermann, 2023). Policy development involves creating, updating, and implementing policies that govern digital practices within the organisation. These policies should be comprehensive, covering all aspects of digital responsibility, such as data protection, cybersecurity, ethical use of technology, and employee conduct (Wagener, 2022; Lobschat et al., 2021). Additionally, policies should be regularly reviewed and updated to reflect changes in technology, regulations, and organizational priorities (Mihale-Wilson et al., 2022).

Regulatory compliance involves adhering to digital laws and regulations, including data protection statutes such as the General Data Protection Regulation (GDPR) in Europe and the California Consumer Privacy Act (CCPA) in the United States, cybersecurity standards, and industry-specific mandates (Schneider, 2022). It also includes implementing Information Security Management Systems (ISMS) like ISO 27001 to manage risks and protect sensitive data (Mueller, 2022). Additionally, organisations need to establish compliance programmes to monitor and enforce these regulations, ensuring all digital practices comply with legal requirements (Carl & Hinz, 2024). This process involves conducting regular compliance audits, staying informed about regulatory updates, and providing training to employees on compliance-related topics (Wirtz et al., 2023).

Transparency and reporting emphasize the importance of clear and honest communication about digital practices. This includes regular reporting to stakeholders on compliance activities, risk management efforts, and policy adherence (Elliott et al., 2021). This transparency builds trust and accountability, fostering a culture of responsibility and ethical behaviour (Aitken et al., 2021). Transparency also includes interacting with stakeholders to understand their concerns and expectations, establishing open communication channels for feedback and inquiries, and integrating their feedback into digital responsibility practices (Jones, 2023).

4.2.5 Digital literacy and education

Digital literacy and education are fundamental components of CDR practices, designed to equip employees with essential digital skills and ethical awareness necessary for success in a technology-driven environment (Lautermann & Frick, 2023). The sample analysis indicates that cultivating a digitally proficient and ethically conscious workforce involves employing diverse formats and methodologies (Breivogel, 2024). These formats and methodologies are conceptualised in four second order themes: training programs, digital ethics education, mentorship and peer learning, and continuous learning and development (see Figure 11).

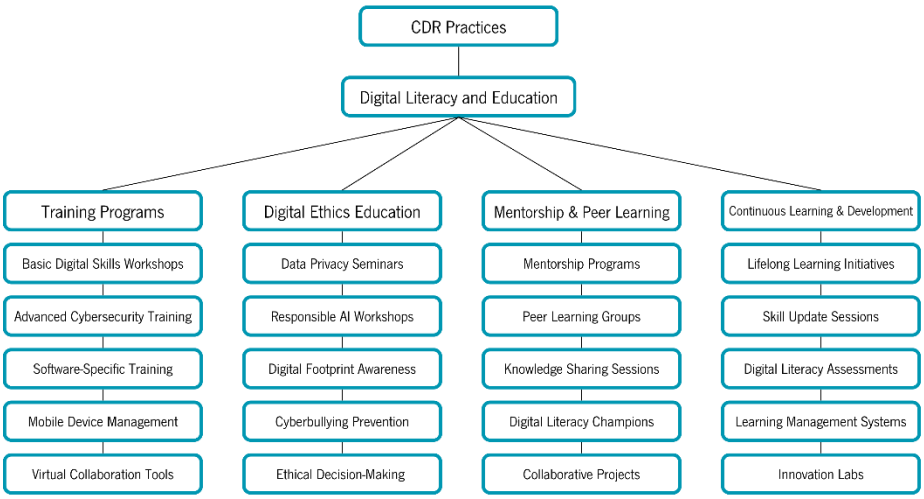


Fig. 11. Aggregate dimension of CDR practices: digital literacy and education

First, training programs are an essential part of digital literacy initiatives, offering structured opportunities for individuals to develop essential digital skills. These programs often encompass a wide range of topics, from basic digital tool usage to advanced cybersecurity measures (Clausen et al., 2023). According to Lautermann and Frick (2023), digital literacy training programs are instrumental in bridging the digital divide and fostering an inclusive digital ecosystem. These

programs are crucial for developing competencies such as information-seeking and communication, which are vital for personal and professional growth in the digital age.

Second, digital ethics education is another critical subdimension, focusing on the ethical implications of digital technology use. It involves informing employees about ethical issues related to digital technology, such as data privacy, cybersecurity, and the responsible use of digital tools (Elliott & Copilah-Ali, 2024). This education serves as a counterpart to the aggregate dimension of ethical and responsible use of technology. It can be provided through courses, seminars, and discussion groups. Real-world case studies and role-playing scenarios can assist employees in understanding and addressing ethical dilemmas they may face in their work.

Third, mentorship and peer learning play a crucial role in fostering a collaborative learning environment. Through mentorship programs, experienced individuals guide less experienced colleagues, sharing knowledge and best practices. Peer learning initiatives further enhance this by promoting knowledge exchange and collaborative problem-solving among employees (Lautermann & Frick, 2023). Additionally, peer learning groups promote knowledge sharing and collaboration among employees, fostering a culture of continuous improvement and ethical awareness (Clausen et al., 2023).

Last, continuous learning and development emphasizes the need for ongoing education to keep pace with rapid technological advancements (Mueller, 2022). This subdimension includes regular reassessments to evaluate progress and identify new learning requirements. This approach encourages a culture of lifelong learning, where employees are motivated to continually update their skills and knowledge (Wagener, 2022).

4.2.6 Innovation and future readiness

The final aggregate dimension for CDR practices is innovation and future readiness, which are crucial for organisations aiming to maintain a competitive edge and to be prepared to navigate and thrive in an ever-evolving digital landscape. This dimension encompasses four second-order themes that constitute a robust framework for innovation and future readiness in CDR: research and development (R&D), agility and adaptability, strategic foresight, and collaboration and partnerships. By incorporating these elements into their strategies, organisations can ensure they are not only prepared for future challenges but are also proactively shaping the future in a responsible and sustainable manner (see Figure 12).

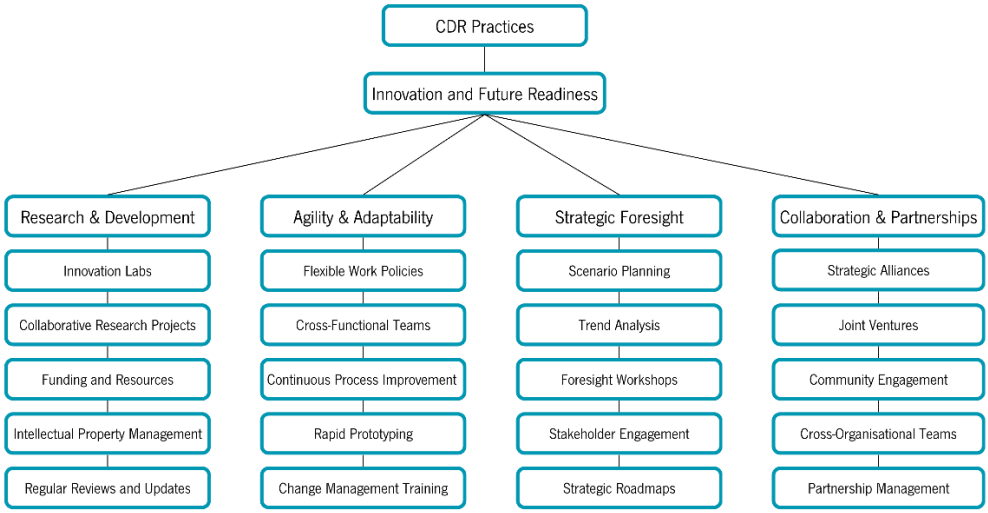


Fig. 12. Aggregate dimension of CDR practices: innovation and future readiness

Current research emphasizes that R&D is an important mechanism to drive the creation of new technologies and solutions that align with CDR practices (Kluiters et al., 2023). By investing in R&D, organisations can develop cutting-edge products and services that meet ethical standards and address societal needs, which in return fosters the successful implementation of CDR practices (Mihale-Wilson et al., 2022). In other words, prioritizing projects that have positive societal impacts, such as developing sustainable technologies or enhancing data privacy and security. By focusing on responsible R&D, organisations can ensure that their innovations do not harm society or the environment and align with broader ethical standards (Elliott et al., 2021).

In a rapidly evolving digital landscape, agility and adaptability are crucial for maintaining relevance and competitiveness. In terms of CDR, this means being able to quickly adapt to new regulations, ethical standards, and societal expectations (Breivogel, 2024). Current research highlights that organisations that are agile can more effectively implement responsible digital practices, such as swiftly addressing data breaches or adapting to new privacy laws (Viitikko, 2022).

Strategic foresight involves anticipating future trends and disruptions, enabling organisations to proactively shape their digital strategies and mitigate potential risks. This phase includes trend analysis and scenario planning, helping organisations prepare for potential future developments (Angermann, 2023). Moreover, current research emphasizes the role of strategic foresight in fostering corporate digital innovation, particularly in the context of environmental, social, and governance (ESG) practices (Herden et al., 2021).

Finally, collaboration and partnerships emphasize the importance of working with various stakeholders, including nonprofits, academia, and other businesses, to foster innovation and share best practices. These partnerships can enhance an organisation's ability to address complex digital challenges and drive collective progress towards responsible digital transformation (Elliott & Copilah-Ali, 2024). The integration of digital technologies in CSR activities has been shown to benefit from such collaborations, leading to more effective and impactful outcomes (Kunz et al., 2024; Lautermann & Frick, 2023).

5. Discussion

5.1. Synthesis and discussion of findings

Returning to the three research questions, RQ1 required a thorough examination of previous research on CDR through the analysis of literature reviews, organised into pre-adoption, adoption, and post-adoption phases, to identify potential research gaps. This structured approach highlighted the importance of a holistic CDR strategy and identified a significant research gap in the post-adoption phase, emphasizing long-term sustainability. RQ2 involved conducting a SLR of 52 studies from 2020 to 2024, defining six dimensions of CDR practices: organisational culture, stakeholder engagement, ethical and responsible use of technology, governance and compliance, digital literacy and education, and innovation and future readiness. These dimensions were derived from a detailed coding process that yielded 180 insights. Finally, RQ3 involves developing a research agenda that proposes new directions for future CDR research based on the synthesised findings and identified gaps. In order to develop the research agenda (RQ3), it is necessary to conduct a comparative discussion of the findings from previous research on CDR (RQ1) and current studies and research papers on CDR practices (RQ2) to achieve a synthesized overview.

To systematically compare the literature on each aggregate dimension, a comprehensive framework was developed to evaluate the presence (P), frequency (F), and relevance (R) of second order themes within both previous research on CDR (28 in total) and current research papers on CDR practices (52 in total).

Within this comprehensive framework, the following literature coding schema, extended based on research from Lacity et al. (2017) and Könning et al. (2019), was applied:

- **Presence (P)**: 1 if second order theme is mentioned, 0 if not.
- **Frequency (F)**: +1 if second order theme is frequently mentioned, 0 if occasionally, -1 if rarely.
- **Relevance (R)**: +1 if second order theme is central, 0 if mentioned, -1 if peripheral.

A detailed overview of the coding results across all second order themes can be found in Table 2.

Table 2. Coding schema results

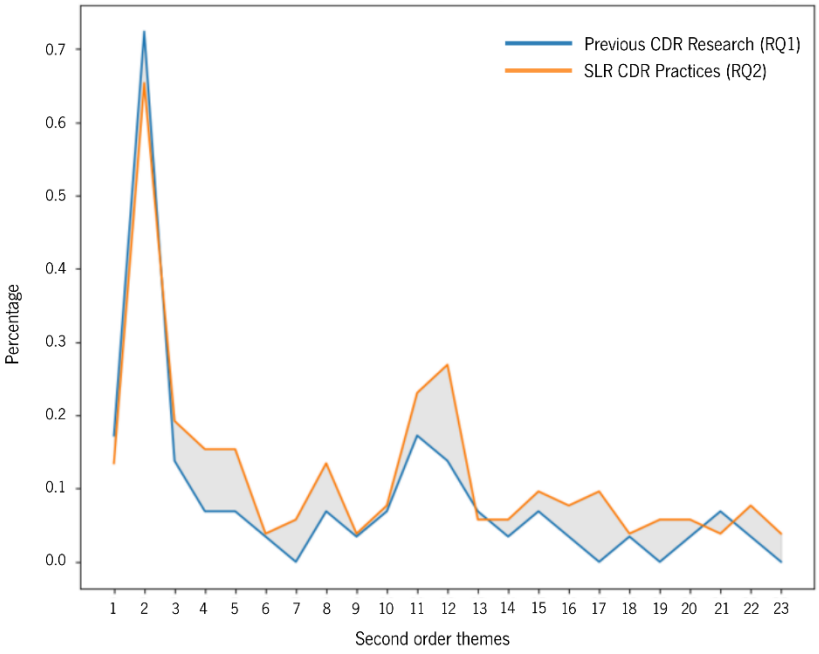
Aggregate dimensions	Second order themes		Previous CDR Research (RQ1)								SLR CDR Practices (RQ2)							
			P		F			R			P		F			R		
			1	0	+1	0	-1	+1	0	-1	1	0	+1	0	-1	+1	0	-1
Organisational culture	1	Digital work environment	5	23	1	1	3	0	3	2	7	45	3	2	2	1	5	1
	2	Responsible digital practices	21	7	8	8	5	4	12	5	34	18	15	12	7	9	18	7
	3	Leadership commitment	4	24	2	1	1	1	2	1	10	42	6	3	1	1	4	1
Stakeholder engagement	4	Internal stakeholders	2	26	1	1	0	0	0	2	8	44	3	3	2	1	4	3
	5	External stakeholders	2	26	1	1	0	0	0	2	8	44	3	3	2	1	4	3
	6	Regulatory & compliance stakeholders	1	27	0	1	0	0	1	0	6	46	2	2	2	1	3	2
	7	Financial stakeholders	0	28	0	0	0	0	0	0	3	49	1	1	1	0	2	1
Ethical and responsible use of technology	8	Data & privacy	2	26	0	1	1	0	0	2	7	45	1	4	2	0	2	5
	9	Fairness & inclusivity	1	27	0	1	0	0	0	1	2	50	0	1	1	0	1	1
	10	Transparency & accountability	2	26	1	1	0	0	1	1	4	48	2	1	1	1	2	1
	11	Sustainability	5	23	2	2	1	1	2	2	12	40	4	5	3	3	5	4
Governance and compliance	12	Regulatory compliance	4	24	1	1	2	0	1	3	14	38	4	3	7	3	4	7
	13	Risk Management	2	26	0	0	2	0	0	2	3	49	0	1	2	0	1	2
	14	Policy development & implementation	1	27	0	0	1	0	0	1	3	49	0	1	2	0	1	2
	15	Transparency & reporting	2	26	0	1	1	0	1	1	5	47	1	2	2	0	2	3

Aggregate dimensions	Second order themes	Previous CDR Research (RQ1)								SLR CDR Practices (RQ2)							
		P		F			R			P		F			R		
		1	0	+1	0	-1	+1	0	-1	1	0	+1	0	-1	+1	0	-1
Digital literacy and education	16 Training programs	1	27	0	0	1	0	0	1	4	48	0	2	2	0	2	2
	17 Digital ethics education	0	28	0	0	0	0	0	0	5	47	0	2	3	0	2	3
	18 Continuous learning & development	1	27	0	0	1	0	0	1	2	50	0	1	1	0	1	1
	19 Mentorship & peer learning	0	28	0	0	0	0	0	0	3	49	0	1	2	0	1	2
Innovation and future readiness	20 Research & development	1	27	0	0	1	0	0	1	3	49	0	1	2	0	1	2
	21 Agility & adaptability	2	26	0	1	1	0	1	1	6	46	1	3	2	1	3	2
	22 Strategic foresight	1	27	0	0	1	0	0	1	4	48	1	2	1	1	2	1
	23 Collaboration & partnerships	0	28	0	0	0	0	0	0	2	50	0	1	1	0	1	1

Figure 13 illustrates the percentage distribution of second order themes across previous research on CDR through the analysis of literature reviews and the SLR results on CDR practices from Table 2. The first three themes, related to organisational culture, show consistent distribution. However, literature on stakeholder engagement varies significantly. Regulatory compliance is mentioned in 14.3% of CDR literature reviews, but appears in 26.9% of research papers on CDR practices. Digital ethics education (item 17) is absent in literature reviews but appears in at least five research papers. Agility and adaptability (item 21) are more frequently discussed in literature reviews than in research papers.

Both previous research on CDR through the analysis of literature reviews and the SLR results on CDR practices underscore the necessity of an in-depth approach that integrates social, economic, technological, and environmental aspects. This integration ensures that CDR practices are aligned with an organisation's strategic objectives and ethical standards. Both sources highlight the importance of fostering an organisational culture that encourages digital responsibility, while also providing a conducive digital work environment for employees. For instance, contemporary literature reviews on CDR primarily discuss the need for employee engagement in promoting ethical and responsible digital practices (e.g., Wirtz et al., 2023). Similarly, research papers on CDR identify organisational culture as a pivotal factor, emphasizing the role of leadership commitment in establishing the foundation for CDR and involving employees in the digital transformation process. For example, Lobschat et al. (2021) emphasize the significance of a supportive organisational culture in advancing CDR initiatives.

While previous research on CDR through the analysis of literature reviews generally address the relevance of organisational culture for CDR, research papers on CDR practices conceptualise the specific subdimensions of organisational culture that need to be involved and how they interact. Additionally, some research papers offer concrete actions such as minimizing digital risks, building an inclusive digital workspace, and establishing digital ethics boards and governance frameworks. However, further research is necessary to analyse the relationship between CDR and organisational culture, including correlating effects, dimensions, and clear, adjustable action plans for organisations. A summary of pertinent future research questions is provided in Table 3, located in the subsequent chapter, as part of the developed research agenda.



	Previous CDR Research (RQ1)			SLR CDR Practices (RQ2)		
Second order themes	P 1	P 0	Percentage	P 1	P 0	Percentage
1	5	23	17.9%	7	45	13.5%
2	21	7	75.0%	34	18	65.4%
3	4	24	14.3%	10	42	19.2%
4	2	26	7.1%	8	44	15.4%
5	2	26	7.1%	8	44	15.4%
6	1	27	3.6%	6	46	3.9%
7	0	28	0.0%	3	49	5.8%
8	2	26	7.1%	7	45	13.5%
9	1	27	3.6%	2	50	3.9%
10	2	26	7.1%	4	48	7.7%
11	5	23	17.9%	12	40	23.1%
12	4	24	14.3%	14	38	26.9%
13	2	26	7.1%	3	49	5.8%
14	1	27	3.6%	3	49	5.8%
15	2	26	7.1%	5	47	9.6%
16	1	27	3.6%	4	48	7.7%
17	0	28	0.0%	5	47	9.6%
18	1	27	3.6%	2	50	3.9%
19	0	28	0.0%	3	49	5.8%
20	1	27	3.6%	3	49	5.8%
21	2	26	7.1%	6	46	3.9%
22	1	27	3.6%	4	48	7.7%
23	0	28	0.0%	2	50	3.9%

Fig. 13. Distribution of second order themes across previous CDR research and SLR results on CDR practices in percentage

Engaging stakeholders is a common theme in both previous CDR literature reviews and research papers on CDR practices. Altmeppen and Filipović(2019) identify ethical considerations, regulatory compliance, reputation management, corporate governance, and competitive advantage as key motivators for stakeholders to adopt CDR strategies. Research papers also emphasize stakeholder engagement, illustrating how organisations collaborate with customers, suppliers, regulatory bodies, and investors to maintain ethical digital practices. Broers (2023) highlights the role of stakeholder engagement in promoting transparency and accountability within CDR practices. Table 2 shows that literature reviews focus on internal and external stakeholders, while research papers additionally highlight regulatory, compliance, and financial stakeholders. Engaging financial stakeholders through updates, meetings, and sustainability reports helps align their interests with long-term CDR objectives. Further research is needed to explore the relationship between behavioural finance, investor management, and CDR implementation.

Both samples highlight the importance of ethical and responsible use of technology, including data privacy, fairness, inclusivity, transparency, and sustainability (Mueller, 2022; Broers, 2023; Mihale-Wilson et al., 2022). As shown in Table 2, most research in both samples focuses on sustainability. Literature reviews primarily discuss the ethical implications of digital technology use and the significance of data protection measures (Wynn & Jones, 2023; Cheng & Zhang, 2023). Research papers on CDR practices elaborate on these themes, providing detailed insights into how organizations can implement responsible digital practices and address issues such as algorithmic biases and cybersecurity threats. For example, Carl (2021) and Volkov and Sidorenko (2022) emphasize the need for robust data protection measures. Although current literature has identified dimensions of ethical and responsible use of technology, research on their intersections and interrelationships remains limited. Chapter 4 introduces Figure 8, which provides an initial illustration to understand the interdependencies among these second-order themes. Further research is necessary to explore each theme and its subdimensions in greater depth. This will improve our understanding of defining and measuring accountable green practices, ethical and inclusive data transparency, sustainable and transparent data management, and other related concepts.

Governance and compliance are foundational to CDR practices in both samples. Previous research on CDR through the analysis of literature reviews outline the need for robust governance frameworks and compliance with digital laws and regulations. For instance, Jelovac et al. (2022) discuss the importance of governance frameworks for maintaining responsible digital conduct. The research papers on CDR practices build on this by identifying governance and compliance as a key dimension, emphasizing the importance of risk management, policy development, regulatory compliance and transparency and reporting (Broers, 2023; Sidaoui et al., 2024). While literature in both samples underscore the significance of governance frameworks and compliance, there is a lack of detailed guidance on the development and implementation of specific policies that address data governance, cybersecurity, and ethical AI usage. It is essential to ensure that digital practices are in alignment with organisational values and societal expectations. Further research is required to address topics such as establishing clear organisational communication regarding digital practices, adhering consistently to laws and regulations governing data protection, privacy, and digital transactions, and mitigating risks associated with digital operations.

For digital literacy and education, previous research on CDR through the analysis of literature reviews primarily focuses on CDR awareness and understanding, emphasizing the role of organisations in promoting these practices (Lobschat et al., 2021; Mueller, 2022). Research papers on CDR practices emphasize the importance of employee training and educational initiatives for effective CDR implementation, with digital literacy being a critical component. For example, Aldboush and Ferdous (2023) examine how digital literacy fosters ethical digital behaviour among employees, while Lautermann and Frick (2023) underscore the role of companies in advancing digital literacy, disseminating knowledge, and shaping digital policies responsibly. As illustrated in Table 2, only two literature reviews comprehensively address training programs and continuous learning for CDR. Moreover, no research paper has centrally focused on analysing the effects of digital ethics education and training programs on the long-term success of CDR practices. Therefore, further research should elaborate on specific training programs, workshop formats, and continuous learning principles for internal and external stakeholders.

Finally, for the aggregate dimension of innovation and future readiness, previous research on CDR through the analysis of literature reviews primarily focuses on the necessity of staying abreast of technological advancements and being prepared for forthcoming challenges (Lobschat et al., 2021; Wirtz et al., 2023). Nevertheless, none of the four second order themes were frequently mentioned in the reviews, nor were they central to the research itself. In contrast, research papers on CDR practices emphasize the significance of continuous improvement and proactive strategies in ensuring that organisations are able to build a strategic foresight about upcoming digital challenges (Broers, 2023; Elliott & Copilah-Ali, 2024). Current literature reviews indicate that research regarding specific mechanisms and actions for preparing for future CDR challenges is limited, largely due to the scarcity of long-term study data. Building on this foundation, Chapter 4 outlines preliminary actions for organisations, highlighting the importance of partnerships, R&D investments, agility, and strategic foresight. Future research could explore how to translate these insights into a flow diagram and process, making them more accessible for organisations of varying sizes, industries, and scopes. Additionally, given that this lies beyond the scope of the current paper, future research should examine the long-term impact of R&D investments in CDR, as well as the advantages of partner collaboration and stakeholder engagement.

5.2. Continued research agenda

Based on the synthesised findings from both sections, a research agenda for RQ3 has been developed that suggests new directions for future CDR research. This involved merging the discussion topics from Table 1 in Section 2 with the related aggregate dimension from Section 4, where applicable. This process provides a comprehensive overview of all potential research questions identified in this study, as illustrated and summarised in Table 3.

Table 3. Potential future research questions in CDR research

Aggregate dimensions	Second order themes	Related discussion topics (if applicable)	Indicative potential research questions
Organisational culture	• Digital work environment • Responsible digital practices • Leadership commitment	• CDR readiness and organisational mindset	• What are the correlating effects between CDR and various dimensions of organisational culture? • How can organisations develop clear and adjustable action plans to integrate CDR into their existing organisational culture?
Stakeholder engagement	• Internal stakeholders • External stakeholders • Regulatory & compliance stakeholders • Financial stakeholders	• Motivating factors • CDR implementation strategies	• How do CDR initiatives affect different stakeholder groups, including employees, consumers, and society? • How does behavioural finance influence investor management practices in the context of CDR implementation strategies? • What are the key factors in investor management that affect the successful implementation of CDR strategies within organisations?
Ethical and responsible use of technology	• Data & privacy • Fairness & inclusivity • Transparency & accountability • Sustainability	• Data and AI • Data privacy and security • Sustainability and environmental impact	• How can accountable green practices be defined and measured within the framework of sustainable and transparent data management? • What are the subdimensions of ethical and inclusive data transparency, and how can they be effectively implemented and assessed in organisational contexts? • How do various regulatory frameworks impact the use of data and AI within the context of CDR?
Governance and compliance	• Regulatory compliance • Risk Management • Policy development & implementation • Transparency & reporting	• Governance and frameworks • Digital governance and accountability • Risk assessment and management • CDR dimensions • Monitoring and evaluation • Reporting and communication	• How can organisations establish clear and effective communication strategies regarding digital practices to ensure transparency and compliance? • What are the best practices for consistently adhering to laws and regulations governing data protection, privacy, and digital transactions while mitigating risks associated with digital operations? • What accountability mechanisms can be developed to ensure responsible digital governance in the context of CDR?
Digital literacy and education	• Training programs • Digital ethics education • Continuous learning & development • Mentorship & peer learning	• CDR awareness and understanding	• What are the most effective training programs and workshop formats for enhancing digital skills among internal and external stakeholders? • How can continuous learning principles be integrated into organisational training to support the evolving needs of a digital workforce? • What structured and iterative approaches can organisations adopt to create a dynamic and adaptive training environment for digital transformation?

Aggregate dimensions	Second order themes	Related discussion topics (if applicable)	Indicative potential research questions
Innovation and future readiness	• R&D • Agility & adaptability • Strategic foresight • Collaboration & partnerships	• Impacts and benefits	• How can insights from CDR be translated into a flow diagram and process to enhance accessibility for organisations of varying sizes, industries, and scopes? • What are the long-term impacts of R&D investments in CDR, and how do partner collaboration and stakeholder engagement contribute to these outcomes? • How can organizations develop frameworks for responsible innovation that balance the need for progress with ethical considerations?

Strong organisational culture and leadership commitment are vital for successful CDR practice implementation. Promoting a culture that supports digital transformation and ethical practices requires effort at all levels. Current research lacks sufficient focus on overcoming resistance to change from employees or management. Future studies should explore strategies to address this and foster continuous improvement and ethical awareness. Additionally, research should examine how organisations can create flexible action plans to integrate CDR into their culture and explore the relationship between CDR and various aspects of organisational culture.

Future research should delve into the power dynamics and conflicts of interest among CDR stakeholders, such as financial entities, regulatory bodies, and the community. Managing these conflicts is crucial for implementing CDR effectively. Additionally, investigating how cultural and regional differences influence CDR adoption and identifying best practices for stakeholder engagement are important research areas.

To ensure the ethical and responsible use of technology, future studies need to investigate the practical challenges that organisations may encounter in implementing principles such as fairness, inclusivity, transparency, and accountability. For instance, maintaining data privacy and security amidst increasing cyber threats is a notable challenge. Additionally, achieving fairness and inclusivity in AI and algorithmic decision-making requires ongoing monitoring and adjustments to mitigate biases. Future research should aim to develop practical tools and frameworks to assist organisations in addressing these challenges. Furthermore, it is crucial to examine how models for data privacy and security can adapt to the rapidly evolving nature of CDR and to identify metrics that effectively measure the environmental impact of digital practices within CDR.

Governance and compliance are key components of CDR practices, which include regulatory compliance, risk management, policy development, and transparency and reporting. The study offers a foundation for understanding these aspects but could further explore the complexities of regulatory compliance in different jurisdictions. Due to the global nature of digital business, organisations often operate across various regulatory environments, each with its own rules and standards. Navigating these complexities requires an understanding of international regulations and the ability to adapt governance frameworks accordingly. Additionally, future research should examine metrics for measuring the impact of CDR initiatives and mechanisms for ensuring transparency and accountability in CDR reporting.

Equipping employees with digital skills and ethical awareness is important for fostering a responsible digital culture, as summarised in the dimension of digital literacy and education. Future studies could examine the barriers to effective digital education, such as varying levels of digital proficiency among employees and the rapid pace of technological change. Additionally, the effectiveness of different training methods and their impact on employee behaviour and organisational culture could be investigated further. Another area of interest is CDR awareness, where future research could analyse how organisations can benchmark their CDR awareness level against industry standards.

Finally, the dimension of innovation and future readiness encourages investment in research and development, agility and adaptability, strategic foresight, and collaboration and partnerships. While these are vital for staying ahead in the digital frontier, the study could address the potential risks associated with rapid innovation. For instance, the rush to adopt new technologies without fully understanding their ethical implications can lead to unintended consequences. Future research should focus on developing frameworks for responsible innovation that balance the need for progress with ethical considerations.

6. Conclusion

This paper contributes valuable insights for both researchers and practitioners, guiding the development of more effective CDR practices and policies. We conducted the first exhaustive SLR on defining dimensions of CDR practices using grounded theory. We identified major and emerging research streams in previous research on CDR through the analysis of literature reviews (RQ1), categorised by adoption phase and discussion topic, showing the field's current state and identified potential research gaps. We further defined and conceptualized the aggregate dimensions of CDR practices to provide a first foundational framework that can drive strategic CDR initiatives (RQ2). Finally, we established a research agenda (RQ3) for the CDR research field to offer additional directions for future research.

The findings from this research paper have significant implications for organisations aiming to implement CDR practices, as well as for researchers and practitioners seeking to understand the scope of CDR practices. The identification of six aggregate dimensions of CDR practices offers a structured framework for organisations to assess and improve their CDR initiatives. By incorporating these dimensions into their strategic planning, organisations can adopt a comprehensive approach to digital responsibility that aligns with their core values and operational objectives.

For researchers, the comprehensive framework of CDR practices offers a solid foundation for empirical studies, enabling hypothesis development and testing across industries and cultures. It emphasizes interdisciplinary research combining business ethics, information systems, and corporate governance to create robust CDR models. Identifying literature gaps, such as the need for long-term impact studies, guides future research.

For practitioners, the comprehensive framework of CDR practices serves as a diagnostic tool to assess and improve CDR practices. It helps develop targeted strategies for enhancing stakeholder engagement and data privacy. Emphasizing continuous education and digital literacy, it highlights the importance of employee training programs. Transparent communication and collaboration with stakeholders are crucial for fostering trust and accountability in CDR initiatives.

There are several limitations to this research paper. First, the subjective nature of qualitative evaluations introduces a potential for bias, which could influence the interpretation of the research findings. Second, given the dynamic and rapidly evolving nature of the digital landscape, the reviewed CDR literature may soon become outdated and obsolete as new technologies and practises emerge. Third, the scope of the research sample studies, even though extensive, may still miss critical studies published in less prominent journals or emerging domains that are not yet widely recognized. However, despite these limitations, it is hoped that the research paper instigates and guides future CDR research.

In conclusion, this research underscores the critical importance of CDR in navigating the complexities of the digital frontier. By identifying and defining the six aggregate dimensions of CDR practices, this study provides a foundational framework for both researchers and practitioners to evaluate and enhance CDR initiatives. As digital transformation continues to evolve, it is imperative for organisations to adopt a holistic approach to CDR, integrating ethical, social, and technological considerations into their strategic planning. Future research should focus on addressing the identified gaps and exploring the long-term impacts of CDR practices, ensuring that companies can effectively contribute to a responsible and sustainable digital economy.

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Appendix A – Database CDR literature reviews (28 studies, in alphabetical order)

	Authors	Year	Title	Outlet	Research Methodology	Region	Key Insights
1.	Aldboush, H.H.H.; Ferdous, M.	2023	Building Trust in Fintech: An Analysis of Ethical and Privacy Considerations in the Intersection of Big Data, AI, and Customer Trust	International Journal of Financial Studies	Systematic Literature Review	Jordan	• Key insights from the paper emphasize the importance of safeguarding customer data, complying with data protection laws, and promoting corporate digital responsibility. • The study provides practical suggestions for companies to enhance trust in fintech services through measures like encryption techniques, transparency regarding data collection and usage, customer opt-out options, and staff training on data-protection policies.
2.	Altmeppen, K.D.; Filipović A.	2019	Corporate Digital Responsibility. Zur Verantwortung von Medienunternehmen in digitalen Zeiten	Communicatio Socialis	Theoretical Analysis and Literature Review	Germany	• The paper highlights various ethical challenges posed by digitalization, including issues related to algorithms, data privacy, artificial intelligence, and the impact on public communication.

	Authors	Year	Title	Outlet	Research Methodology	Region	Key Insights
							• It discusses the dual nature of digitalization, which brings both opportunities (e.g., transparency, participation) and challenges (e.g., commercialization, manipulation, loss of credibility). • The authors review several initiatives aimed at promoting CDR, such as the German Federal Ministry of Justice and Consumer Protection's CDR initiative and the activities of the Zentrum Digitalisierung Bayern. • These initiatives aim to develop principles and guidelines for CDR, encouraging companies to voluntarily adopt ethical practices beyond legal requirements. • The paper argues for the integration of CDR into media ethics, proposing that media companies have a unique societal responsibility due to their role in public communication. • It calls for a systematic approach to defining and implementing CDR, considering the specific responsibilities of media organizations in the digital age. • They emphasize the importance of interdisciplinary collaboration and the inclusion of philosophical and social science perspectives in the ongoing discourse on digital responsibility.
3.	Bednarova, M.; Serpeninova, Y.	2023	Corporate digital responsibility: bibliometric landscape – chronological literature review	International Journal of Digital Accounting Research	Bibliometric Literature Review Data Collection (Scopus, Web of Science, and Google Scholar) Analysis Tools (VOSviewer, Google Trends) Analytical Instruments (inbuilt tools in Scopus and Web of Science)	Slovakia	• Emergence and Importance of CDR: The study highlights the rapid development and increasing importance of CDR due to the proliferation of new technologies like AI, which raise concerns about privacy, data protection, and ethical considerations. • Regional Leadership: Germany is identified as a leader in CDR efforts, with significant contributions from Spanish and other European scholars. • Bibliometric Trends: There has been a significant increase in publications on CDR, especially from 2020 onwards, driven by the digital transformation accelerated by the COVID-19 pandemic. • Thematic Focus: The research identified key thematic areas in CDR literature, including digital transformation, digital ethics, AI, and data privacy. • Definitions and Frameworks: The paper provides an overview of various definitions and frameworks for CDR, emphasizing its connection to CSR and its role in sustainable development.
4.	Breivogel, S.	2024	Competencies for Corporate Digital Responsibility A Literature and Practice Perspective	BPS Working Paper Series of the Berlin Professional School at the Berlin School of Economics and Law (HWR Berlin)	Systematic Literature Review	Germany	• Competency Framework: A comprehensive set of 23 CDR-related competencies was identified across four domains: cognitive, functional, social, and meta. • Understanding internal and external stakeholder needs and the ability to employ adaptability were highlighted as crucial. • The competency framework can be used by practitioners for recruitment, professional development, and advancing CDR in companies. • The findings are primarily based on experts located in Germany, which may limit the generalizability of the results. Future research could involve a quantitative follow-up study to assess the importance of each identified competency.
5.	Carl, K.V.	2023	Data privacy and security in the context of corporate digital responsibility: A scoping review	Lecture Notes in Informatics (LNI), Proceedings - Series of the Gesellschaft fur Informatik (GI)	Scoping Literature Review	Germany	• The study highlights a growing interest in CDR within IS research, particularly concerning data privacy and security. • It emphasizes the need for a more comprehensive view on data privacy and security within the broader context of CDR, rather than isolated approaches. • The research indicates that corporate responsibilities, such as data privacy and security, are interwoven and should be evaluated in an interconnected manner across different sub-fields of CDR. • Practical Implications: The findings suggest that a holistic approach to data privacy and security, employing the concept of CDR, can help practitioners better implement corporate responsibilities in practice.
6.	Carl, K.V.	2021	Corporate Digital Responsibility: Evaluating Privacy and Data Security Activities on Company-level	Lecture Notes in Informatics (LNI), Proceedings - Series of the Gesellschaft fur Informatik (GI)	Literature Review (incl. Theoretical Framework Development, and Benchmark Corpus Creation)	Germany	• It highlights privacy and data security as critical components of CDR, proposing specific norms and measures for evaluating these activities at the company level. • The study introduces a benchmark corpus to evaluate CDR activities, focusing on seven sub-dimensions of privacy and data security, such as data collection, purpose specification, data use, transparency, secure storage, data quality, and user access and correction. • The benchmark corpus serves as a guideline for companies to assess and improve their CDR activities, aiming to enhance ethical and responsible digital practices.
7.	Carl, K.V.; Hinz, O.	2024	What we already know about corporate digital responsibility in IS research: A review and conceptualization of potential CDR activities	Electronic Markets	Systematic Literature Review	Germany	• Advances in New Technologies: The paper discusses how new technologies affect both private and professional lives, presenting new opportunities and threats for companies, consumers, and society. • Concept of CDR: It emphasizes the growing importance of CDR in enabling technologies that benefit humanity beyond mere technological advancements. • Systematic Understanding: The study aims to provide a more concrete and deeper understanding of the concept's scope by drawing on available knowledge in the field of Information Systems (IS) and electronic markets. • Classification of CDR Activities: The paper develops an in-depth classification of potential CDR activities, contributing to the conceptualization of CDR and anchoring the concept in the context of electronic markets to foster human and social value creation

	Authors	Year	Title	Outlet	Research Methodology	Region	Key Insights
8.	Cheng, C.; Zhang, M.	2023	Conceptualizing Corporate Digital Responsibility: A Digital Technology Development Perspective	Sustainability (Switzerland)	Mixed Methods Approach (Literature Review and Empirical Research (Survey among high-technology enterprises listed on the Shanghai and Shenzhen stock exchanges in China. The survey targeted executives in charge of digital business, focusing on their practices and perceptions related to CDR))	China	• The authors propose a new conceptualization of CDR by distinguishing it into two main components: corporate digitized responsibility and corporate digitalized responsibility. Corporate digitized responsibility includes unbiased data acquisition, data protection, and data maintenance. Corporate digitalized responsibility involves appropriate data interpretation, objective predicted results, and tackling value conflicts in data-driven decision-making. • Measurement of CDR: The study develops a series of measurements for CDR, identifying 15 indicators corresponding to the digitization and digitalization stages. These measurements were tested for their impact on corporate digital performance. • Empirical Findings: The empirical analysis demonstrated a positive relationship between CDR and corporate digital performance. The study found that digitization (data-related practices) is slightly more important than digitalization (application of digital technology) in promoting corporate digital performance. • Managers should emphasize CDR issues as they significantly influence a firm's digital performance. Ethical challenges in data creation, transfer, and storage should be addressed to ensure unbiased data acquisition, data protection, and data maintenance. Companies should develop appropriate tools for data interpretation and prediction, and address value conflicts in data-driven decision-making.
9.	Covucci, C.; Confetto, M. G.; Kljucnikov, A.; Panait, M.	2024	Unrevealing the nexus between Digital Sustainability and Corporate Digital Responsibility: a dual-track systematic literature review Authors affiliation and contact information	SSRN	Dual-Track Systematic Literature Review (with 202 studies)	Italy	• The interconnectedness of Digital Sustainability (DS) and CDR. • A convergence on the crucial role of digital technology in achieving sustainable development. • The potential for integrating DS and CDR into a unified framework, leading to the concept of Corporate Digital Sustainability (CDS).
10.	Elliott, K.; Price, R.; Shaw, P.; Spiliotopoulos, T.; Ng, M.; Coopamootoo , K.; van Moorsel, A.	2021	Towards an Equitable Digital Society: Artificial Intelligence (AI) and Corporate Digital Responsibility (CDR)	Society	Literature Review	United Kingdom	• Ethical AI Principles: The paper identifies over 160 ethical AI principles, highlighting the complexity and fragmentation in current AI governance frameworks. • CDR is proposed as a collaborative mechanism to address the governance complexity of AI and to promote an equitable digital society. • AI Governance: The authors emphasize the need for harmonized and aligned approaches to AI governance, advocating for responsible corporate actions to avoid digital societal harms. • Public Trust and Transparency: The paper discusses the importance of transparency, responsibility, and stewardship in building public trust in AI systems. • Digital Society and Surveillance Capitalism: The authors explore the concept of surveillance capitalism and its implications for digital society, emphasizing the need for ethical oversight and governance. • Regulatory Challenges: The paper reviews the new EU AI regulation and its potential impact, noting the challenges in achieving compliance and the risk of a "tick-box" compliance culture.
11.	Herden, C. J.; Alliu, E.; Cakici, A.; Cormier, T.; Deguelle, C.; Gambhir, S.; ... & Edinger-Schons, L. M.	2021	"Corporate Digital Responsibility" New corporate responsibilities in the digital age	Sustainability Management Forum	Mixed Methods Approach Qualitative: Literature Review Quantitative: Online Survey with 509 US-based Respondents	Germany	• The survey revealed both opportunities (e.g., better services, reduction of repetitive work) and threats (e.g., cybercrime, data security issues) associated with digitalization. • CDR Topics: The authors identified 20 key topics related to CDR, categorized under the ESG framework, including energy and carbon footprint, digital waste, digital well-being, data security, and robot ethics. • A five-step guide for companies to develop and implement a CDR strategy, emphasizing the need for continuous updates and alignment with company goals and culture.
12.	Ivancic, R.; Giermindl, L.	2023	Corporate Digital Responsibility - opportunities and obstacles for businesses and information systems research	CNow Workshop	Literature Review	Switzerland	• Research Gaps: The paper identifies significant research gaps in understanding and implementing CDR, particularly in the deontological, utilitarian, and situational dimensions of ethics. • Systemic Constraints and Self-Interests: Companies often face tensions between exploiting digital technologies for profit and adhering to ethical standards. The voluntary nature of CDR commitments and the lack of effective measurement tools for CDR activities are highlighted as major obstacles. • Push and Pull Mechanisms for CDR: The paper discusses strategic approaches to promoting CDR, including market-driven (outside-in) and resource-based (inside-out) perspectives. It suggests the creation of global authorities to monitor and enforce CDR and emphasizes the importance of value-based management principles. • Implementation Challenges: The paper underscores the need for collaboration between academia and industry to address the implementation challenges of CDR. It calls for raising awareness, educating stakeholders, and providing concrete guidance for companies to integrate CDR into their operations.
13.	Jelovac, D.; Ljubojević, Č; Ljubojević, L.	2022	HPC in business: the impact of corporate digital responsibility	Digital Policy, Regulation and Governance	Literature Review	Serbia	• RQ: How and in what way does CDR influence digital trust? • The implementation of HPC in business is accompanied by a certain extent of mistrust, necessitating the building of digital trust among stakeholders.

	Authors	Year	Title	Outlet	Research Methodology	Region	Key Insights
			on building digital trust and responsible corporate digital governance				• The study found a correlation between CDR and digital trust, although previous research did not elaborate on this explicitly. • The indirect influence of digital trust via CDR was explored through a new conceptual model that presented the influence of total CDR on digital trust as well as the influence of specific CDR dimensions on particular dimensions of digital trust.
14.	Jones, P.; Comfort, D.	2021	Corporate digital responsibility challenges for sports betting companies	Journal of Gambling Issues	Literature Review	United Kingdom	• Emergence of Digital Technologies: Digital technologies have significantly transformed the sports betting industry, creating new opportunities but also introducing various responsibility challenges. • Privacy and Cybersecurity: Sports betting companies face significant challenges in protecting customer data from sophisticated hacking and malicious software. • Trust: Maintaining customer trust is crucial, especially regarding the safety of their financial and personal information. • Protection of Vulnerable Customers: There are concerns about digital technologies promoting addictive and compulsive gambling behaviours. Companies emphasize responsible gambling but face scrutiny over their actual practices. • The paper discusses the balance between self-regulation by sports betting companies and government regulation. It highlights the ongoing review of gambling legislation in the UK to address digital era challenges.
15.	Knopf, T.; Pick, D.	2023	Corporate Responsibility for Digital Innovation: A Systematic Review of the Literature	Proceedings of the European Conference on Innovation and Entrepreneurship (ECIE)	Systematic Literature Review with PRISMA Guidelines	Germany	• The authors propose a unified definition of CDR and suggest a comprehensive framework based on the ESG (Environmental, Social, and Governance) criteria. They emphasize the importance of context-specific adaptations for different industries and cultures. • The scope of beneficiaries of CDR activities needs further exploration to understand motivations and impacts. • A clearer understanding of CDR can guide the development of practical strategies for organizations. Establishing a shared understanding of CDR is essential for developing effective strategies to address the ethical, social, and environmental impacts of digital technologies.
16.	Kunz, W.; Wirtz, J.	2023	Corporate digital responsibility (CDR) in the age of AI: implications for interactive marketing	Journal of Research in Interactive Marketing	Literature Review	Singapore	• One of the first paper in the service domain to apply the concept of CDR to recent developments in generative AI. • Analyses the importance of considering the ethical implications of AI in interactive marketing and the concept of CDR as it relates to new advances in AI. • Underlines the risks involved when companies do not prioritize good CDR practices, the financial benefits and improved customer experience that can come from AI-driven customization, and the trade-offs between organizational goals and CDR practices. • Highlights opportunities for responsible business restructuring and service automation to ensure fairness and human oversight.
17.	Kunz, W.; Wirtz, J.; Hartley, N.; Tarbit, J.	2024	The importance of corporate digital responsibility in a Digital Service World	Emerald Publishing Limited	Literature Review	United Kingdom	• Ethical Implications of AI: The chapter highlights the ethical challenges posed by AI technologies, such as biased decision-making and privacy concerns. • CDR is presented as a framework to address ethical dilemmas in digital service ecosystems. It emphasizes the need for ethical norms, customer privacy, and equitable power dynamics with business partners. • Data and Technology Life Cycles: The chapter discusses the stages of data and technology life cycles (creation, operation, refinement, and retention) and their associated CDR challenges. • Digital Service Ecosystems: It explores the front-end (customer-facing) and back-end (business partners) aspects of digital service ecosystems and the ethical issues arising from data sharing and AI usage. • Generative AI Challenges: The emergence of generative AI technologies like ChatGPT and DALL-E introduces new CDR challenges, including AI complexity, monitoring, accountability, and workforce changes. • Building a Strong CDR Culture: The chapter provides recommendations for service firms to establish a strong CDR culture, including ethical norms, digital governance, and equitable power dynamics with business partners.
18.	Lobschat, L.; Mueller, B.; Eggers, F.; Brandimarte, L.; Diefenbach, S.; Kroschke, M.; Wirtz, J.	2021	Corporate digital responsibility	Journal of Business Research	Literature Review	United States	• The authors identify four principal stakeholders (organizations, individual actors, artificial/technological actors, and institutional/governmental/legal actors) and four key processes (creation of technology and data capture, operation and decision making, inspection and impact assessment, and refinement of technology and data) that are central to CDR. • The paper discusses how to embed CDR within an organization's culture, highlighting the importance of shared values, specific norms, and artifacts and behaviours that reflect CDR principles. • Managerial Implications: The authors provide insights into how organizations can translate their CDR values into actionable guidelines for managers, technology designers, and other employees. They also discuss the potential benefits of a strong CDR culture, including enhanced trust, reputation, and competitive advantage. • The paper identifies several avenues for future research, such as exploring the antecedents and consequences of CDR, developing metrics for assessing CDR readiness and implementation, and understanding the impact of CDR on consumer behaviour and organizational performance.

	Authors	Year	Title	Outlet	Research Methodology	Region	Key Insights
19.	Londoño-Cardozo, J.; Paz, M.P.	2021	Corporate Digital Responsibility: Foundations and Considerations for Its Development	RAM – Mackenzie Management	Hermeneutical Investigation and Literature Review	Brazil	• The paper introduces CDR as a new area of interest for social accountability in the context of Industry 4.0 technologies. • It highlights the lack of sufficient theoretical and legal frameworks to address the implications of new technologies. • The authors argue that new technologies pose social risks, making them a subject of social responsibility. • Despite the absence of regulations on Industry 4.0, the development of CDR is deemed necessary and possible.
20.	Mihale-Wilson, C.; Hinz, O.; Van Der Aalst, W.; Weinhardt, C.	2022	Corporate Digital Responsibility	Business & Information Systems Engineering	Literature Review	Germany	• Need for CDR: The paper argues that while CSR addresses general business responsibilities towards society, CDR specifically focuses on the responsibilities related to the development and use of technology. This distinction is necessary due to the unique challenges and opportunities that digital technologies present. • Characteristics of CDR: CDR encompasses various aspects such as ethical, legal, and social responsibilities in the context of digital technologies. It highlights issues like data privacy, algorithmic transparency, and the ethical use of AI. • Comparison with CSR: The authors compare CDR with CSR, noting that while CSR is broad and encompasses various societal concerns, CDR is more focused on the digital realm. They argue that CDR should be seen as a distinct but related concept to CSR. • Implementation of CDR: The paper discusses how CDR can be operationalized within organizations. It suggests that companies need to develop specific frameworks and action plans to address digital responsibilities effectively. • Opportunities for Research: The authors highlight the importance of further research in the field of CDR, particularly in developing concrete guidelines and best practices for businesses to follow. They also emphasize the role of the Business & Information Systems Engineering (BISE) community in advancing CDR research.
21.	Mueller, B.	2022	Corporate Digital Responsibility	Business and Information Systems Engineering (BISE)	Literature Review	Germany	• The paper identifies two main domains of CDR: a content-oriented perspective on digital ethics and an instrumental perspective on governance. • The paper emphasizes the importance of identifying and considering relevant stakeholders, including internal (e.g., employees) and external (e.g., customers, regulators) actors. • The article explores how organizations can manifest CDR-related norms and values through codified standards, codes of conduct, and embedded ethical guidelines in digital artifacts. • It also examines the processes and structures necessary to enforce CDR within organizations, including centralized and decentralized approaches. • The paper discusses the potential impacts of CDR on economic, social, and environmental aspects. It suggests that adopting CDR can enhance an organization's reputation, attract talent, and appeal to investors, thereby providing a competitive advantage.
22.	Orbik, Z.; Zozuľaková, V.	2019	Corporate Social and Digital Responsibility	Management Systems in Production Engineering	Literature Review	Poland	• The paper highlights the growing importance of integrating CSR with digital transformation, emphasizing that digital maturity is crucial for modern businesses to remain competitive. • Digital transformation is identified as a key driver of the Fourth Industrial Revolution, fundamentally changing business processes, models, and the work environment. • The authors introduce CDR as a new dimension of CSR, focusing on the ethical use of digital technologies and the responsible management of digital transformation within organizations. • The authors provide strategic recommendations for businesses to successfully integrate digital technologies and CSR, including long-term planning, organizational flexibility, and fostering a digital culture.
23.	Van Der Merwe, J.; Al Achkar, Z.	2022	Data responsibility, corporate social responsibility, and corporate digital responsibility	Data and Policy	Literature Review	United States	• The commentary argues that existing CSR and CDR mechanisms are not sufficient for managing data responsibility effectively. It highlights the need for a broader societal and comprehensive approach. • It discusses the emergence of CDR as a concept and its overlap with CSR, while arguing that CDR should be treated as a separate mechanism due to the unique challenges posed by digital transformation. • The authors suggest that data responsibility should be embedded throughout the entire business cycle and not treated as an afterthought. They also call for stronger enforcement and accountability mechanisms.
24.	Volkov, V.R.; Sidorenko, E.L.	2022	Digital Platforms and Issues of Corporate Criminal Responsibility, Self-regulation	Lecture Notes in Networks and Systems	Literature Review	Russia	• The paper emphasizes that corporations can be subject to criminal punishment for crimes, integrating this responsibility within the broader scope of corporate social responsibility. • It discusses the diminishing scope of self-regulation due to increasing state regulation, highlighting the need for internal control mechanisms within corporations. • The authors introduce concepts like "digital social responsibility" and "corporate digital responsibility," stressing the lack of a unified scientific direction for developing corporate responsibility provisions on digital platforms. • Legal Models: The paper calls for collaborative efforts among scientists to justify and explain the effectiveness of different legal models for corporate responsibility in the digital age.

	Authors	Year	Title	Outlet	Research Methodology	Region	Key Insights
25.	Wagener, A.	2022	Corporate Digital Responsibility und KI Bias	Hofer Beiträge zur digitalen Transformation	Literature Review	Germany	• Key Areas of CDR: • Resource Conservation: Efficient use of energy in digital services and products. • Social Compatibility: Creating humane work environments with digital technology. • Democratization of Digitalization: Enhancing access through skill-building and promoting accessible digital infrastructure. • Data Security and Privacy: Preventing misuse of data power, combating surveillance capitalism, and ensuring transparency in AI decision-making. • Challenges and Solutions: • Identifying applicable value standards is challenging due to societal fragmentation and evolving norms. • The paper calls for the development of tools that address both technical and organizational requirements for effective CDR management. • It stresses the importance of integrating business objectives with societal concerns to create a comprehensive CDR strategy.
26.	Wilkinson, C.	2023	Corporate digital responsibility: The influence of digitalisation on sustainable corporate development	FOM Hochschule für Oekonomie & Management	Literature Review	Germany	• Digitalisation's Dual Role: Digitalisation supports daily activities but also poses significant threats that need to be addressed. • Companies have a responsibility to act as multipliers by setting a good example in sustainable practices. • The paper highlights the importance of addressing global challenges such as climate change, loss of biodiversity, and pollution.
27.	Wirtz, J.; Kunz, W.H.; Hartley, N.; Tarbit, J.	2023	Corporate Digital Responsibility in Service Firms and Their Ecosystems	Journal of Service Research	Literature Review / Multi-disciplinary Literature Synthesis Approach	United States	• The paper highlights that CDR is critical in service contexts due to the vast streams of customer data involved and the omnipresence, opacity, and complexity of digital service technologies. • The authors synthesize literature on ethics, privacy, and fairness using the CDR data and technology life-cycle perspective to better understand these risks in service contexts. • The paper examines the digital service ecosystem and the related flows of money, service, data, insights, and technologies to provide insights into the origins of CDR risks. • The authors introduce the concept of the CDR calculus, which captures the trade-offs between good CDR practices and organizational objectives. They argue that regulation is necessary when a firm's CDR calculus becomes too negative. • The paper advances a set of strategies, tools, and practices that service firms can use to manage these trade-offs and build a strong CDR culture.
28.	Wynn, M.; Jones, P.	2023	Corporate Responsibility in the Digital Era	Information (Switzerland)	Scoping Literature Review and Case Studies (Walmart and Deutsche Telekom))	United Kingdom	• The paper identifies several key parameters of CDR, including data protection, privacy, security, transparency, and ethical use of digital technologies. • Case Study Findings: • Walmart: Focuses on digital trust commitments, promoting fairness, protecting privacy, and ensuring cybersecurity. • Deutsche Telekom: Emphasizes human-centred technology, digital ethics, digital participation, future work, and environmental impacts. • Emergent Issues: • The paper discusses issues such as fair and equitable access to digital technologies, personal and social well-being, environmental impacts, and the complexities of cross-supply chain digital responsibilities.

Appendix B – Exemplary definitions of CDR in the literature

Authors	Definition
BMUV (2021)	"CDR is a voluntary corporate activity, particularly considering the consumers' perspective, which strives to go beyond what is required by law to shape the digital world for the advancement of society."
Carl et al. (2022)	"CDR activities exceed the legally binding (national) minimum requirements and rather describes the voluntary acceptance of additional responsibilities."
Dörr et al. (2021)	"CDR is a set of practices and behaviours that help an organisation use data and digital technologies in ways that are perceived as socially, economically, and environmentally responsible."
Herden et al. (2021)	''CDR is an extension of a firm's responsibilities which takes into account the ethical opportunities and challenges of digitalization.''
Huber (2022) (translated from German)	"Framework for action and decision-making that shoes how AI risks and opportunities are to be balanced in order to meet the social responsibility of companies with regard to digital issues."
Joynson (2018)	''CDR is about recognizing that the organizations driving forward the advancement of technology, and those that leverage technology to engage and provide services to the citizen, have a responsibility to do so in a manner that is fundamentally leading us toward a positive future.''
Knopf & Pick (2023)	"CDR is a voluntary commitment, beyond what is legally required, that an organisation makes to itself and to society as a whole, as well as to the individual. It is also a framework that guides an organisation's operations by providing a business orientation with a set of practices, behaviours, policies and governance structures based on a set of shared values and norms to achieve economic, social and environmental goals when engaging with stakeholders or shaping the digital world with responsible digital innovation for the advancement of society."

Authors	Definition
Lobschat et al. (2021)	"CDR is the set of shared values and norms guiding an organization's operations with respect to the creation and operation of digital technology and data.''
Mihale-Wilson et al. (2021)	"CDR seeks to ensure an ethical and responsible development, deployment, and use of digital technologies and data", Part of the "obligations that companies have toward society."
Suchacka (2019)	"CDR means that awareness of duties binding the organisations active in the field of technological development and using technologies to provide services."
Trittin-Ulbrich Böckel (2022)	"CDR emphasizes the voluntary, self-regulatory character of corporate commitment to responsible digital innovation."
Weißenberger & Marrocco (2022)	"CDR is a voluntary corporate orientation to ensure a responsible use of digital technologies."
Wirtz et al. (2023)	"We define CDR in the context of service as the principles underpinning a service firm's ethical, fair, and protective use of data and technology when engaging with customers within their digital service ecosystem."
BMUV (2021)	"CDR is a voluntary corporate activity, particularly considering the consumers' perspective, which strives to go beyond what is required by law to shape the digital world for the advancement of society."
Carl et al. (2022)	"CDR activities exceed the legally binding (national) minimum requirements and rather describes the voluntary acceptance of additional responsibilities."
Dörr et al. (2021)	"CDR is a set of practices and behaviours that help an organisation use data and digital technologies in ways that are perceived as socially, economically, and environmentally responsible."
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Appendix C – Database CDR practices literature sample (52 studies, in alphabetical order)

	Authors	Year	Title	Outlet	Research Methodology	Region	Key Insights
1.	Aitken, M.; Ng, M.; Horsfall, D.; Coopamootoo, K.P.L.; van Moorsel, A.; Elliott, K.	2021	In pursuit of socially-minded data-intensive innovation in banking: A focus group study of public expectations of digital innovation in banking	Technology in Society	Qualitative Research (Series of five focus groups to explore the role of public deliberation in informing ethical data practices in banking)	United Kingdom	• Deliberative forms of public engagement present valuable opportunities to incorporate diverse views and perspectives, enabling critical reflection on organizational practices and the trajectory of innovation. • The study concludes that public engagement is vital to ensure that private sector organizations move beyond "ethics-washing" or tokenistic efforts at CDR to meaningfully address public concerns and reflect public values in all innovation processes.
2.	Al-Omoush, K.; Ribeiro-Navarrete, B.; McDowell, W.C.	2023	The impact of digital corporate social responsibility on social entrepreneurship and organizational resilience	Management Decision	Quantitative Research (Sample of 223 managers, collecting data from telecommunication companies in Jordan, Smart-PLS to test the research model and hypotheses)	Jordan	• Digital CSR has a significant impact on social entrepreneurship. • Digital CSR significantly impacts organizational resilience. • Digital CSR plays a significant role in competitive intelligence. • Social entrepreneurship significantly impacts organizational resilience. • Competitive intelligence significantly impacts organizational resilience.
3.	Andersen, N. (2020).	2020	Redesigning Corporate Responsibility How Digitalization	Redesigning organizations: Concepts for the	Conceptual	Germany	• Digitalization as a Catalyst: Digitalization offers companies new opportunities to rethink and enhance their corporate responsibility strategies. • Companies should prioritize CDR, addressing gaps that education and regulation cannot fill.

	Authors	Year	Title	Outlet	Research Methodology	Region	Key Insights
			Changes the Role Companies Need to Play for Positive Impacts on Society	connected society			• Treating CDR with high strategic priority can lead to positive outcomes for both businesses and society.
4.	Angermann, N. P.	2023	Corporate Digital Responsibility – An Analysis of Key Elements for CDR Implementation	University Católica Portugal	Mixed Methods Approach (Literature Review, Surveys, and Semi-Structured Interviews)	Germany	• Low Awareness and Partial Implementation: Many companies are partially implementing CDR, often unintentionally and without realizing its full potential. • Overall awareness of CDR is very low. • Challenges in Implementation: Key challenges include a lack of guidance and structure, and the need for a holistic view of economic, social, environmental, and technological factors. • Key Elements for CDR Implementation: • Holistic Integration: CDR must be integrated into the core strategy, considering economic, social, environmental, and technological factors. • Transparency and Communication: CDR must be communicated transparently and comprehensively to all stakeholders. • Beyond Compliance: CDR should go beyond mere compliance with regulations. • Anticipation and Adaptation: In the fast-changing environment of digital innovation, it is important to anticipate consequences and constantly adapt the strategy. • CSR serves as a foundation for CDR implementation due to similar goals, but CDR expands the scope and is seen as the next major strategic shift for companies.
5.	Boin, M.	2022	Farce, Frankenstein, or Future Model? A Policy Evaluation of Germany's Trial to Foster Corporate Digital Responsibility	Central European University	Mixed Methods Approach Qualitative: Interviews (conducted with CDR-practitioners and scientists) Quantitative: Vedung's Goal-Attainment and Side-Effects Model	Austria	• Evaluation of the German CDR-Initiative: The initiative aims to foster CDR by encouraging companies to voluntarily join and comply with certain principles and goals for a human-centred digitalisation. • The initiative is seen as a potential future model for encouraging credible CSR. • Findings from Interviews: The initiative has raised awareness and commitment to CDR among participating companies. The initiative's setup transfers responsibility from consumer choice to companies, creating more awareness and benefiting member companies through exchange, ministerial approval, and media attention. • Societal and Entrepreneurial Added Value: The initiative has societal added value by introducing a standard for CDR and consolidating it as a minimum standard in participating companies. Entrepreneurial added value includes benefits such as enhanced reputation, trust from consumers, and facilitated exchange of best practices among companies. • Challenges and Recommendations: The initiative needs to attract more companies to increase its impact. Providing tools for implementation and integrating CDR into various business promotion activities are recommended to support non-participating companies.
6.	Breivogel, S.	2024	Competencies for Corporate Digital Responsibility A Literature and Practice Perspective	BPS Working Paper Series of the Berlin Professional School at the Berlin School of Economics and Law (HWR Berlin)	Qualitative Research (Systematic Literature Review)	Germany	• Competency Framework: A comprehensive set of 23 CDR-related competencies was identified across four domains: cognitive, functional, social, and meta. • Understanding internal and external stakeholder needs and the ability to employ adaptability were highlighted as crucial. • The competency framework can be used by practitioners for recruitment, professional development, and advancing CDR in companies. • The findings are primarily based on experts located in Germany, which may limit the generalizability of the results. Future research could involve a quantitative follow-up study to assess the importance of each identified competency.
7.	Broers, N.	2023	How Organizations Institutionalize Corporate Digital Responsibility in their Culture and the Influence on Employees' Digital Responsible Behavior	University of Twente	Qualitative Research (Semi-structured interviews with nine employees and five (C-level) managers from five organizations, and Thematic Analysis (TA))	Netherlands	• Drivers of CDR: Board of Directors, Customers, Regulations, Technology, Employees and Marketing Department. • CDR Practices: Environmental Practices: Reducing energy and carbon footprint, waste reduction, and using technology for environmental benefits. Social Practices: Enhancing digital competence, digital well-being, digital inclusion, and being a positive digital influence. Governance Practices: Data security, digital ethics, data privacy, and transparency. • Strategies of Institutional Work: • Creating Legitimacy: Board members' commitment and CDR reports. Sense of Ownership: Involving employees and creating a personal connection to CDR. Employee Ambassadors: Using a network of employees to communicate and educate about CDR. Continuous Informing: Regular communication about CDR developments. Awarding Employees: Gamification, praising responsible behaviour, and providing rewards. • Influence on Employees' Behaviour: Positive Attitudes: Pride and happiness towards the organization's CDR efforts. Subjective Norms: Feeling that CDR is valued by others. Perceived Behavioural Control: Complexity and extra workload associated with CDR. Commitment: Intrinsic motivation and existing organizational culture positively influence CDR behaviour.
8.	Carl, K.V.	2022	The status-quo of companies' data privacy and security communication: An ethical evaluation and future paths	Lecture Notes in Informatics (LNI), Gesellschaft für Informatik	Qualitative Research (Text Analysis with MAXQDA Software)	Germany	• Consumer Expectations: Consumers expect companies to behave ethically and voluntarily assume more responsibilities in the digital context, particularly related to data privacy and security. • The concept of CDR provides a broader perspective on digital responsibilities, integrating data privacy and security into a holistic understanding of corporate responsibilities.

	Authors	Year	Title	Outlet	Research Methodology	Region	Key Insights
							• Communication Practices: The study evaluated current corporate communication regarding data privacy and security from an ethical viewpoint, identifying best practices and future paths for corporate communication. • Best Practices: The research highlighted several best practices for ethically responsible corporate communication, such as transparency in data processing practices, limited data collection, secure data processing, and providing consumers with access to their data. • Challenges for SMEs: Small and medium-sized enterprises (SMEs) often struggle with ethical communication due to a lack of guidelines and best practices, emphasizing the need for further guidance in this area.
9.	Carl, K.V.; Zilcher, T.M.C.; Hinz, O.	2022	Corporate Digital Responsibility and the current Corporate Social Responsibility standard: An analysis of applicability	Lecture Notes in Informatics (LNI), Proceedings - Series of the Gesellschaft fur Informatik (GI)	Conceptual (Theoretical Analysis to evaluate applicability of the existing CSR standard (ISO 26000) to the context of CDR)	Germany	• Applicability of ISO 26000: The ISO 26000 standard covers some aspects of CDR but lacks detailed guidance on digital-specific issues. The authors suggest that either the ISO 26000 standard needs extensive additions or a separate CDR standard should be developed. • Eight Dimensions of CDR: The paper evaluates the applicability of the CSR standard to eight dimensions of CDR: access, dispute resolution and awareness, economic interests, education and awareness, governance and participation, information and transparency, privacy and data security, and product safety and liability. • Need for Standardization: The authors emphasize the need for a specific CDR standard to provide clear guidance for companies on implementing CDR practices, thereby enhancing consumer trust in corporate activities in a digitized world.
10.	Cheng, C.; Zhang, M.	2023	Conceptualizing Corporate Digital Responsibility: A Digital Technology Development Perspective	Sustainability (Switzerland)	Mixed Methods Approach (Literature Review and Empirical Research (Survey among high-technology enterprises listed on the Shanghai and Shenzhen stock exchanges in China. The survey targeted executives in charge of digital business, focusing on their practices and perceptions related to CDR))	China	• The authors propose a new conceptualization of CDR by distinguishing it into two main components: corporate digitized responsibility and corporate digitalized responsibility. Corporate digitized responsibility includes unbiased data acquisition, data protection, and data maintenance. Corporate digitalized responsibility involves appropriate data interpretation, objective predicted results, and tackling value conflicts in data-driven decision-making. • Measurement of CDR: The study develops a series of measurements for CDR, identifying 15 indicators corresponding to the digitization and digitalization stages. These measurements were tested for their impact on corporate digital performance. • Empirical Findings: The empirical analysis demonstrated a positive relationship between CDR and corporate digital performance. The study found that digitization (data-related practices) is slightly more important than digitalization (application of digital technology) in promoting corporate digital performance. • Managers should emphasize CDR issues as they significantly influence a firm's digital performance. Ethical challenges in data creation, transfer, and storage should be addressed to ensure unbiased data acquisition, data protection, and data maintenance. Companies should develop appropriate tools for data interpretation and prediction, and address value conflicts in data-driven decision-making.
11.	Clausen, S.; Braun, L.-M.; Stieglitz, S.	2023	Towards More Digital Wellbeing in Knowledge Work - A Signaling Theory Perspective	IEEE Computer Society	Mixed Methods Approach (Content Analysis of social media accounts of 25 technology companies and Semi-Structured Interviews with 10 students and young professionals)	Germany	• Study identified six categories of digital wellbeing initiatives offered by organizations. • Impact on Organizational Attractiveness: Digital wellbeing initiatives can positively influence organizational attractiveness and job choice, especially among millennials. However, these initiatives are often seen as secondary factors compared to primary job attributes like salary and job content. • Perception of Digital Wellbeing: Many participants were not initially aware of the term "digital wellbeing" and did not always relate their wellbeing issues to ICT use. There is a need for greater awareness and explicit communication about the impact of ICT on wellbeing. • Trust and Credibility: Digital wellbeing initiatives promoted on social media are often viewed with scepticism. Organizations need to ensure that these initiatives are perceived as genuine and not just marketing tools. • Cost and Effectiveness: Participants had difficulty estimating the costs of digital wellbeing initiatives. Organizations should consider communicating the costs and benefits of these initiatives to enhance their credibility and effectiveness.
12.	De Freminville, M.	2020	Corporate governance and digital responsibility	IEEE Xplore	Qualitative Research (Case Studies and Interview with Stakeholders in Corporate Governance and Digital Responsibility Sectors)	France	• Emphasizes the importance of integrating digital responsibility into corporate governance frameworks to enhance trust and sustainability. • Highlights the need for active engagement with stakeholders to address digital risks and opportunities. • Provides recommendations for policymakers to support the implementation of digital responsibility practices in corporations.
13.	Dörr, S.	2021	Corporate Digital Responsibility	Springer	Conceptual (Comprehensive Guideline for Implementing CDR in Practice)	Germany	• A detailed description of how corporate responsibility is changing in the age of big data and artificial intelligence. • Demonstrating how CDR can offer companies a sustainable competitive advantage. • Providing concrete assistance with the digital transformation for companies.

	Authors	Year	Title	Outlet	Research Methodology	Region	Key Insights
							• Inviting executives, corporate responsibility officers, digital ethics experts, sustainability consultants, and anyone interested to learn about the opportunities of responsible digitalization at companies.
14.	Dörr, S.; Lautermann, C.	2024	Beyond direct stakeholders: The extensive scope of Societal Corporate Digital Responsibility (CDR)	Organizational Dynamics	Conceptual	Germany	• The paper defines Societal CDR as the responsibility of companies to consider the impacts of their digital business strategies on societal stakeholders and institutions, beyond just direct stakeholders like employees and customers. • It highlights the difficulties in measuring societal impact and influencing indirect stakeholders, emphasizing the need for businesses to address passive stakeholder groups and societal institutions affected by digitalization. • The authors propose nine "vitality factors" across economic, social, and political domains to guide businesses in assessing their impact on society. These factors include promoting economic equity, enhancing social well-being, and supporting political engagement and transparency. • The paper concludes with practical recommendations for businesses to integrate Societal CDR into their strategies, stressing the importance of inclusivity, ethical practices, and transparency.
15.	Elliott, K.; Copilah-Ali, J.	2024	Implementing corporate digital responsibility (CDR): Tackling wicked problems for the digital era: Pilot study insights	Organizational Dynamics	Mixed Methods Approach (Pilot Study with CDR Sessions, Interviews, Surveys, Workshops and Readiness Reports)	United Kingdom	• Introduces the CDR Framework, which builds on CSR to address the responsibilities arising from digitization. • Highlights the concept of wicked problems, which are complex and difficult to define or solve, requiring iterative management and real stakeholder involvement. • Pilot Study Findings: • Employee Readiness: The survey indicated a high level of readiness among employees to embrace CDR, with 76% actively considering how to incorporate ethical practices within their roles. • Leadership Initiatives: Leadership showed awareness and initiatives towards environmental impact and responsible business practices. • Common Dilemmas: Identified common dilemmas such as the consultancy business model's limitations, cultural fears of hindering innovation, and the risk of CDR becoming a tick-box exercise. • Recommendations: • CDR Champions: Advocates for the role of CDR champions to facilitate organization-wide feedback and embed CDR principles. • Use Cases: Suggests creating CDR use cases to evaluate the cost/benefits of implementing CDR. • Deliberative Leadership: Emphasizes the need for deliberative leadership to embed ethically aligned values and address wicked problems.
16.	Esselmann, F., Golle, D., Thiel, C., & Brink, A.	2020	Corporate Digital Responsibility Unternehmerische Verantwortung als Chance für die deutsche Wirtschaft	Zentrum Digitalisierung.Bayern	Mixed Methods Approach Quantitative: Online Survey (n = 50) Qualitative: Semi-Structured Expert Interviews (n = 12)	Germany	• Over 80% of the surveyed companies have integrated responsible digitalization into their business strategies or specific projects, recognizing the importance of CDR for building consumer trust. • Responsible data handling and privacy are critical areas, driven by both market demands and legal requirements like the GDPR. • Companies view CDR as a means to enhance their competitive position, particularly against firms from the USA and China. Compliance with GDPR is seen as a market differentiator. • There is a stronger demand for responsible technology use in B2B contexts compared to B2C, presenting an opportunity for Germany as an export nation. • Companies face challenges in balancing positive and negative impacts of digitalization, such as improving customer experience while maintaining privacy. • Increasingly, employees demand clear value positioning from their employers, making CDR a tool for attracting and retaining talent. • There is a need for systematic governance and integration of CDR into business processes, beyond ad-hoc management discussions. • Effective CDR implementation requires collaboration across sectors, involving businesses, policymakers, and consumer organizations.
17.	Girrbach, P.	2021	Corporate Responsibility in the Context of Digitalization	Tehnicki Glasnik	Case Study	Croatia	• The paper emphasizes the need to enhance traditional corporate responsibility to include digital aspects, termed as CDR. • It provides insights into how blockchain can be used to improve resource efficiency and transparency in supply chains. • The study highlights the importance of a holistic approach to corporate responsibility, considering economic performance, environmental protection, and social responsibility in the digital age.
18.	Hamadi, H.; Manzo, C.	2021	"Corporate Digital Responsibility" A Study on Managerial Challenges for AI integration in Business	Lund University School of Economics and Management (LUSEM)	Mixed Methods Approach Literature Review (CSR Approaches to Digitalisation) Semi-Structured Interviews (AI Experts and Managers)	Sweden	• The research identifies several managerial challenges in integrating AI into business processes, including the "black box" problem, where managers struggle to understand and explain AI decisions. It emphasizes the importance of a top-down approach to digital responsibility, where leadership sets the tone for ethical digital practices. • The study discusses the concept of technological artifacts as actors, but concludes that they should not be considered as embodying agency in the same way humans do. • It suggests that while AI technologies can influence decisions, the moral responsibility remains with the companies that create and use them. • The research highlights a moral responsibility gap due to the unpredictability of AI outputs. It calls for a collective effort among corporations, governments, and individuals to define and uphold digital ethics.

	Authors	Year	Title	Outlet	Research Methodology	Region	Key Insights
							• The study stresses the need for secure data handling, constant training, and human intervention in AI decision-making processes. • It also points out the reactive nature of laws and regulations, which often lag behind technological advancements.
19.	Hamdallah, M.E.; Srouji, A.F.; Al-Ibbini, O.	2022	Does Perceived Organizational Support Have a Mediating Role in Directing the Relationship Between E-Banking and Corporate Digital Responsibility?	Studies in Computational Intelligence	Quantitative Research (E-Survey with 88 Respondents from the Financial Departments of 16 Jordanian Banks)	Jordan	• E-Banking is a direct element in the dimensional model that indicates a positive relationship with Social Corporate Digital Responsibility (SCDR), Economic Corporate Digital Responsibility (ECDR), and Technological Corporate Digital Responsibility (TechCDR). • Perceived Organizational Support (POS) has a partial positive mediating effect in the relationship between E-Banking and ECDR, and between E-Banking and TechCDR. However, there is no mediating effect in the relationship between E-Banking and SCDR.
20.	Herden, C. J.; Alliu, E.; Cakici, A.; Cormier, T.; Deguelle, C.; Gambhir, S.; ... & Edinger-Schons, L. M.	2021	"Corporate Digital Responsibility" New corporate responsibilities in the digital age	Sustainability Management Forum	Mixed Methods Approach Qualitative: Literature Review Quantitative: Online Survey with 509 US-based Respondents	Germany	• The survey revealed both opportunities (e.g., better services, reduction of repetitive work) and threats (e.g., cybercrime, data security issues) associated with digitalization. • CDR Topics: The authors identified 20 key topics related to CDR, categorized under the ESG framework, including energy and carbon footprint, digital waste, digital well-being, data security, and robot ethics. • A five-step guide for companies to develop and implement a CDR strategy, emphasizing the need for continuous updates and alignment with company goals and culture.
21.	Jones, P.	2023	Corporate Digital Responsibility in the Retail Industry: Cameo Case Studies of Two German Retailers	Athens Journal of Business & Economics	Cameo Case Study (Rewe Group and Otto Group, illustrate how they are addressing CDR)	Greece	• Rewe Group: Focuses on ethical data use, data protection, and the responsible use of digital technologies. The company developed an AI manifesto to guide the ethical use of AI. • Otto Group: Launched the "Future Values Initiative" to promote social discourse on the opportunities and challenges of digitization. The initiative aims to integrate sustainability and digitization. • Reflections on CDR: The paper discusses potential internal inconsistencies within CDR, such as tensions between economic and social dimensions. It highlights the importance of transparency and stakeholder involvement in addressing CDR.
22.	Kärpänen, T.	2022	Corporate Digital Responsibility and Accessibility in Digital Services	International Conferences Interfaces and Human Computer Interaction 2022	Qualitative Research (Semi-structured Interviews with eight Finnish Micro-Entrepreneurs)	Finland	• Current Knowledge and Practices: Most interviewees associated accessibility with clear and understandable digital services. Many had tried to create simple and user-friendly digital services without knowing these were accessibility features. Challenges included a lack of knowledge, resources, and proper testing with users. • Understanding of Legislation: All participants were familiar with the GDPR but not with the Web Accessibility Directive or Finland's national legislation based on it. There was a general lack of awareness about future legislation requirements for SMEs under the European Accessibility Act (EAA). • Role of Accessibility in CDR: Accessibility in digital services is part of the Corporate Digital Responsibility (CDR) framework, falling under the 'social' and 'governance' domains. Legal requirements like the GDPR influence CDR culture, emphasizing the need for accessible and understandable digital services.
23.	Kempkes, E.; Kempkes, J.A.; Suprano, F.; Wömpener, A.	2021	Corporate Digital Responsibility	Controlling & Management Review	Qualitative Research (Analysis of Business and Sustainability Reports to systemize CDR action fields)	Germany	• Many aspects of digital corporate responsibility can be integrated into the CSR concept. However, new responsibilities, particularly related to trustworthy AI technologies and IT security, require additional focus. • Companies need to develop a comprehensive CDR strategy to address these new responsibilities. This includes identifying relevant CDR action fields, managing and evaluating all CDR activities, and effectively communicating these to stakeholders. • The paper provides a framework for companies to derive CDR measures from business practice. It highlights the importance of continuous monitoring and adaptation of these measures to ensure they meet evolving societal expectations. • Focus Areas: • Ecological Dimension: Addressing the digital CO2 footprint and managing digital waste. • Social Dimension: Ensuring responsible workplace design and digital health. • Digital Dimension: Developing ethical standards for AI, ensuring IT security, and maintaining data sovereignty and transparency.
24.	Kivistö, M.	2024	The balance between corporate digital responsibility and organizational benefit	LUT School of Business and Management	Qualitative Research (Semi-structured Interviews with two Groups: Employees of a Finnish Media Agency and	Finland	• The concept of CDR is relatively new and not widely understood. Companies often equate digital responsibility with legal compliance rather than a holistic set of values and norms. • There are ethical concerns related to the type and amount of data collected, how it is collected, and its potential misuse. Companies often collect more data than necessary, which can be ethically problematic. • GDPR has significantly improved digital responsibility practices, but there are still challenges in understanding and implementing regulations. Legislation is seen as a positive force that helps protect consumer privacy and rights.

	Authors	Year	Title	Outlet	Research Methodology	Region	Key Insights
					Regular Consumers)		• Reporting on CDR could be beneficial for both internal and external stakeholders. It could enhance consumer trust and potentially influence consumer behaviour, although it might not necessarily become a competitive advantage. • The future of data-driven marketing is seen as challenging due to the deprivation of third-party cookies and stricter regulations. However, it is also viewed as an opportunity to develop new solutions and adapt to changes. • Consumers value their privacy highly but often do not act in accordance with their stated concerns due to the privacy paradox. They prefer clear and brief information about how their data is used and would appreciate certifications indicating responsible data practices.
25.	Kluiters, L.; Srivastava, M.; Tyll, L.	2023	The impact of digital trust on firm value and governance: an empirical investigation of US firms	Society and Business Review	Quantitative Research Create Combined Digital Trust Score with Data Collection from US firms, 2011-2016 Linear Regression (Effect of firm- and governance-specific characteristics on digital trust)	Czech Republic	• Firm Profitability and Size: A firm's profitability (measured by return on assets, ROA) decreases while its size increases Digital Trust (DT). This suggests that firms with lower DT might monetize data more actively, decreasing DT but increasing short-term profitability. • Digital Trust and Firm Value: Increasing DT leads to an increase in firm value. This highlights the importance of cybersecurity investments and their positive impact on shareholder value and consumer perceptions. • The study extends the knowledge of CDR by providing a novel method for calculating DT across industries. It emphasizes how firms can enhance DT through firm- and governance-level factors, subsequently increasing firm value. • Managerial Implications: The study provides empirical evidence that investments in cybersecurity and digital trust can increase firm value, suggesting that these should be viewed as value drivers rather than cost drivers.
26.	Lautermann, C.; Frick, V.	2023	Corporate Digital Responsibility	IÖW-Schriftenreihe	Conceptual	Germany	• Comprehensive CDR Framework: The study outlines a broad CDR framework applicable to companies across various industries, not just IT firms. • Six Responsibility Areas: These include digital ethics & compliance, digital governance, digital accountability, digital strategy, employee data protection, and ecological responsibility in digitalized production. • Stakeholder Engagement: The framework emphasizes the importance of engaging with stakeholders, including employees, customers, and supply chain partners, in the context of digital transformation. • Policy and Society: It highlights the role of companies in promoting digital literacy, sharing knowledge with society, and responsibly influencing digital policy.
27.	Liu, H.; Han, P.; Wang, S.	2023	Enhancing corporate social responsibility in the digital economy era: Evidence from China	Heliyon	Quantitative Research Statistical analysis for the impact of digital economy on CSR Database: Chinese listed companies over the period from 2013 to 2021	China	• The digital economy significantly promotes CSR performance among companies, especially state-owned and large-scale enterprises. • The digital economy facilitates CSR fulfilment across financial, human, and social capital levels, with the most significant impact observed at the human capital level. • The digital economy improves CSR by alleviating financial constraints, facilitating digital transformation, and enhancing the transparency of internal control information within enterprises. • The study suggests that government support for digital finance applications and investments in digital infrastructure can further enhance CSR performance.
28.	Liyanaarachchi, G.; Deshpande, S.; Weaven, S.	2020	Market-oriented corporate digital responsibility to manage data vulnerability in online banking	International Journal of Bank Marketing	Conceptual	Australia	• Managing consumer data vulnerability requires a unique strategy different from conventional service delivery. • A holistic approach is recommended by integrating corporate digital responsibility as a pivotal element of organizational strategy. • Vulnerable customers should be positioned as a critical stakeholder. • The paper introduces an innovative set of consumer segments based on data vulnerability and a data vulnerability growth model (DVGM) connecting vulnerability with age.
29.	Londoño-Cardozo, J.; Paz, M.P.	2021	Corporate Digital Responsibility: Foundations and Considerations for Its Development	RAM – Mackenzie Management	Qualitative Research (Hermeneutical Investigation and Literature Review)	Brazil	• The paper introduces CDR as a new area of interest for social accountability in the context of Industry 4.0 technologies. • It highlights the lack of sufficient theoretical and legal frameworks to address the implications of new technologies. • The authors argue that new technologies pose social risks, making them a subject of social responsibility. • Despite the absence of regulations on Industry 4.0, the development of CDR is deemed necessary and possible.
30.	Marengo, C.L.	2023	Corporate Digital Responsibility -Does it Pay to be Good? Understanding how active CDR can lead to a Competitive Advantage for Firms	University Católica Portugal	Mixed Methods Approach Quantitative: Survey	Portugal	• Active CDR can lead to performance benefits for companies, such as improved access to certain markets, differentiation, stakeholder involvement, and compliance. • The impact of CDR on business performance can be influenced by factors such as company size. • Legislative changes and a shift from voluntary to mandatory CDR are expected to have significant impacts on future business practices.

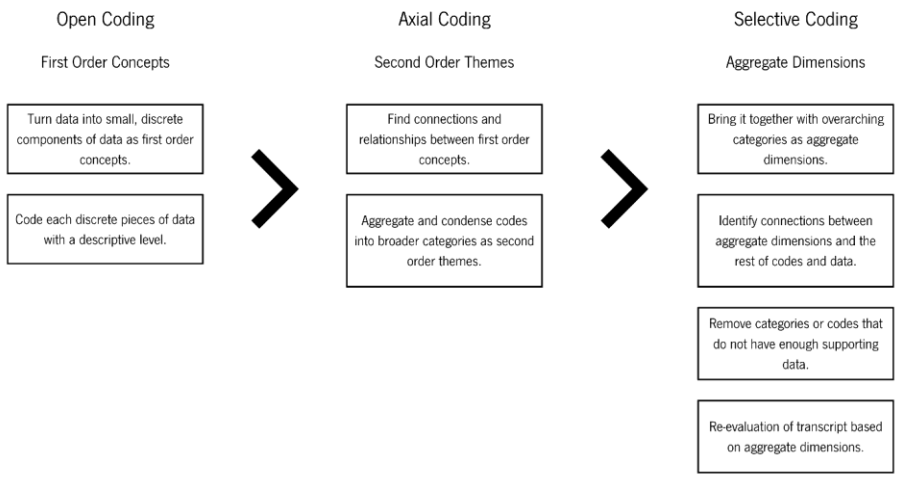
	Authors	Year	Title	Outlet	Research Methodology	Region	Key Insights
			A mixed-methods study		Qualitative: Guided Interviews (n = 7)		
31.	Merbecks, U.	2023	Corporate digital responsibility (CDR) in Germany: background and first empirical evidence from DAX 30 companies in 2020	Journal of Business Economics	Qualitative Research (Content Analysis with Software MAXQDA of nonfinancial Reports of German DAX 30 Companies from 2020)	Germany	• The study found a significant amount of disclosed information on CDR initiatives, indicating that large German companies are actively addressing digital responsibility. • Most disclosures were related to CDR activities, particularly those concerning customer and employee-related initiatives. • The extent of CDR disclosures varied significantly by industry and company size, with ICT and Chemical industries leading in CDR initiatives. • There was a notable absence of performance-related CDR disclosures and information on CDR-related risks. • The study highlighted the lack of standardized reporting on CDR, suggesting the need for more detailed guidelines and KPIs for meaningful CDR reporting.
32.	Nagano, A.	2023	Institutional Values and CDR for Green ITC: Transforming E-waste to Ethical Gems	Institute of Electrical and Electronics Engineers Inc	Conceptual	Japan	• The importance of institutional values in shaping corporate behaviour towards environmental sustainability. • A proposed model for integrating institutional values into CDR practices within ICT companies. • The potential for transforming e-waste into ethical gems through responsible management and recycling practices.
33.	Napoli, F.	2023	Corporate Digital Responsibility: A Board of Directors May Encourage the Environmentally Responsible Use of Digital Technology and Data: Empirical Evidence from Italian Publicly Listed Companies	Sustainability (Switzerland)	Quantitative Research (Data from Sustainability Reports of 53 publicly listed Italian Companies from 2014 – 2018)	Italy	• The study found that a higher level of board independence is associated with better environmental performance. Independent directors are more likely to push for environmentally responsible practices. • There was no direct, statistically significant association between the use of digital technologies (ERP systems) and environmental performance. However, in firms with a high proportion of independent directors, the use of digital technologies positively influenced environmental performance. • The research highlighted the importance of CDR, showing that the presence of independent directors on a board positively impacts CDR practices. This includes using data and digital technologies in environmentally responsible ways.
34.	Pelters, E.	2021	Corporate Digital Responsibility—Understanding and Applying	Springer Proceedings in Business and Economics	Qualitative Research (Scenario Technique)	Germany	• The paper proposes a solution for evolving the CSR concept into CDR, considering economic, ecological, and social aspects of sustainability in both physical and digital environments. • The scenario technique is shown to be adaptable to contexts beyond companies, such as universities. It highlights the importance of a close exchange between universities and the state for successful implementation. • Impact of the COVID-19 Pandemic: The pandemic accelerated digital transformation in universities, revealing both challenges and opportunities. The findings emphasize the need for a balanced approach combining digital and physical teaching methods.
35.	Rugeviciute, A.	2023	Analysis and modelling of socio-environmental impacts of Corporate Digital Responsibility	CEUR Workshop Proceedings	Mixed Methods Approach Quantitative: Mathematical modelling Qualitative: Literature Review	France	• Organizations face challenges in minimizing the negative impacts of ICT while maximizing the positive ones. The research highlights the need for strategies aligned with sustainable development. • The study proposes a framework to assess an organization's degree of CDR implementation and conceptualizes strategic CDR decisions. • The research aims to develop methods to link CDR decisions with socio-environmental impacts, helping organizations make better-informed decisions.
36.	Scarpi, D.; Pantano, E.	2024	"With great power comes great responsibility": Exploring the role of Corporate Digital Responsibility (CDR) for Artificial Intelligence Responsibility in Retail Service Automation (AIRRSA)	Organizational Dynamics	Conceptual	United Kingdom	• The importance of Corporate Digital Responsibility (CDR) in addressing ethical issues unique to digital technology. • The need for comprehensive guidelines beyond legal obligations to ensure ethical and responsible actions in AI applications. • The concept of CDR and its role in shaping Artificial Intelligence Responsibility in Retail Service Automation (AIRRSA). • The link between CDR and AIRRSA lies in responsible data management, which is fundamental for training and developing ethical AI systems. • The paper discusses the managerial applications and tools of CDR in AI retail service automation to identify value for consumers and retail managers.
37.	Schneider, G.	2022	Framing Accountability in Business-to-Government Data Sharing: The Gap Filling Role of Businesses' Corporate Digital Responsibility	European Business Law Review	Qualitative Research (Analysis of existing European Policies, Regulations, and Frameworks related to B2G Data Sharing)	Italy	• Accountability Gaps in B2G Data Sharing: The paper identifies significant accountability gaps in the current B2G data sharing frameworks within the EU. These gaps arise due to the lack of specific regulatory frameworks and the inadequacy of existing public and data protection laws to ensure transparency and accountability. • The study introduces the concept of CDR as a potential solution to these accountability gaps. CDR involves businesses taking on responsibilities that align with both corporate social responsibility (CSR) and legal and ethical obligations related to data management. • Businesses are seen as crucial players in ensuring accountability in B2G data sharing. By adopting CDR, businesses can bridge the gaps left by public and data protection laws, ensuring that data sharing agreements are executed transparently and accountably.

	Authors	Year	Title	Outlet	Research Methodology	Region	Key Insights
							• The paper suggests that businesses should integrate B2G data sharing into their CSR strategies. It also recommends the development of specific regulatory frameworks to govern B2G data sharing, ensuring that both public and private entities are held accountable.
38.	Sidaoui, K.; Mahr, D.; Odekerken-Schröder, G.	2024	Generative AI in Responsible Conversational Agent Integration: Guidelines for Service Managers	Organizational Dynamics	Conceptual (Managerial Guidelines focusing on CDR Culture, Management Structure, and Digital Governance)	Netherlands	• The importance of responsible integration of conversational agents (CAs) like chatbots for service firms to mitigate risks and foster positive outcomes. • The role of generative AI (GenAI) in implementing CDR factors and responsible CA software development lifecycle phases during development and integration. • Guidelines for leveraging GenAI to enhance CDR Culture, incorporate ethical considerations into CDR Management Structure, and enable robust Digital Governance mechanisms to prioritize customer/societal well-being. • A multilevel framework illustrating reinforcing the guidelines through organizational sensemaking processes, and fostering responsible CA integration aligned with ethical principles and societal values.
39.	Singh, R.; Bansal, R.	2022	Role and Benefits of Corporate Digital Responsibility (CDR) in the Public and Private Enterprises in a Digitalization Era	Nova Science Publishers, Inc.	Conceptual	India	• CDR is defined as the set of shared values and norms guiding an organization's actions regarding digital technology and data. It emphasizes the ethical considerations and responsibilities of organizations in the digital age. • The chapter proposes a framework for CDR, highlighting four key processes related to digital technology and data: Creation of technology and data capture, Operation and decision-making, Inspection and impact assessment, Refinement of technology and data • The framework identifies four main stakeholders in CDR: Individual actors (managers, employees, customers), Artificial/technological actors, Organizations, Institutional/governmental/legal actors • The chapter outlines the lifecycle stages of digital technologies and data, emphasizing the need for ethical considerations at each stage. • It discusses how an organization's culture can support CDR by embedding shared values, specific norms, and artifacts/practices that promote ethical behaviour. • The chapter highlights the challenges of implementing CDR, such as ensuring data privacy, promoting digital diversity and inclusion, and ethical AI decision-making. It also discusses the benefits, including improved trust, reputation, and long-term financial performance.
40.	Stahl, B.C.	2024	From Corporate Digital Responsibility to Responsible Digital Ecosystems	Sustainability (Switzerland)	Conceptual	United Kingdom	• The paper explores the concept of CDR and extends it to the idea of responsible digital ecosystems. • It suggests that digital technologies and their responsibilities are best understood using the metaphor of an "ecosystem," which accommodates the complex nature of socio-technical systems. • The article highlights the challenges of ascribing responsibility within digital ecosystems due to their complexity and the difficulty in delineating boundaries. • Emphasizes the importance of systems thinking in understanding and addressing ethical and social issues related to digital technologies. • Introduces the concept of "meta-responsibility," which involves shaping, maintaining, developing, and aligning existing and novel responsibilities within digital ecosystems. • The paper discusses the implications for research and practice, including the need for adaptive governance structures and the importance of aligning research and innovation processes with societal values and expectations.
41.	Tóth, Z.; Blut, M.	2024	Ethical compass: The need for Corporate Digital Responsibility in the use of Artificial Intelligence in financial services	Organizational Dynamics	Conceptual	United Kingdom	• The authors propose an AI accountability framework that combines the locus of morality and moral intensity to assess ethical issues in AI applications. This framework helps managers navigate the complexities of integrating AI into their strategies and operations. • The paper identifies four accountability clusters: • Professional Norms: Ethical guidelines integrated into AI use. • Business Responsibility: Strategic-level decision-making within organizations. • Inter-Institutional Normativity: Collaboration between different institutions for ethical AI use. • Supra-Territorial Regulations: International and inter-sectoral collaborations to create best practices. • CDR Roadmap: The authors provide a CDR roadmap with specific measures and steps for implementing ethical AI use, considering different accountability clusters and time perspectives.
42.	Trittin-Ulbrich, H; Böckel, A.	2022	Institutional entrepreneurship for responsible digital innovation: The case of corporate digital responsibility	Journal of Business Ethics	Qualitative Research	Germany	• Research explores how institutional entrepreneurs construct CDR as an issue to legitimize corporate commitment to responsible digital innovation. • The discursive, relational, and material legitimization of responsible digital innovation through CDR. • The role of multi-stakeholder efforts in shaping a firm's approach to CDR. • Additional topics associated with the issue of CDR. • Theoretical and practical implications for institutional research on digital innovation.
43.	Van Der Merwe, J.; Al Achkar, Z.	2022	Data responsibility, corporate social responsibility, and corporate digital responsibility	Data and Policy	Qualitative Research (Theoretical Analysis and Case Studies)	United States	• The commentary argues that existing CSR and CDR mechanisms are not sufficient for managing data responsibility effectively. It highlights the need for a broader societal and comprehensive approach. • It discusses the emergence of CDR as a concept and its overlap with CSR, while arguing that CDR should be treated as a separate mechanism due to the unique challenges posed by digital transformation.

	Authors	Year	Title	Outlet	Research Methodology	Region	Key Insights
							• The authors suggest that data responsibility should be embedded throughout the entire business cycle and not treated as an afterthought. They also call for stronger enforcement and accountability mechanisms.
44.	Viitikko, V.	2022	Corporate digital responsibility in the context of data-driven marketing	Lappeenranta-Lahti University of Technology LUT	Qualitative Research (Multiple Case-Study Structure with Semi-Structured Interviews with Company Representatives (n = 7) and seven Consumers (n = 7))	Finland	• Common threats identified include loss of privacy, lack of transparency, increasing data breaches, and companies' exclusive decision-making power over data. • Opportunities Identified: Enhanced transparency and efficiency, equal power balance over data, digital privacy and strengthened trust between companies and consumers, sustainable development of digital transformation. • Stakeholder Perspectives: • Company: Focuses on leveraging data for marketing while being aware of the need for digital responsibility. • Consumer: Concerned about privacy and transparency but recognizes the benefits of personalized marketing. • Society: Emphasizes the need for regulations and ethical guidelines to govern digital transformation.
45.	Vo Thai, H.-C.; Hue, T.H.H.; Chen, P.-F.; Tran, M.-L.	2024	Unravelling the influence of human capital and stakeholder engagement on corporate digital responsibility: Implications for firm performance in Southeast Asia enterprises	Corporate Social Responsibility and Environmental Management	Case Study (Data collected from 2106 Enterprises across Vietnam, the Philippines, and Indonesia)	United States	• The importance of human capital and stakeholder engagement in formulating and executing CDR strategies. • The impact of CDR strategies on firm performance in Southeast Asian enterprises. • The moderating role of stakeholder engagement in the effectiveness of CDR approaches. • Practical implications for organizations to navigate responsible digital practices within the context of Southeast Asian enterprises.
46.	Volkov, V.R.; Sidorenko, E.L.	2022	Digital Platforms and Issues of Corporate Criminal Responsibility, Self-regulation	Lecture Notes in Networks and Systems	Qualitative Research (Literature Review)	Russia	• The paper emphasizes that corporations can be subject to criminal punishment for crimes, integrating this responsibility within the broader scope of corporate social responsibility. • It discusses the diminishing scope of self-regulation due to increasing state regulation, highlighting the need for internal control mechanisms within corporations. • The authors introduce concepts like "digital social responsibility" and "corporate digital responsibility," stressing the lack of a unified scientific direction for developing corporate responsibility provisions on digital platforms. • Legal Models: The paper calls for collaborative efforts among scientists to justify and explain the effectiveness of different legal models for corporate responsibility in the digital age.
47.	Wagener, A.	2022	Corporate Digital Responsibility und KI Bias	Hofer Beiträge zur digitalen Transformation	Qualitative Research (Literature Review)	Germany	• Key Areas of CDR: • Resource Conservation: Efficient use of energy in digital services and products. • Social Compatibility: Creating humane work environments with digital technology. • Democratization of Digitalization: Enhancing access through skill-building and promoting accessible digital infrastructure. • Data Security and Privacy: Preventing misuse of data power, combating surveillance capitalism, and ensuring transparency in AI decision-making. • Challenges and Solutions: • Identifying applicable value standards is challenging due to societal fragmentation and evolving norms. • The paper calls for the development of tools that address both technical and organizational requirements for effective CDR management. • It stresses the importance of integrating business objectives with societal concerns to create a comprehensive CDR strategy.
48.	Wagner, D.; Tąkiel, M.; Dąbrowski, P.	2023	The Paradigm of Corporate Digital Responsibility and Challenges to Its Implementation in a Law Firm	Koźmiński University	Qualitative Research (Literature Review)	Poland	• Strategic Approach for Law Firms: • Law firms need to balance providing high-quality services with maintaining responsible and ethical business practices. • Emphasis on legal tech and cloud storage as key drivers for CDR in law firms. • Measuring CDR Maturity: • Two main groups of indicators: measures of effort and measures of result. • Importance of external evaluation and cooperation with specialized providers for technical aspects. • Future Directions: • Integration of CDR into broader strategic perspectives, such as the Balanced Scorecard. • Emphasis on the importance of CDR for sustainable business models and competitive advantage.
49.	Weber-Lewerenz, B.	2020	Corporate digital responsibility in construction engineering: Ethical principles in dealing with digitization and AI	International Journal of Responsible Leadership and Ethical Decision-Making (IJRLEDM	Qualitative Research (Scientific Questionnaires, Personal and Written Interview Surveys)	Germany	• It highlights the importance of CDR in the construction industry, especially in the context of increasing AI applications. • The research examines the challenges and potential of human-led technologies undergoing digital transformation. • It reviews the status quo and ethical framework by law, differentiating between human and AI to define risks and potential areas of application. • The study underscores the social, educational, economic, and political impacts of AI and digitization, advocating for value-based decision-making.

	Authors	Year	Title	Outlet	Research Methodology	Region	Key Insights
50.	Wilkinson, C.	2023	Corporate digital responsibility: The influence of digitalisation on sustainable corporate development	FOM Hochschule für Oekonomie & Management	Qualitative Research (Literature Review)	Germany	• Digitalisation's Dual Role: Digitalisation supports daily activities but also poses significant threats that need to be addressed. • Companies have a responsibility to act as multipliers by setting a good example in sustainable practices. • The paper highlights the importance of addressing global challenges such as climate change, loss of biodiversity, and pollution.
51.	Wirtz, J.; Kunz, W.H.; Hartley, N.; Tarbit, J.	2023	Corporate Digital Responsibility in Service Firms and Their Ecosystems	Journal of Service Research	Qualitative Research (Multi-disciplinary Literature Synthesis Approach)	United States	• The paper highlights that CDR is critical in service contexts due to the vast streams of customer data involved and the omnipresence, opacity, and complexity of digital service technologies. • The authors synthesize literature on ethics, privacy, and fairness using the CDR data and technology life-cycle perspective to better understand these risks in service contexts. • The paper examines the digital service ecosystem and the related flows of money, service, data, insights, and technologies to provide insights into the origins of CDR risks. • The authors introduce the concept of the CDR calculus, which captures the trade-offs between good CDR practices and organizational objectives. They argue that regulation is necessary when a firm's CDR calculus becomes too negative. • The paper advances a set of strategies, tools, and practices that service firms can use to manage these trade-offs and build a strong CDR culture.
52.	Wynn, M.; Jones, P.	2023	Corporate Responsibility in the Digital Era	Information (Switzerland)	Qualitative Research (Scoping Literature Review and Case Studies (Walmart and Deutsche Telekom))	United Kingdom	• The paper identifies several key parameters of CDR, including data protection, privacy, security, transparency, and ethical use of digital technologies. • Case Study Findings: Walmart: Focuses on digital trust commitments, promoting fairness, protecting privacy, and ensuring cybersecurity. • Deutsche Telekom: Emphasizes human-centred technology, digital ethics, digital participation, future work, and environmental impacts. • Emergent Issues: The paper discusses issues such as fair and equitable access to digital technologies, personal and social well-being, environmental impacts, and the complexities of cross-supply chain digital responsibilities.

Appendix D – Coding Process



Appendix E – Summary of emergent core themes and dimensions of CDR practices from the literature

Aggregate Dimensions	Second Order Themes	First Order Concepts	Illustrative Quotes	Example of other Sources addressing Second Order Themes
Organisational culture	1. Digital work environment	Remote work policies, digital collaboration tools, cybersecurity awareness, digital literacy training, inclusive digital practices	Clausen et al. (2023): "Research shows that the abundance of digital technology and constant connectivity can negatively affect employees' wellbeing and performance, for example by causing stress. Therefore, work culture and human resource management measures are needed to prevent such adverse consequences of technology use. One way to do so is to tackle negative effects of ICT use with the help of digital wellbeing initiatives as part of CDR." (p. 4599)	Broers (2023); Angermann (2023); De Freminville (2020)
	2. Responsible digital practices	Ethical use of technology, regular audits and assessments, employee training programs, clear guidelines and policies, continuous improvement and updates	Broers (2023): "The last principle is the accountability principle, which is focussed on who is responsible for ensuring digital responsibility, where organizations can define roles and processes. The principles collectively guide individuals, organizations, and governments to responsible digital behaviour." (p. 9)	Andersen (2020); Carl (2022); Al-Omoush et al. (2023)
	3. Leadership commitment	Transparent leadership, setting the tone for digital responsibility, employee empowerment, inclusive leadership practices, commitment to continuous learning	Elliott & Copilah-Ali (2024): "This leadership approach echoes the core tenets of CDR to inform ethical decision-making for leaders, the organisation and demonstrates a commitment to a shared responsibility towards consumers and the environment. For example, deciding to ascribe to the CDR Manifesto and adopt the logo to demonstrate compliance with CDR core tenets." (p. 7)	Hamadi & Manzo (2021); Napoli (2023); Broers (2023)
Stakeholder engagement	4. Internal stakeholders	Employee engagement, cross-functional collaboration, transparent communication, professional development, workplace well-being	Vo Thai et al. (2024): "Furthermore, this study contributes to the existing literature on CDR and stakeholder engagement by highlighting the role of stakeholder engagement as a moderator. It underscores the importance of actively engaging stakeholders to enhance the link between CDR and firm performance. Specifically, the study demonstrates that utilizing CDR for "Coordinating or collaborating between employees" and actively involving employees can be an effective strategy for SAEs to expand their customer or supplier base." (p. 1936)	Esselmann et al. (2020); Elliott & Copilah-Ali (2024); Broers (2023)
	5. External stakeholders	Customer relationship management, supplier partnerships, community engagement, stakeholder feedback mechanisms, corporate social responsibility	Broers (2023): "At last, CDR is of great importance to other stakeholders such as employees and consumers, as the new digital technologies bring new social issues. This research can stimulate the discourse about CDR, pushing organizations towards digital responsible behaviour." (p. 5)	Boin (2022); De Freminville (2020); Singh & Bansal (2022)
	6. Regulatory & compliance stakeholders	Compliance audits, risk management, regulatory trainings, policy development, stakeholder reporting	Aitken et al. (2021): "Deliberative forms of public engagement present valuable opportunities to incorporate diverse views and perspectives, enabling critical reflection on organizational practices and the trajectory of innovation. The study concludes that public engagement is vital to ensure that private sector organizations move beyond 'ethics-washing' or tokenistic efforts at CDR to meaningfully address public concerns and reflect public values in all innovation processes." (p. 1)	Hamadi & Manzo (2021); Stahl (2024); Singh & Bansal (2022)
	7. Financial stakeholders	Financial transparency, investment in innovation, cost management, shareholder communication, financial risk assessment	Liu et al. (2023): "Therefore, the government should intensify support for inclusive digital finance applications, promote investments in the digital financial infrastructure, raise awareness of the digital economy in less advanced regions, and actively stimulate the growth of digital service scenarios." (p. 10)	Kluiters et al. (2023); Wirtz et al. (2023)
Ethical and responsible use of technology	8. Data & privacy	Data protection policies, user consent management, data anonymization techniques, data breach response plans, privacy impact assessments	Carl (2022): "Broader approaches, like the emerging concept of Corporate Digital Responsibility, make it possible to see responsibility with regard to data privacy and security in the broader context of a company's digital responsibilities and thus to develop a more holistic understanding. However, responsible behaviour alone is not enough; rather an adequate communication is the evaluation basis of consumers." (p. 1)	Cheng & Zhang (2023); Viitikko, (2022); Kärpänen (2022)
	9. Fairness & inclusivity	Bias mitigation strategies, inclusive design practices, diversity training programs, equitable opportunity policies, employee resource groups	Broers (2023): "In addition, the fairness principle promotes fair treatment of others in the digital world and not excluding specific groups. The seventh principle is the norms & values principle, which indicates that organizations should consider human norms and values in the development of products and services, which are important for individuals." (p. 9)	Stahl (2024); Singh & Bansal (2022); Hamadi & Manzo (2021)
	10. Transparency & accountability	Transparent reporting practices, accountability mechanisms, open communication channels, ethical guidelines and standards, regular audits and reviews	Schneider (2022): "This specific responsibility of businesses handling digital assets, as data, is given by the match between businesses' social accountability duties under the more general corporate social responsibility (CSR) framework and the legal and ethical obligations these bear in respect to the design and management of their datasets." (p. 1)	Kunz et al. (2024); Van Der Merwe & Achkar (2022)
	11. Sustainability	Carbon footprint reduction, sustainable supply chain management, waste reduction programs, sustainability reporting, employee engagement in sustainability	Covucci et al. (2024): "CDR as voluntary corporate commitment in planning digital strategies for sustainable development. This perspective expands the scope of CDR to also refer to the planning of corporate strategies and practices designed to act consistently with sustainability principles. It recognizes that the pervasiveness of digital technologies has far-reaching implications that go beyond ethical considerations."	Wilkinson (2023); Jones (2023); Rugeviciute (2023)
Governance and compliance	12. Regulatory compliance	Compliance audits, risk management, regulatory training, policy development, stakeholder reporting	Lautermann & Frick (2023): "Dass CDR keine Einzelleistung eines Unternehmens sein kann, zeigt schließlich auch der Struktur verändernde Charakter zahlreicher Digitaltechnologien. Wenn Big Data, industrielles Internet der Dinge und Blockchain-Technologie Unternehmensgrenzen auflösen, Wertschöpfungsketten reorganisieren und Stakeholder-Beziehungen umdefinieren können, dann stellt sich unmittelbar die Frage nach	Schneider (2022); Hamadi & Manzo (2021); Stahl (2024)

Aggregate Dimensions	Second Order Themes	First Order Concepts	Illustrative Quotes	Example of other Sources addressing Second Order Themes
			der Verantwortbarkeit solcher Disruptionen bzw. ihrer Folgen. Da diese aber per se nicht in der Hand einzelner Unternehmen liegen, kann CDR in dieser Hinsicht nur als Multi-Stakeholder-Governance gelingen. Das bedeutet schließlich: Um die Übernahme von Digitalverantwortung durch Unternehmen zu unterstützen, ja überhaupt erst zu ermöglichen, ist eine politisch-ökonomische Steuerung notwendig, bei der vielfältige Anspruchsgruppen eingebunden werden.“ (p. 116)	
	13. Risk Management	Risk identification, risk assessment, risk mitigation, risk monitoring, risk reporting	Elliott et al. (2021): “We have focused on “what” needs to be considered in governing AI systems and building trust—risk reduction of the potential harms that technologies inflict on our digital society, whereby the underpinning science is not fully understood. Who is re sponsible to ensure our digital safety as more AI systems are free to operate devoid of human oversight?” (p. 186)	Schneider (2022)
	14. Policy development & implementation	Policy formulation, stakeholder engagement, policy communication, policy implementation, policy evaluation	Aitken et al. (2021): “The findings indicate that deliberative forms of public engagement present valuable opportunities to incorporate diverse views and perspectives and to enable critical reflection on organisational practices and the trajectory of innovation.”	Carl et al. (2022); Boin (2022)
	15. Transparency & reporting	Transparent reporting practices, accountability mechanisms, open communication channels, ethical guidelines and standards, regular audits and reviews	Carl et al. (2022): “Existing guidelines related to Corporate Responsibilities, like the ISO standard 26000, provide guidance on Corporate Social Responsibility (CSR) addressing socially responsible and sustainable behaviour. However, current standards do not cover CDR directly. As such, the purpose of this contribution is to evaluate the applicability of the existing CSR standard to CDR to pave the way for CDR standardization in the future.”	Kärpänen (2022); Viitikko (2022); Wirtz et al. (2023)
Digital literacy and education	16. Training programs	Needs assessment, customized training modules, blended learning approaches, continuous feedback mechanisms, certification and recognition	Breivogel (2024): “Accepting and responding constructively to feedback might be a crucial competency for effectively implementing CDR in an organization. This requires the ability to accept criticism openly and to learn from one's own mistakes (cf. Interview 4/32). Moreover, CDR professionals should create a setting which provides a safe space for feedback as well as actively embodying a constructive ‘no blame culture’ (cf. Interview 4/36).” (p.23)	Lautermann & Frick (2023)
	17. Digital ethics education	Ethical frameworks, case studies and scenarios, interactive workshops, ongoing education, ethics committees	Wynn & Jones (2023): “The company has clear governance structures for cybersecurity and information security and reported that its “Information Security Management Policy” is the foundation of its information security programme, and that “this policy applies everywhere Walmart data is stored or processed—within Walmart and outside it—and speaks to the security requirements for assessments, account and device security; personnel security; and awareness and training” [19] (para. 27).” (p. 5)	Mueller (2022); Lautermann & Frick (2023)
	18. Continuous learning & development	Learning culture, personalised learning paths, mentorship programs, learning communities, regular skill assessments	Wynn & Jones (2023): “There are a range of actors and stakeholders involved in CDR, but employees and customers are arguably those most affected. Whilst a number of stakeholders interact with most of these parameters, it is company employees who are at the forefront of CDR related upskilling and redeployment, cultural change and process re-design, and measures and policies aimed at greater data transparency and access. Customers are central to data protection, privacy and security issues, and to the end-to-end theme of building trust across the organisation’s interface with the customer through a growing range of digital engagement technologies (social media, chatbots, analytics, big data, AI).” (p. 7)	Lobschat et al. (2021); Lautermann & Frick (2023)
	19. Mentorship & peer learning	Structured mentorship programs, peer learning groups, reverse mentorship, knowledge sharing platforms, recognition and rewards	Breivogel (2024): “As a result of the rapid pace of technological developments it may be important to continuously enhance personal and professional competencies. In this context, knowledge has become increasingly transit, challenging the utility of information in an ever-evolving digital environment (cf. Interview 5/48). This requires constant proactivity in terms of looking for learning opportunities, as well as a high level of receptiveness (cf. Interview 4/38), which can be a considerable challenge, given the diversity of topics in the field of CDR (cf. Interview 6/50).” (p. 24)	Lautermann & Frick (2023)
Innovation and future readiness	20. Research & development	Innovation labs, collaborative research projects, funding and resources, intellectual property management, regular reviews and updates	Angermann (2023): “The connection between sustainable development, CSR and digitalization continues with the topic of responsible innovation. Industry 4.0 is the collective result of the last big innovations and not all of them are based on responsible values.” (p. 5)	Aitken et al. (2021)
	21. Agility & adaptability	Flexible work policies, cross-functional teams, continuous improvement processes, rapid prototyping, change management training	Breivogel (2024): “In particular, „understanding internal and external stakeholder needs“ and the ability to „employ adaptability“ play a crucial role. These results are contextualized and discussed in light of the current academic debate on competencies for implementing CDR.”(p. 4)	Kivistö (2024)
	22. Strategic foresight	Scenario planning, trend analysis, foresight workshops, stakeholder engagement, strategic roadmaps	Esselmann et al. (2020): “In diesem Bereich wird bereits intensiv über ethische Fragen digitaler Innovationen nachgedacht. Des halb ist KI oftmals ein Startpunkt für Unternehmen, sich dem Feld CDR zu nähern und sich dabei als zukunftsorientierte Organisation zu präsentieren. Auf der anderen Seite bedeutet dies, dass im deutlich konkreteren Bereich Privacy bisher die DSGVO-Compliance überwiegt und wenige, darüber hinausgehende Aktivitäten von Unternehmen zu erkennen sind.” (p. 12)	Mueller (2022)
	23. Collaboration & partnerships	Strategic alliances, joint ventures, community engagement, cross-organisational teams, partnership management	Tóth & Blut (2024): “To address these issues systematically, firms must define the underlying CDR principles (e.g., code of ethics, ethical use of data, accessibility standards, legal compliance) before defining strategic initiatives (e.g., training/education, transparent communication, privacy by design, cross-functional collaboration) and engaging in ongoing activities (e.g., continuous improvements, digital responsibility reporting).” (p. 5)	Ivancic & Giermindl (2023); Esselmann et al. (2020); Altmeppen & Filipović(2019)

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RESEARCH ARTICLE

Fostering retention among project managers through career sustainability

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Abstract

Considering the high turnover rates in project management due to limited development opportunities, this paper examines the role played by career sustainability in addressing this organizational challenge. Career sustainability is defined as the opportunity and capability of individuals to remain in productive and meaningful work overtime, across the lifespan and in changing career contexts. Drawing on sustainable career theory, a conceptual model was tested using partial least squares structural equation modelling (PLS-SEM) with data from 224 project managers. The model incorporates four dimensions of career sustainability – resourcefulness, renewability, flexibility, and integrativeness – as predictors of career satisfaction, well-being, and both organisational and career turnover intentions. Results indicate that resourcefulness and renewability are the strongest predictors of positive outcomes. Socio-demographic analyses suggest that resourcefulness plays a greater role in reducing career turnover among senior professionals, while renewability more strongly enhances well-being for participants without children. These findings provide empirical evidence on the relevance of career sustainability in project-based contexts and offer practical insights for organisations aiming to retain and support their project management workforce.

Keywords

project managers; career sustainability; well-being; turnover intentions; career satisfaction.

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1. Introduction

In the face of rapid technological advancements and market changes, project management plays a critical role in driving innovation and organizational adaptability (Hobday, 2000; Serrador & Pinto, 2015) which is essential for maintaining a competitive edge and meeting evolving customer needs (Conforto et al., 2014). Project management significantly contributes to the economy by facilitating large-scale infrastructure projects, technological innovations, and business expansions (Flyvbjerg, 2017). These projects create jobs, stimulate economic growth, and improve societal well-being (Flyvbjerg, 2017).

Projects are no longer just temporary endeavours limited to an organizational context; they are a fundamental way of organizing human activities, a contemporary phenomenon often referred to as the "projectification" of society, which underscores the increasing prevalence and significance of projects in our daily lives, shaping our actions, conversations, and identities (Lundin, 2016). The Project Management Institute (PMI) predicts that by 2027, employers will need nearly 88 million individuals working in project management-oriented roles, highlighting the substantial job creation potential (PMI, 2017). As the project-based mode of work becomes increasingly dominant, professionals face heightened expectations to adapt quickly, work autonomously, and manage ongoing demands. Li et al. (2025) argue that this transformation in the employment landscape, characterised by rapid change and reduced structural stability, has made career sustainability a pressing concern, especially for individuals in project-intensive environments.

However turnover rates in project management are quite high, encompassing both direct (recruitment, hiring, and training) (Yan & Zhang, 2020) and indirect costs (loss of productivity, decreased team efficiency, potential project delays, loss of project-specific knowledge) (Dai et al., 2015; Longenecker & Scazzero, 2003) which can undermine the effectiveness of project management function (Skulmoski et al., 2021), threating project continuity and, increasing the risk of project delays and failures (Thamhain, 2014).

These high turnover rates are partly because most project managers are often outsourced (Turner et al., 2009), limiting their opportunities for continuous development and career progression (Hodgson & Paton, 2016), reducing career sustainability (Van der Heijden & De Vos, 2015).

By providing a framework that addresses the long-term viability of careers, it has been recently proposed that career sustainability theory may be an appropriate theoretical framework to study project managers careers (Sundqvist, 2019; Venkatesh et al., 2018) and address turnover in project management (Chin et al., 2022; Skulmoski et al., 2021). Nonetheless, there is a significant lack of empirical research focused on project managers career sustainability (Lo Presti et al., 2021).

Career sustainability is defined as the opportunity and capability of individuals to remain in productive and meaningful work overtime, across the lifespan and in changing career contexts (De Vos et al., 2020; Van der Heijden & De Vos, 2015). Unlike boundaryless or protean career models, which emphasise autonomy and self-direction, sustainable career theory integrates individual and organisational dimensions, focusing on long-term career viability within changing work environments (Lo Presti et al., 2021). The present study adopts Chin et al.'s (2022) operationalisation of career sustainability, which includes four interrelated dimensions: flexibility, resourcefulness, renewability, and integrativeness.

Recent scholarship has sought to refine the concept of career sustainability to better address contemporary career challenges. Greenhaus (2024) defines career sustainability as the capacity to maintain a career characterized by ongoing development, well-being, and employability over the lifespan. This perspective emphasizes the dynamic interplay between individual agency and contextual factors in achieving long-term career success. Incorporating this definition provides a nuanced understanding that aligns with the multidimensional nature of sustainable careers.

Previous research highlights that many organizations do not have dedicated career pathways or support structures for project managers, such as a supportive organizational culture, mentorship programs, training and development opportunities, and effective feedback and performance management systems, which can lead to career stagnation and dissatisfaction (Crawford et al., 2006; Lloyd-Walker et al., 2016). Low career satisfaction not only hampers individual career growth but also increase the intention to leave the organization negatively impacting organizational performance (Ng & Feldman, 2014). Inversely, research indicates that employees who perceive their careers as sustainable report higher levels of career satisfaction (De Vos et al., 2021).

Turner et al. (2008) explored the well-being of project managers and highlighted the unique challenges they face, such as high job demands and stress, which significantly impact their overall well-being. Considering the demanding nature of the job, that often leads to poor well-being, which in turn contributes to turnover (Boudrias et al., 2020), there is a pressing need for research that further explores these challenges to develop strategies that may enhance project managers' well-being (Bredin & Söderlund, 2013). Sustainable careers characterized by continuous learning, adaptability, and work-life balance contribute significantly to employees' overall well-being (Van der Heijden & De Vos, 2015).

By examining the combined effects of career sustainability on career satisfaction, well-being and turnover intention among project managers, this study aims to contribute to the broader discourse on career development and sustainability within the field of project management, providing actionable insights for organizations, policymakers, and practitioners.

The novelty of this study lies in its empirical examination of how career sustainability affects both individual outcomes (career satisfaction and well-being) and behavioural outcomes (organisational and career turnover intention) among project managers - a population facing unique structural and career development challenges. While sustainable career theory has been conceptually proposed as a relevant lens for understanding project-based work, few empirical studies have tested its applicability in this context, even though, the gig economy's expansion has brought career sustainability to the forefront (Wu & Wang, 2025). This study addresses this gap by applying a structural equation model (PLS-SEM) to test a comprehensive model using a sample of 224 project managers, while also exploring the role of socio-demographic factors.

The remainder of the paper is structured as follows: Section 2 presents the theoretical framework and hypotheses development. Section 3 details the methodology, including the sample and measurement instruments. Section 4 presents the results of the analysis. Section 5 discusses the findings and implications of the study, as well as limitations and directions for future research. Section 6 presents a brief conclusion.

2. Background

Employee retention refers to an organisation's capacity to maintain its workforce over time and reduce turnover. In the context of project management, retention poses a unique challenge due to the high-paced, high-responsibility, and often temporary nature of project-based work (Alkhudary & Gardiner, 2021; Lloyd-Walker et al., 2016). The departure of skilled project managers not only disrupts ongoing projects but also threatens organisational learning and performance continuity (Parker & Skitmore, 2005). However, measuring actual retention requires longitudinal data, which is often impractical in empirical research. For this reason, many studies rely on turnover intention—the self-reported likelihood of leaving an organisation – as a commonly accepted proxy for employee retention (Cho et al., 2009; Akdur et al., 2024; Borg & Scott-Young, 2022). Following this approach, this study conceptualises retention as the inverse of organisational turnover intention, operationalised through project managers' intention to leave their current employer.

Turnover intention refers to an individual's subjective assessment of the likelihood of leaving an organization soon (Mowday et al., 1979). It is influenced by personal attitudes and organizational or managerial behaviours (Cho et al., 2009). Turnover intention can be categorized as voluntary or involuntary and is influenced by both internal and external workplace factors such as better job opportunities, organizational dynamics, social influences, and external conditions (Dubey et al., 2016). Poor human resource management often leads to high turnover intention, which is detrimental to organizational success

(Slavich et al., 2014). Limited career advancement opportunities can significantly influence a project manager's intention to leave, since project managers who perceive limited growth and development opportunities within their current organization are more likely to seek employment elsewhere (Armstrong-Stassen & Ursel, 2009).Turnover disrupts and negatively affects the performance of the project team, the project itself, and potentially negates the competitive advantage of the organizations involved (Parker & Skitmore, 2005).

In addition to organizational turnover intention, project managers may experience career turnover intention, which refers to their desire to leave the project management profession entirely (Barthauer et al., 2020). Career turnover intention can arise from burnout, a lack of passion for the profession, and the desire for a career change (Salvagioni et al., 2017a). Project managers who do not find their work fulfilling or aligned with their personal values and interests are more likely to seek alternative career paths (Vandenberghe & Tremblay, 2008). Aligning personal values with career choices contributes to long-term career satisfaction and well-being, thereby decreasing the desire to leave both the organization and the profession (Tsaur & Tang, 2012).

2.1. Career sustainability

Career sustainability is a concept that has gained significant attention in recent years (Chin et al., 2022)due to its relevance in the context of rapid technological changes and evolving labour markets (Bozionelos et al., 2019). Career sustainability refers to the ability of individuals to remain employable over the lifespan by continually adapting to changes in the work environment and personal circumstances, which includes maintaining work-life balance, continuous professional development, and career adaptability to encompass changes in the job market (Van der Heijden & De Vos, 2015). It involves a proactive approach to career management, emphasizing long-term employability, resilience, and adaptability (Van der Heijden & De Vos, 2015).

Clarke (2013) emphasized that sustainable careers are those that are enduring and resilient, allowing individuals to achieve long-term career success while maintaining well-being and satisfaction, also highlighting the importance of adaptability and continuous learning (Clarke, 2013). Savickas (2012), in turn, focused on the life design paradigm, which integrates career sustainability with the ability to construct a coherent career narrative that aligns with personal goals and changing work environments. This approach underscores the role of personal agency and adaptability in career sustainability (Savickas, 2012). De Vos et al. (2020) propose a conceptual model for sustainable careers, emphasizing the following three key components: individual agency (the role of individuals in actively shaping their career paths through proactive behaviours and strategies), contextual factors (the influence of organizational, social, and economic contexts on career sustainability) and career outcomes (the long-term results of career sustainability, including job satisfaction, well-being, and employability) (De Vos et al., 2020). Recent research by Greenhaus et al. (2024) and Borg & Scott-Young (2022) also underscore the need for multifaceted approaches to comprehensively address career sustainability's impact on various career outcomes.

While multiple conceptualisations of career sustainability exist in the literature, this study adopts the framework proposed by Chin et al. (2022), which builds on Newman's (2011) eudaimonic approach. Chin et al.'s model offers a pragmatic, actionable structure derived from cumulative work experiences, and it has been operationalised through four dimensions: flexibility, renewability, integrativeness, and resourcefulness. This approach contrasts with more hedonic and outcomes-based frameworks, such as De Vos et al. (2018), which define sustainable careers in terms of health, happiness, and productivity: these constructs span different domains - physiological, psychological, and performance-related - making them challenging to measure consistently within a single, unified scale. Although those models offer valuable theoretical insights, their broader and more abstract components make them less suitable for scale development and empirical testing. Moreover, the model proposed by Lo Presti et al. (2021), which describes sustainable careers through four theoretical lenses - time, social space, agency, and meaning - is primarily conceptual and not intended as a measurement tool. Chin's framework allows for a more focused and measurable operationalisation of sustainable career practices,

especially relevant for mid-career professionals like project managers, who operate in fast-evolving, project-based environments and must actively mobilise resources to sustain their careers over time.

Newman (2011) combined theories of adult development and career development to define sustainable careers as possessing three key characteristics: renewability, flexibility, and integrity. Building on Newman's (2011) model, Chin et al. (2019) extended this framework by adding a fourth dimension - resourcefulness - and developed a scale to measure career sustainability that included four dimensions of a sustainable career (Chin et al., 2022):

- Flexibility - refers to holding a flexible, adaptable attitude that enables individuals to continuously learn, seek new opportunities, and remain open to new experiences.
- Renewability - reflects the extent to which careers provide opportunities for individuals to reassess their capabilities, update their skills, and rebrand themselves to maintain career sustainability.
- Integrativeness – relates to the extent to which employees can critically evaluate, integrate, and absorb disparate information and knowledge acquired in their current jobs to further develop their careers.
- Resourcefulness - embodies the vital importance of using resources effectively to maintain a good standard of living and ensure future employment opportunities. This includes leveraging networks, time, and financial resources to navigate career challenges and opportunities successfully.

Career sustainability adds to and interacts with several other career theories, providing a better understanding of career development and management. Career sustainability builds on the protean career theory (Hall, 2004), that describes career paths as self-directed, values-driven and, characterized by adaptability and continuous learning, by adding the dimension of long-term employability and work-life balance (Gubler et al., 2014). Career sustainability also complements boundaryless career theory (Arthur,1996) that suggests careers are not confined to a single organization but span multiple employers and roles, by focusing on the skills and adaptability needed to navigate such fluid career paths while ensuring long-term employability and satisfaction (Baruch & Sullivan, 2022). Career sustainability also adds to career construction theory (Savickas, 2012) that posits individuals build their careers by interpreting and adapting it to their life experiences, by emphasizing the importance of continuous skill development and adaptability in constructing a sustainable career.

Sustainable career theory aligns with broader trends in sustainable development, emphasizing the need for careers that not only support individual and organizational goals but also contribute positively to society and the environment (Donald et al., 2024). This approach encourages individuals to consider the broader impact of their career choices and to strive for a balance between personal success and social responsibility (De Vos et al., 2016).

Considering the ever-evolving landscape of project management, project managers must embrace career sustainability as it becomes imperative for fostering resilient careers and contributing to organizational success in an increasingly complex world (Westerman et al., 2020).

The hypotheses in this study were directly derived from the four-dimensional model proposed by Chin et al. (2022), which operationalises career sustainability through flexibility, renewability, integrativeness, and resourcefulness. Each hypothesis reflects how these dimensions function in real-life professional contexts and is supported by a broader body of literature on sustainable careers (De Vos & Van der Heijden, 2015; Van der Heijden, De Vos, & Akkermans, 2020). For instance, resourcefulness, defined as the capacity to effectively mobilise networks, time, and financial assets, is expected to enhance career satisfaction and well-being while reducing turnover intentions by equipping professionals to navigate uncertainty and seize opportunities (Hobfoll, 2002). Renewability reflects the ability to update skills and rebrand oneself, supporting long-term engagement and satisfaction (Fugate et al, 2004). Flexibility enables individuals to adjust to evolving demands and roles, thereby fostering autonomy and adaptability in increasingly dynamic work environments (Arthur & Rousseau, 1996; Hall, 2004). Integrativeness, or the capacity to synthesise diverse knowledge sources, supports continuous learning and complex problem-solving, which can contribute to more positive career evaluations (Pulakos et al., 2000).

To improve practical understanding, we further illustrate how the four dimensions of career sustainability manifest in real-life professional contexts. Flexibility refers to the ability of project managers to adapt to evolving methodologies (e.g., agile vs. waterfall), collaborate across diverse teams, or assume new roles within dynamic projects. This aligns with the notion of adaptive project management competence, which is increasingly required in turbulent environments (Turner, 2016). Renewability is evident in the continuous pursuit of professional development, including the acquisition of certifications (e.g., PMP, Scrum Master), upskilling in digital tools, and engaging in reflective learning practices – critical behaviours for maintaining long-term employability and credibility (Crawford, 2005). Integrativeness involves synthesising knowledge gained across projects, learning from interdisciplinary teams, and applying lessons learned to new challenges – practices associated with knowledge integration and organisational learning in project-based work (Scarbrough et al 2004). Finally, resourcefulness reflects a project manager's ability to navigate constraints by leveraging networks, managing competing stakeholder demands, and optimising time and financial resources – skills considered central to effective project leadership and stakeholder management (Müller & Turner, 2010). These dimensions reflect the actionable behaviours and strategies that mid-career professionals rely on to sustain their careers in high-demand, complex project environments.

Careers that provide professional growth and adaptability, opportunities for skill development, alignment with personal values, and effective resource use, lead to reduced desire to leave both the organization and the profession (Barthauer et al., 2020). We propose the following hypothesis in the context of project management careers:

H1: Career sustainability is negatively related to organizational turnover intentions.

H1a: Flexibility dimension of career sustainability is negatively related to organizational turnover intentions.

H1b: Resourcefulness dimension of career sustainability is negatively related to organizational turnover intentions.

H1c: Renewability dimension of career sustainability is negatively related to organizational turnover intentions.

H1d: Integrativeness dimension of career sustainability is negatively related to organizational turnover intentions.

H2: Career sustainability is negatively related to career turnover intentions.

H2a: Flexibility dimension of career sustainability is negatively related to career turnover intentions.

H2b: Resourcefulness dimension of career sustainability is negatively related to career turnover intentions.

H2c: Renewability dimension of career sustainability is negatively related to career turnover intentions.

H2d: Integrativeness dimension of career sustainability is negatively related to career turnover intentions.

2.2. Career satisfaction

Career satisfaction measures how well individuals believe their career progress aligns with their goals, values, and preferences (Seibert & Kraimer, 2001). While often considered a facet of work satisfaction alongside job satisfaction, career satisfaction is distinct as it encompasses one's overall experiences throughout their entire career, and it is the most prevalent measure of subjective career success (Hall & Chandler, 2005).

Previous studies suggest that sustainable career practices, such as lifelong learning and proactive career management, increase career satisfaction by aligning career trajectories with personal aspirations and market demands (De Vos et al. (2011). Clarke (2013) also emphasizes that employees who engage in regular skill development and learning activities are more likely to feel confident and satisfied with their career progression. Baruch and Vardi (2016) found that individuals who exhibit higher levels of career adaptability, experience greater career satisfaction. This adaptability allows employees to navigate career transitions smoothly, thereby reducing stress and increasing overall job fulfilment (Baruch & Vardi, 2016). Therefore, following (Chin et al., 2022) we propose that career sustainability is positively related to career satisfaction for project managers:

H3: Career sustainability increases career satisfaction.

H3a: Flexibility dimension of career sustainability increases career satisfaction.

H3b: Resourcefulness dimension of career sustainability increases career satisfaction.

H3c: Renewability dimension of career sustainability increases career satisfaction.

H3d: Integrativeness dimension of career sustainability increases career satisfaction.

Previous research shows that employees who are satisfied with their jobs and/or careers are less likely to leave their organizations or consider changing careers (Griffeth et al., 2000; Hur, 2024; Igbaria & Guimaraes,1999; Nicholson & De Waal-Andrews, 2005). Therefore, we propose that enhancing career satisfaction can decrease the likelihood of employees leaving both the organization and the profession of project management:

H4: Career satisfaction reduces turnover intention.

H4a: Career satisfaction reduces organizational turnover intention.

H4b: Career satisfaction reduces career turnover intention.

2.3. Well-being

Well-being encompasses an individual's overall assessment of life satisfaction, mental health, and sense of purpose (Deci et al., 2017). This approach acknowledges well-being as more than the absence of illness, emphasizing a positive state characterized by thriving across various life domains (Huppert & So, 2013). The concept of well-being finds its roots in ancient philosophy, notably Aristotle's notion of eudaimonia, or human flourishing (Ryff & Singer, 2008). This foundational idea underpins contemporary understandings focused on achieving potential and living a fulfilling life (Waterman et al., 2010). Recent research expands well-being models to include an equilibrium between an individual's resources and challenges (Deci et al., 2017).

Previous studies have emphasized the impact of employee well-being on several organizational outcomes, namely organizational success (Salvagioni et al., 2017), job performance (Kundi et al., 2021), organizational and career turnover intention (Akdur et al., 2024; Boudreau & Rhéaume, 2024; Putri et al., 2024; Zimeng & Ho, 2023). Thus, while psychological distress increases turnover intentions (Chughtai, 2021), experiencing well-being in the workplace reduces the likelihood of employees leave their organization or profession (Kundi et al., 2020; Salvagioni et al., 2017c). Therefore, we propose the following hypothesis:

H5: Employee well-being is negatively related to turnover intention.

H5a: Employee well-being is negatively related to organizational turnover intention.

H5b: Employee well-being is negatively related to career turnover intention.

In project management, work-related stressors like strict deadlines and overload can lead to diminished well-being (Hämmig & Bauer, 2009; Hrvatin et al., 2022; Turner et al., 2008). Project managers who maintain a balance between their professional and personal lives, continuously engage in learning, and adapt to changing work environments are more likely to experience high levels of well-being (Moradi et al., 2020). De Lange et al. (2003) found that career sustainability practices, such as continuous skill development and proactive career management, mitigate the adverse effects of job stress, leading to improved well-being. Similarly, Tams & Arthur (2010) demonstrated that employees who actively manage their careers by setting goals and seeking development opportunities experience greater career satisfaction and overall well-being. Therefore, we propose that:

H6: Career sustainability increases well-being.

H6a: Flexibility dimension of career sustainability increases well-being.

H6b: Resourcefulness dimension of career sustainability increases well-being.

H6c: Renewability dimension of career sustainability increases well-being.

H6d: Integrativeness dimension of career sustainability increases well-being.

Figure 1 depicts the research model and the research hypotheses understudy.

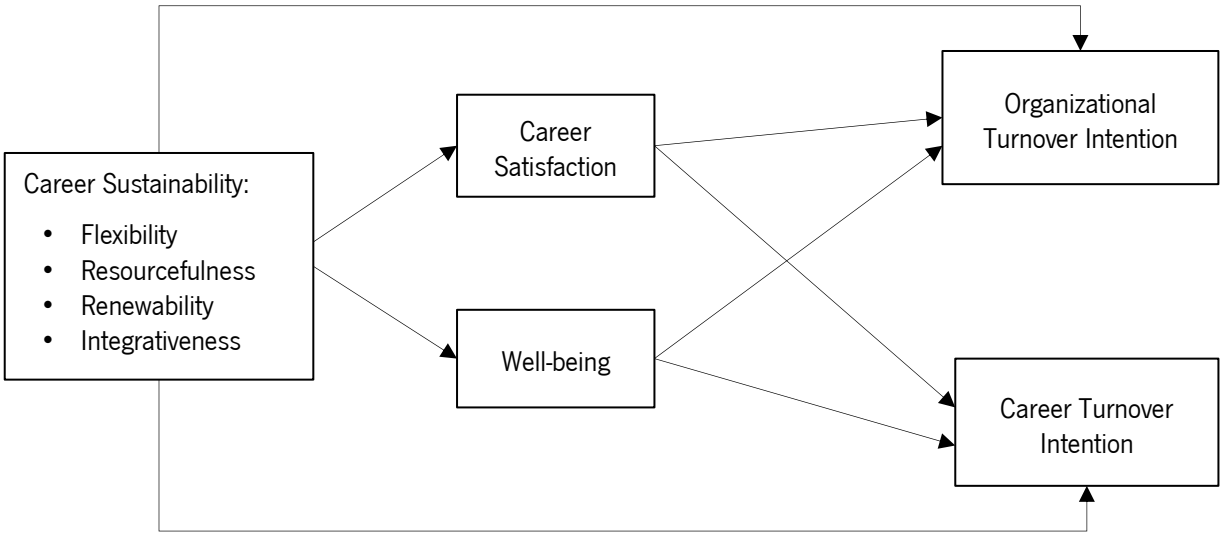

Fig. 1. Research model

3. Method

Lo Presti et al. (2021) demonstrated that project managers' careers could serve as a prototypical example of sustainable careers. Their study adopted a qualitative approach to delve deeply into individual career narratives, thereby uncovering underexplored issues and peculiarities that future research could investigate further using quantitative methods. Following their recommendations, we chose a quantitative methodology to explore the consequences of career sustainability for project managers.

3.1. Data collection and Sample

Data collection followed a snow-ball approach, where an initial pool of project managers, identified through personal contacts received an e-mail with an internet link to a questionnaire located on the Qualtrics platform, during the period from May to July 2023. Participants were encouraged to share the link to other project managers of their acquaintance. To ensure that all participants in the study were actively serving as project managers, an inclusion criterion was implemented at the beginning of the questionnaire. Following the recommendation of Randel & Jaussi (2008), a pre-test was conducted to assess the appropriateness and clarity of the questionnaire for the target group. Also, as per their suggestion, demographic variables were positioned at the end of the questionnaire.

Out of the total sample of 224 participants, 95.8% reside in Portugal. Most of the respondents (63.1%) identify as male. Most participants (76.1%) are in-house employees, being the other 23.9% outsourced. 72.8% of participants work on site al least two days/week. Furthermore, 49.1% are aged 35 or younger. Approximately 50.5% of participants have children,

with the majority having only one child. 54.3% of participants work in the IT sector. Nearly half of the participants (49.8%) have less than 5 years of professional experience, and a significant portion (64.5%) have completed a master's degree. Most participants work in medium to large corporate organisations, particularly in the IT, finance, and engineering sectors. Their work primarily involves organisational and operational-level projects rather than large-scale infrastructure or megaprojects. As such, the results of this study are most applicable to project managers operating in internal, business-driven project environments.

Hair et al. (2017) emphasise that Partial Least Squares Structural Equation Modelling (PLS-SEM) is particularly well-suited for exploratory research and situations involving smaller sample sizes, making it more appropriate than covariance-based SEM in such contexts. With a sample of 224 project managers, this study exceeds the minimum recommended sample size to ensure model stability and statistical power when using PLS-SEM (Huang, 2021; Indriyarti et al., 2022). Furthermore, PLS-SEM is known for its flexibility in handling complex models, especially when the primary goal is to maximise explained variance rather than confirm established theoretical frameworks (Hair et al., 2017). The method has also been widely applied in career sustainability and project management research to estimate relationships between latent constructs. For example, Chin et al. (2022) employed PLS-SEM to develop and validate the Career Sustainability Scale, further demonstrating the method's suitability for studying nuanced career-related variables.

To conduct the analysis, we followed the two-stage approach recommended by Hair et al. (2019), starting with the assessment of the measurement model (including reliability, convergent and discriminant validity), followed by structural model evaluation to test the proposed hypotheses. Additionally, we performed multi-group analyses (MGA) to explore whether the structural relationships varied across key socio-demographic groups. These groups included gender, age, parenting status, project management seniority, employment contract type (in-house vs. outsourced), and industry (IT vs. non-IT).

3.2. Instrument

The instrument included four distinct scales to measure the constructs understudy – career satisfaction, well-being, turnover intention, career turnover intention and career sustainability. All scales were previously validated in other studies. A consistent 5-point Likert scale was employed across all measures, where 1 denoted "Strongly Disagree" and 5 "Strongly Agree."

Well-being was gauged using the 5-item "Satisfaction with life Scale" (SWLS) from Diener et al. (1985). Respondents indicated their level of agreement with each of the five statements (e.g., "*In most ways my life is close to my ideal"*).

Career satisfaction was measured using 5 items adapted from Greenhaus et al. (1990) Respondents indicated their level of agreement with each of the five statements, prefaced with the stem "I am satisfied with" (e.g., "*Success I have made toward meeting my overall career goals."*).

Organizational turnover intention was measured using the 3-item scale originally developed by Cammann (1979). An example item is: *"I will probably look for a new job as project manager in the next year."*

Career turnover intention was assessed using the "Career turnover intentions Scale" adapted from Baillod & Semmer (1994), comprising three items (e.g., "*I think a lot about leaving the profession of project manager"*).

To measure career sustainability was used the 12-item "Career Sustainability Scale" developed by Chin et al. (2022). The scale has four dimensions, each one measured by three items: Resourcefulness (e.g., *"My career allows me to seek new opportunities."*); Renewability (e.g., *"My career provides me opportunities to update my skills."*); Flexibility (e.g., "*My career gives me a lot of flexibility*") and, Integrativeness (e.g., "*My career enables me to integrate information obtained from different sources."*). A complete list of the measurement items is provided in Appendix A.

4. Results

4.1. Data analysis

Considering that the paper addresses multiple relationships, Structural Equations Modelling (SEM) is used for data analysis. More specifically, we use Partial Least Squares-SEM (PLS-SEM), due to its reliability in estimating composite factor models for being less affected by errors in subparts of the model (Henseler et al., 2014). This method also allows to estimate complex models without needing data to follow a normal distribution, showing greater statistical power when compared to CB-SEM (Covariance-Based Structural Equation Modelling) (Shela et al., 2023). PLS is a suitable tool for exploratory research, since it focuses on explaining the variance in the dependent variables of the model (Hair & Sarstedt, 2021).

It's crucial for researchers to recognize that PLS-SEM, it is not exempt from basic multivariate regression assumptions. Therefore, it's essential to conduct tests before running the measurement and structural model analyses (Shela et al., 2023).

4.2. Analysis of the measurement models

We proceeded with the analyse of the reliability and validity of the scales. As far as reliability is concerned, we started with the analysis of indicator reliability. Two items of the Well-being variable, one items of the Resourcefulness variable and one item of the Renewability variable had standardized loadings below the threshold of 0.7 and were thus deleted (Hair et al., 2019). Subsequently, we analysed the reliability of the latent variables. Except for the flexibility variable, all measurement models surpass the recommended internal consistency threshold of 0.7. Thus, flexibility was excluded from the model. Table 1 presents the Cronbach alphas and the composite reliabilities of the remaining variables.

Table 1. Reliability and validity measures

	Cronbach's alpha	Composite reliability (rho_c)	Average variance extracted (AVE)
Career Satisfaction	0.873	0.908	0.665
Career Turnover Intention	0.874	0.922	0.798
Integrativeness	0.850	0.907	0.765
Renewability	0.776	0.899	0.816
Resourcefulness	0.742	0.886	0.795
Organisational Turnover Intention	0.821	0.892	0.733
Well-being	0.780	0.872	0.694

Since the average variance extracted (AVE) by each latent variable exceeds the threshold of 0.5 (Table 1), and the bootstrap t-statistics of the indicators' standardized loadings are significant at the 1 percent significance level, we conclude that the model has convergent validity (Hair *et al.*, 2017). For discriminant validity, we used the Heterotrait-Monotrait (HTMT) Ratio (Henseler *et al.*, 2015). The upper bound of the 95 per cent confidence interval of HTMT is lower than the more conservative threshold of 0.85, indicating that are no discriminant validity problems (Table 2). Cross-loadings are presented in Appendix B to further support discriminant validity.

Table 2. Discriminant validity – Heterotrait-monotrait

	(1)	(2)	(3)	(4)	(5)	(6)
Career Satisfaction						
Career Turnover Intention	0.178					
Renewability	0.510	0.342				
Resourcefulness	0.723	0.443	0.667			
Organisational Turnover Intention	0.229	0.438	0.145	0.407		
Well-being	0.533	0.199	0.457	0.701	0.169	

Table 2 shows that the measurement models present discriminant validity. The upper bound of the 95 per cent confidence interval of Heterotrait-Monotrait (HTMT) is lower than the more conservative threshold of .85, indicating that are no discriminant validity problems.

Considering that we used self-report measures for all variables, common method bias was assessed. Kock (2015) full collinearity assessment approach evidenced that all variance inflation factor values remained below the 5.0 threshold, indicating the absence of common method bias in the model.

4.3. Analysis of the structural model

To test the research hypotheses, the analysis of the structural model was conducted (Henseler et al., 2009) and the significance of the path coefficients was analysed. Figure 2 presents the significant relationships found in the model (t value < 1.96; $p < .05$).

Two dimensions of career sustainability – resourcefulness and renewability - have a positive impact on career satisfaction (B=0.522 and B=0.170, respectively; p<0.05) and on well-being (B=0.410 and B=0.173, respectively; p<0.05) and a negative impact on career turnover intention (B=-0.287 and B=-0.163, respectively; p<0.05). The resourceful dimension also has a negative impact on organizational turnover intention (B=-0.306; p<0.01). Resourcefulness on career satisfaction and resourcefulness on well-being show strong effects. Renewability on career satisfaction, renewability on well-being, resourcefulness on career turnover intention, renewability on career turnover intention, and resourcefulness on organizational turnover intention show moderate effects (Cohen, 1988).

Table 3 exhibits the direct significant effects and the effect sizes (f^2) for each validated hypothesis.

Several hypothesised relationships did not reach statistical significance and were therefore not supported by the data. Specifically, no significant effects were found for H1c (Renewability -> Organisational Turnover Intention), H1d (Integrativeness -> Organisational Turnover Intention), H2d (Integrativeness -> Career Turnover Intention), H3d (Integrativeness -> Career Satisfaction), and H6d (Integrativeness -> Well-being). Additionally, contrary to expectations, H4a and H4b (Career Satisfaction -> Organisational and Career Turnover Intention, respectively), as well as H5a and H5b (Well-being -> Organisational and Career Turnover Intention), were not statistically significant. These non-significant paths are highlighted in Table 3. Potential explanations for these results, and their implications for theory and practice, are explored in the Discussion section.

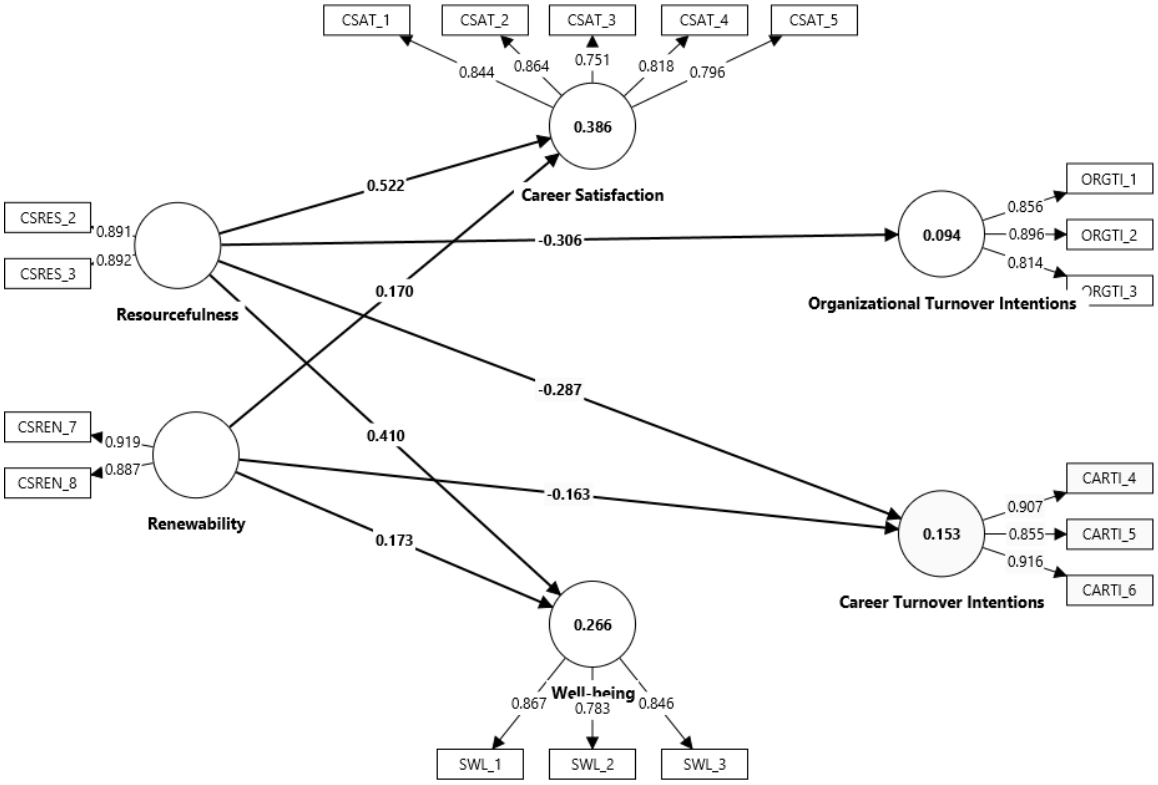

Fig. 2. Structural model

Table 3. Direct significant effects and f^2

H	Relationships	*B*	*t*	*p*	*f²*
3c	Renewability -> Career Satisfaction	0.170	2.284	0.022	0.037
2c	Renewability -> Career Turnover Intention	-0.163	2.249	0.025	0.024
6c	Renewability -> Well-being	0.173	2.020	0.043	0.032
3b	Resourcefulness -> Career Satisfaction	0.522	9.354	<0.001	0.345
2b	Resourcefulness -> Career Turnover Intention	-0.287	3.381	0.001	0.075
1b	Resourcefulness -> Organizational Turnover Intention	-0.306	4.586	<0.001	0.103
6b	Resourcefulness -> Well-being	0.410	6.397	<0.001	0.178

To evaluate the explanatory power of the model, the coefficient of determination (R^2) of the endogenous constructs was analysed (Sarstedt et al., 2014). The model explains 38.6% of variance for career satisfaction, 26.6% of variance for well-being, 15.3% of variance for career turnover intention and 9.4% of variance for organizational turnover intention (Table 4).

Table 4. Explanatory power and predictive relevance.

	R^2	R^2 adjusted	Q^2
Career Satisfaction	0.386	0.380	0.369
Career Turnover Intention	0.153	0.145	0.128
Organizational Turnover Intention	0.094	0.090	0.080
Well-being	0.266	0.259	0.247

To evaluate the predictive relevance of the model, the Stone–Geiser's Q^2 was calculated using the blindfolding procedure. Since $Q^2 > 0$ for all the endogenous constructs (Table 4), the model has predictive relevance (Hair et al., 2011).

To analyse the effects of socio-demographic variables on the relationships considered in the model, multi-group analyses were conducted. It was analysed gender (male/female), parenting (child/no child), age (<= 35 years old/> 35 years old), seniority in the profession of project management (<5 years/>=5 years), employment contract (in house/outsourced), and industry (IT/other than IT). Concerning seniority in the profession, results show that the negative impact of resourcefulness on career turnover intention is stronger for senior project managers ($B_{<5years}$= -0.086; $B_{>=5years}$=-0.441; p=0.042). In what refers to the parenting situation, the impact of renewability on well-being is negative for those who have children but positive for those who do not have (B_{child}=-0.230 and $B_{nochild}$=0.414, respectively; p=0.035).

5. Discussion

Both resourcefulness and renewability dimensions of career sustainability play crucial roles in shaping project managers experiences, promoting career satisfaction (Chin et al., 2022) and, well-being (De Lange et al., 2003). The robust positive relationship of resourcefulness with career satisfaction and well-being underscores its significance beyond its traditional role in project management responsibilities (El-Sabaa, 2001). Resourcefulness not only ensures project managers' success in completing projects but also enhances their sense of accomplishment and personal well-being.

Furthermore, resourcefulness reduces employees' intention to leave either the organization or the project management profession (Han et al., 2023). Additionally, opportunities for skill development and career growth mitigate the risks of skill obsolescence, enhance employees' perceptions of their future career prospects and reducing employees' intention to leave the project management career (Abid et al., 2016; Harden et al., 2018; Salleh et al., 2020).

Concerning seniority in the profession, results show that the negative impact of resourcefulness on career turnover intention is stronger for senior project managers, which can be explained by the higher level of commitment and integration into the organizational culture that senior project managers typically possess (Chipulu et al., 2013). As they gain more experience and seniority, their deepening ties and responsibilities within the organization might make the idea of turnover more impactful, hence a stronger negative effect on career turnover intention. Additionally, senior project managers often have a greater sense of resourcefulness, which can enhance their ability to navigate and mitigate career challenges, reducing their inclination to leave (Paton & Hodgson, 2016).

In what refers to the parenting situation, the impact of renewability on well-being is negative for those who have children but positive for those who do not have. This could be explained by the additional stress and time demands placed on individuals who have children (Chasserio & Legault, 2010), which may reduce their capacity to renew themselves effectively. Parents often face significant challenges in balancing work and family responsibilities, which can negatively impact their overall well-being. Conversely, individuals without children might have more time and resources to focus on renewal activities, thereby experiencing a positive effect on their well-being. Studies have indicated that the challenges of parenting can increase stress and decrease overall life satisfaction, thereby impacting well-being negatively (An et al., 2019).

Several relationships expected to be significant were not supported by the data, offering important insights into how career sustainability operates in the specific context of project management. The integrativeness dimension did not show a meaningful influence on turnover intentions, career satisfaction, or well-being. While the ability to combine knowledge and skills from various experiences may be conceptually valuable (Chin et al., 2022), it may not directly affect affective outcomes unless reinforced by enabling organisational conditions such as recognition, autonomy, or support (De Vos & Van der Heijden, 2017). In highly dynamic and task-oriented environments like project-based work, integrative capabilities may function more as background strengths, indirectly contributing to performance but not necessarily to individual career perceptions in the short term (Söderlund & Bredin, 2006).

Similarly, although renewability was linked to reduced intentions to leave the profession, it did not significantly influence the desire to leave one's current organisation. This suggests that the opportunity to update skills supports long-term professional engagement, but it may not be sufficient to retain talent within a particular organisational setting. As previous research highlights, retention in project-based roles often hinges on contextual factors such as perceived organisational support and quality of project assignments (Hobday, 2000; Keegan & Den Hartog, 2004). Project managers may feel equipped and motivated to continue in the profession but still seek more favourable organisational contexts in which to do so.

Unexpectedly, the results also showed that career satisfaction and well-being did not significantly reduce either organisational or career turnover intentions. This challenges traditional assumptions linking positive affective states to retention (Greenhaus et al., 1990; Judge et al., 1997). In the boundaryless and protean career landscapes that characterise project management work (Arthur & Rousseau, 1996; Briscoe & Hall, 2006), professionals may proactively seek mobility and change as part of career self-management, even when they are satisfied or psychologically well. As such, turnover may reflect strategic career decisions rather than dissatisfaction, particularly in sectors where short-term contracts, outsourcing, and shifting priorities are common (Bredin & Söderlund, 2013; Clarke, 2013).

The spread of the sample across different socio-demographic groups adds nuance to the interpretation of the findings. The fact that the structural model held consistently across employment types (in-house vs outsourced) and industry sectors (IT vs non-IT) suggests that the relationships between career sustainability and its outcomes are broadly applicable across varied organisational contexts. This aligns with prior findings that sustainable career mechanisms are generally robust across diverse environments (De Vos et al., 2020; Donald et al., 2024).

At the same time, the observed differences based on seniority and parenting status highlight how specific dimensions of career sustainability may interact with personal and professional life stages. For instance, senior professionals often accumulate greater personal agency and social capital, which may enhance the protective role of resourcefulness against career turnover (Borg et al., 2023; Clarke, 2013). Similarly, the moderating effect of parental responsibilities on the relationship between renewability and well-being reflects the dual demands faced by working parents, especially in project-based roles, where time autonomy and flexibility are limited (Chasserio & Legault, 2010; Turner et al., 2008).

These findings suggest that while sustainable career dynamics are relevant across contexts, their impact is shaped by life-course variables and must be interpreted through a lens sensitive to individual circumstances (Tordera et al., 2020; Van der Heijden & De Vos, 2015). Despite the overrepresentation of in-house professionals and IT sector employees, the sample distribution allowed for meaningful comparison, and the multi-group analysis confirmed the structural model's overall robustness. However, the moderating effects of seniority and parenting underline the need for contextualised career support strategies, tailored to professionals' evolving needs across life stages.

5.1. Theoretical and Practical Implications of the study

This study significantly advances the career sustainability theory and extends theoretical frameworks in several keyways. Firstly, this study contributes by providing empirical evidence on the relevance of the resourcefulness dimension of career sustainability, which is still an understudied dimension. This is particularly noteworthy due to the explanatory power of resourcefulness for critical dependent variables such as career turnover intention, organizational turnover intention, well-being, and career satisfaction. Secondly, by examining the differentiated effects of the four dimensions of career sustainability on several organizational outcomes, this study extends existing theories of career development (Greenhaus et al., 2024). Thirdly, the model demonstrates that when employees perceive their careers has resourceful and renewable, they are more likely to experience higher levels of career satisfaction and psychological well-being. This reinforces the findings of prior studies that have linked career sustainability to enhanced career satisfaction and mental health (Tordera et al., 2020). The positive relationship between resourcefulness and career satisfaction, well-being, and retention, shows the importance of project managers effectively utilizing their resources, specifically by leveraging networks, time and financial resources, to navigate career challenges and opportunities successfully to improve career outcomes. Also, the positive relationship between renewability and career satisfaction highlights the importance of adaptability and continuous learning in fostering long-term career fulfillment (Alkhudary & Gardiner, 2021; Heslin et al., 2020). This indicates that continuous professional development is a key factor in career sustainability, which is an important contribution for the career sustainability framework.

Furthermore, by uncovering the role of resourcefulness in project management, i.e., leveraging resources efficiently to address the challenges posed by dynamic and temporary project environments (Müller & Turner, 2010), and renewability in project management, i.e., continuous professional development and skill enhancement to update for the latest tools, techniques, and methodologies to manage projects effectively (El-Sabaa, 2001.), in mitigating turnover intentions, we provide a more comprehensive understanding of the mechanisms through which individuals navigate their careers within project-based environments, i.e., the career sustainability dimensions that allow project managers to be better equipped to handle project demands (Parker & Skitmore, 2005).

We present and validate a comprehensive model that elucidates the specific dimensions through which career sustainability exerts its influence on both career turnover and organizational turnover. By identifying these dimensions - resourcefulness and renewability - we provide a nuanced understanding of how sustainable career practices can mitigate turnover rates. This model extends the theoretical framework proposed by De Vos et al. (2020), by linking specifically two dimensions of career sustainability on career outcomes such as career satisfaction, well-being and turnover intention. Resourcefulness can be viewed as a critical competency, enabling individuals to effectively utilize resources and opportunities within their careers, which aligns with the emphasis on individual agency in De Vos et al.'s model (De Vos et al., 2020). Renewability emphasizes the importance of ongoing learning and adaptation, aligning with the contextual factors in De Vos et al.'s model, since it highlights the dynamic nature of career sustainability and the need for continuous skill renewal (De Vos et al., 2020). We advocate that this study contributes to the theoretical literature by introducing a validated model that identifies the dimensions of career sustainability that are more relevant in explaining project managers' career satisfaction, well-being and turnover, while also contributing to a more general understanding of career

sustainability by illustrating how resourcefulness and renewability lead to enhanced career satisfaction, well-being, and employability over time.

This study makes a distinct theoretical contribution by advancing the operationalisation of career sustainability within project-based contexts. While previous frameworks, such as those by De Vos et al. (2020) and Lo Presti et al. (2021), offer rich conceptual models, they lack empirically tested, multidimensional measurement tools suited for high-mobility, dynamic roles like project management. By validating Chin et al.'s (2022) four-factor model—particularly highlighting the critical role of resourcefulness and renewability—this study demonstrates which specific dimensions are most predictive of meaningful career outcomes. It thus offers a more granular understanding of how career sustainability functions in boundaryless, time-bound work environments and provides a theoretical basis for future studies to explore career sustainability across different professional ecosystems.

The practical implications of our research are manifold and offer actionable recommendations for organizations, policymakers, and practitioners in the field of project management. Firstly, organizations can leverage our findings to design more effective talent management strategies that prioritize the cultivation of resourcefulness and renewability among project managers (Morin et al., 2015). By providing access to relevant resources (e.g., networks, time, and financial resources) and opportunities for continuous learning and skill development, organizations can create a supportive work environment conducive to career satisfaction, retention, and well-being (Ekrot et al., 2018; Harris & Cameron, 2005).

HR departments and project-based organisations should consider implementing systems that embed sustainability into career development frameworks—such as structured resource access (e.g., mentoring programs, career coaching, learning budgets) and long-term professional development plans aligned with project rotations. These practices not only increase individual well-being and satisfaction but also serve as organisational retention tools, helping to reduce turnover in critical roles. Such alignment between individual agency and organisational support is consistent with Van der Heijden, De Vos, and Akkermans et al. (2020), who underscore the mutual responsibility of individuals and organisations in sustainable career management.

Furthermore, practitioners in project management roles can apply our findings directly to their own career development efforts. By prioritizing the acquisition of resourcefulness skills such as leveraging networks, time, and financial resources to navigate career challenges and opportunities successfully (Chin et al., 2022), project managers can enhance their career satisfaction, well-being, and long-term career prospects (De Vos & Van der Heijden, 2017). Similarly, embracing renewability through continuous learning and professional development activities can help project managers navigate the evolving demands of their roles and remain resilient in the face of change (Cristina et al., 2019).

This research offers valuable insights into the benefits of a sustainable career in project management for both professionals and organizations, providing actionable recommendations for enhancing project managers career satisfaction, well-being and retention in the project management profession. By integrating these insights into organizational practices and individual career management efforts, stakeholders can contribute to the creation of a more sustainable and resilient project management workforce (Borg et al., 2023).

6. Conclusion

The high turnover of project managers poses critical challenges for organizations across various industries, impacting project continuity, organizational stability, and financial performance (Hobday, 2000). The findings of this study underscore the importance of fostering both resourcefulness and renewability dimensions of career sustainability to enhance career satisfaction and well-being of project managers while reducing turnover intention.

This study has some limitations. Firstly, the reliance on a convenience sample restricts the generalizability of findings, as noted by Shim et al. (2022). Secondly, the cross-sectional design used in this study limits our ability to establish causal

relationships among variables, as highlighted by Cui et al. (2016). To overcome this constraint, we recommend that future studies adopt longitudinal designs, allowing for the exploration of temporal sequences and causal links between the variables in question.

Additionally, the use of self-report measures introduces the potential for social desirability bias, compromising the reliability of the obtained data, as cautioned by Van De Mortel (2008). Participants may have responded in ways they perceived as socially acceptable, thereby affecting the accuracy of the results. To enhance the robustness of future investigations, researchers should consider supplementing self-report measures with data from alternative sources, such as evaluations from supervisors or peers, facilitating data triangulation and ensuring greater accuracy (Van De Mortel, 2008).

Our findings provide a foundation for future research and offer practical insights for organizations seeking to enhance project managers retention through sustainable career practices. Future research should continue to explore these dimensions in various contexts and further validate the proposed model to enhance its generalizability and practical application.

Further avenues for research could include longitudinal studies to gain a more dynamic understanding of how career sustainability influences career satisfaction, well-being, and turnover intentions over time (Ng et al., 2024). Additionally, exploring the mediating and moderating roles of variables such as organizational support (Noto et al., 2023) could offer nuanced insights into these relationships. Given the growing prevalence of remote and hybrid work models, investigating how career sustainability operates within these contexts would be particularly valuable. Finally, integrating qualitative methods (Noto et al., 2023) could uncover the personal and contextual factors contributing to sustainable career practices, providing a richer understanding.

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Appendix A. Measurement items

All items were measured on a 5-point Likert scale ranging from 1 ("Strongly disagree") to 5 ("Strongly agree"). The table below presents the full set of items used in the study.

Table A1. Full List of Measurement Items for Constructs

Construct	Item	Statement	Source
Career Satisfaction	CSAT_1	I am satisfied with the success I have achieved in my career.	Greenhaus et al. (1990)
	CSAT_2	I am satisfied with the progress I have made toward meeting my overall career goals.	
	CSAT_3	I am satisfied with the progress I have made toward meeting my goals for income.	
	CSAT_4	I am satisfied with the progress I have made toward meeting my goals for advancement.	
	CSAT_5	I am satisfied with the progress I have made toward meeting my goals for the development of new skills.	
Well-being	SWL_1	In most ways my life is close to my ideal.	Diener et al. (1985)
	SWL_2	The conditions of my life are excellent.	
	SWL_3	I am satisfied with my life.	
	SWL_4	So far I have gotten the important things I want in life.	
	SWL_5	If I could live my life over, I would change almost nothing.	
Organizational Turnover Intention	ORGTI_1	I will probably look for a new job as project manager in the next year.	Cammann (1979)
	ORGTI_2	I often think about quitting my job.	
	ORGTI_3	I intend to search for a position with another employer within the next year.	
Career Turnover Intention	CARTI_1	I think a lot about leaving the profession of project manager.	Baillod & Semmer (1994)
	CARTI_2	I am seriously considering changing careers.	
	CARTI_3	I often think that project management may not be the right profession for me.	
Career Sustainability – Resourcefulness	CSRES_1	My career allows me to seek new opportunities.	Chin et al. (2022)
	CSRES_2	My career enables me to effectively use my network to achieve my goals.	
	CSRES_3	My career allows me to allocate my time and financial resources effectively.	
Career Sustainability – Renewability	CSREN_1	My career provides me with opportunities to update my skills.	Chin et al. (2022)

Construct	Item	Statement	Source
	CSREN_2	My career allows me to reassess my strengths and weaknesses.	
	CSREN_3	My career offers opportunities to rebrand myself professionally.	
Career Sustainability – Integrativeness	CSINT_1	My career enables me to integrate information obtained from different sources.	Chin et al. (2022)
	CSINT_2	My current role helps me to combine diverse knowledge and skills.	
	CSINT_3	I often connect different experiences to develop new career perspectives.	

Note: The flexibility dimension was removed from the final model due to insufficient reliability, and therefore the items are not included.

Appendix B. Cross-Loadings of Measurement Items

To further support the assessment of discriminant validity, Appendix B presents the cross-loadings of all measurement items on the model constructs, demonstrating that each item loads more strongly on its intended construct than on any other.

Table B1. Cross-Loadings of Measurement Items on All Constructs

Cross loadings							
	Career Satisfaction	Career Turnover Intentions	Integrativeness	Organizational Turnover Intentions	Renewability	Resourcefulness	Well-being
CARTI_4	-0.107	0.908	-0.174	0.361	-0.241	-0.324	-0.185
CARTI_5	-0.117	0.855	-0.169	0.379	-0.236	-0.269	-0.090
CARTI_6	-0.190	0.916	-0.198	0.301	-0.294	-0.367	-0.161
CSAT_1	0.845	-0.129	0.281	-0.216	0.279	0.504	0.352
CSAT_2	0.862	-0.133	0.263	-0.153	0.343	0.513	0.424
CSAT_3	0.759	-0.129	0.167	-0.139	0.264	0.496	0.387
CSAT_4	0.819	-0.099	0.229	-0.173	0.364	0.471	0.271
CSAT_5	0.788	-0.154	0.297	-0.103	0.456	0.413	0.298
CSINT_10	0.162	-0.200	0.870	-0.125	0.562	0.364	0.271
CSINT_11	0.253	-0.122	0.882	-0.086	0.508	0.311	0.202
CSINT_12	0.350	-0.197	0.870	-0.094	0.633	0.400	0.316
CSREN_7	0.414	-0.307	0.541	-0.115	0.894	0.462	0.323
CSREN_8	0.329	-0.227	0.510	-0.133	0.858	0.413	0.328
CSREN_9	0.235	-0.131	0.604	-0.005	0.642	0.298	0.202
CSRES_1	0.286	-0.194	0.346	-0.215	0.310	0.657	0.347
CSRES_2	0.532	-0.304	0.317	-0.305	0.384	0.851	0.452
CSRES_3	0.543	-0.344	0.352	-0.233	0.474	0.865	0.462

Cross loadings							
	Career Satisfaction	Career Turnover Intentions	Integrativeness	Organizational Turnover Intentions	Renewability	Resourcefulness	Well-being
ORGTI_1	-0.183	0.161	-0.074	0.874	-0.073	-0.231	-0.117
ORGTI_2	-0.203	0.230	-0.105	0.911	-0.084	-0.266	-0.111
ORGTI_3	-0.116	0.552	-0.114	0.788	-0.138	-0.305	-0.136
SWL_1	0.374	-0.143	0.273	-0.120	0.346	0.486	0.821
SWL_2	0.287	-0.140	0.242	-0.140	0.289	0.416	0.738
SWL_3	0.250	-0.096	0.210	-0.133	0.273	0.386	0.817
SWL_4	0.268	-0.104	0.241	-0.043	0.183	0.292	0.667
SWL_5	0.372	-0.106	0.121	-0.045	0.149	0.276	0.497

Biographical notes

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RESEARCH ARTICLE

Enhancing client controls and information systems development project outcomes: Roles of team collaborative culture and coordination technology

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Abstract
Effective client controls, both behavioral and outcome based, are essential to the success of Information Systems Development (ISD) projects, yet the role of project team collaborative culture and coordination technology in enabling these controls remains insufficiently examined. We propose and test a research model about these relationships using structural equation modeling with survey responses from 218 ISD projects. The results show that collaborative culture and coordination technology both significantly increase clients' use of behavior and outcome controls. In turn, these controls are positively associated with project outcomes, underscoring the importance of aligning project culture and tools with management practices. Our findings contribute to the IS project management literature by highlighting how fostering a collaborative culture and leveraging coordination technology can lead to more successful project outcomes. This study provides practical guidance for ISD practitioners by demonstrating how collaborative culture and coordination technology can be leveraged alongside client behavioral and outcome controls to reduce coordination costs, manage task dependencies, and improve project assessment and adaptive management for enhanced project success.

Keywords
collaborative culture; coordination technology; client's behavior; outcome controls; project outcomes.

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1. Introduction

Information Systems Development (ISD) projects have become increasingly complex, involving extensive project planning, process design, requirements determination, and logical and physical system designs (Iivari, 2021; Ko et al., 2019). These projects often span multiple organizations and require close interactions between clients and vendors, making collaboration a critical success factor (Dieterich & Ohlhausen, 2023). However, effective collaboration in ISD environments is challenging due to differing interests, cultural mismatches, and communication barriers between clients and vendors (Ahmed et al., 2025; Xia et al., 2024).

A growing body of research highlights the significance of a collaborative culture in ensuring the success of ISD projects (Dieterich & Ohlhausen, 2023; Gupta et al., 2019; Narayanaswamy & Henry, 2005). Collaborative culture encompasses shared values and norms that encourage trust, mutual respect, and transparent communication among stakeholders (Bendoly et al., 2012; Cameron & Quinn, 2005). It facilitates open decision-making and aids project teams in navigating unexpected challenges (Ko et al., 2019). This cultural alignment between vendors and clients is especially valuable when uncertainty and ambiguity emerge (Dieterich & Ohlhausen, 2023; Mao et al., 2008). Lacking a collaborative culture can obstruct alignment and create barriers to project success.

To reduce collaboration complexity and support joint work across boundaries, ISD vendors have increasingly adopted coordination technologies such as workflow systems, collaboration platforms, and communication tools (Bala et al., 2017; Behn & Silvius, 2025; Mentzas, 1993) to reduce collaboration complexity and support joint work across boundaries. These technologies facilitate timely information exchange and tracking, allowing clients to monitor project progress, provide input, and maintain alignment with business objectives. Coordination integrates and aligns individual efforts toward a shared goal (Hoegl & Gemuenden, 2001; Singh, 1989). In ISD projects, coordination technologies enable and support the project's shared task-related goal structure, helping to synchronize activities across clients, vendors, and users (Bala et al., 2017; Mentzas, 1993). Despite their growing importance, the role of coordination technologies in enabling new strategic processes and ensuring project success remains an emerging area of research (Bala et al., 2017; Sarma, 2019).

Coordination technologies enhance controls such as contract monitoring, scope enforcement, and milestone tracking (Ditmore, 2019; Ko et al., 2019). They are particularly relevant in ISD outsourcing contexts, where vendor accountability and project transparency are critical to success. In addition to supporting contract monitoring and milestone tracking, coordination technologies enable clients to access real-time project information and communicate directly with development teams (Bala et al., 2017; Kuciapski & Marcinkowski, 2023). For example, digital communication tools such as videoconferencing and asynchronous messaging help facilitate remote meetings, streamline information exchange, and maintain clear records of project progress and team decisions (Swart et al., 2022). As ISD outsourcing becomes more prevalent, the limitations of contract-based controls have become increasingly evident due to project uncertainty and scope variability (Ditmore, 2019; Ko et al., 2019). Project requirements continuously evolve during the development process, often emergent, making it difficult for rigid contracts to accommodate unanticipated changes and uncertainty (Xia et al., 2024). By leveraging coordination technologies, clients can strengthen their controls by leveraging coordination technologies while facilitating effective collaboration with ISD vendors. These technologies enhance transparency, streamline communication, and support the coordination of project activities, making them particularly valuable in outsourced ISD environments (Kuciapski & Marcinkowski, 2023; Xia et al., 2024). They also help reinforce shared expectations and facilitate the monitoring of project commitments (Behn & Silvius, 2025).

While collaborative culture and coordination technology have been recognized as essential ISD projects, their influences on clients' controls and project success remain underexplored (Das & Teng, 2001; Dieterich & Ohlhausen, 2023; Iivari, 2021; Sundaramurthy & Lewis, 2003). Prior research has rarely examined how collaborative culture influences client controls. Most IS studies focus on control types, such as behavior and outcome (Choudhury & Sabherwal, 2003; Kirsch, 1997), overlooking the role of collaborative culture. The relationship between collaborative culture and client controls has

yet to be integrated into ISD control literature (Gopal & Gosain, 2010; Gregory et al., 2013; Maruping et al., 2019). Empirical evidence linking collaborative culture to client control remains limited and warrants further investigation (Dieterich & Ohlhausen, 2023; Iivari, 2021). Moreover, while some studies have highlighted coordination technologies' role in enabling clients to monitor progress, assess performance, and regulate vendor activities (Bala et al., 2017; Im & Rai, 2014; Mao et al., 2008), few have explicitly examined how these technologies affect clients' controls and ISD project success (Faraj & Xiao, 2006; Germonprez et al., 2007). These gaps are further underscored by recent work on paradoxical tensions in project management, highlighting a persistent gap in addressing the complex and often contradictory dynamics in ISD environments, such as the need to balance control and collaboration (Dieterich & Ohlhausen, 2023; Iivari, 2021).

This study addresses these gaps by examining how collaborative culture and coordination technology influence clients' behavior, outcome controls, and ISD project outcomes. Specifically, we answer the following research questions: (1) How are the ISD project team's collaborative culture and coordination technology related to the client's behavior and outcome controls? (2) How are the client's behavior and outcome controls related to ISD project outcomes?

This study offers significant contributions to both the theoretical understanding and practical management of Information Systems Development (ISD) projects. On the theoretical side, it broadens the understanding of how a collaborative culture and coordination technology influence clients' behavior and outcome controls – areas that previous IS research has largely overlooked. The study achieves this by constructing and empirically testing a model that links the project context, control mechanisms, and project outcomes. This approach effectively bridges two previously disconnected research streams: project governance and collaborative practices. On the practical side, the findings provide actionable insights for ISD project managers. For instance, fostering a collaborative culture and adopting coordination technologies can strengthen client oversight, reduce coordination complexity, and enhance project performance. Taken together, these results offer a roadmap for balancing control and collaboration, a common challenge in outsourced ISD environments.

The remainder of this paper is structured as follows: Section 2 reviews relevant literature and theoretical frameworks. Section 3 outlines the research model and the hypotheses. Section 4 details the methodology used in the study. Section 5 presents the research results. Section 6 discusses the findings. Section 7 examines both the theoretical and practical implications of the research, as well as suggestions for future studies. Finally, conclusions are drawn in Section 8.

2. Literature review

As the conceptual foundation for our study, we review the literature related to our five core constructs: collaborative culture, coordination technology, client's behavior control, client's outcome control, and project outcomes.

2.1. Collaborative culture in ISD projects

A collaborative culture supports trust, open communication, and shared responsibility through shared values, norms, and beliefs. It helps teams make better decisions, communicate clearly, and build a common understanding (Cameron & Quinn, 2005; Gupta et al., 2019; Leidner & Kayworth, 2006; Narayanan et al., 2015). As ISD projects become more complex and involve multiple stakeholders, creating a culture that supports teamwork and innovation becomes more important (Gupta et al., 2019; Hoegl & Wagner, 2005; Mao et al., 2008). Aligning the project environment with external challenges and competitive demands can help improve project performance (Child, 1997; Sydow et al., 2009; Venkatraman, 1990). A strong collaborative culture helps teams respond to change, solve problems, and align vendor skills with clients' goals (Blazevic & Lievens, 2008; Ko et al., 2019; Leidner & Kayworth, 2006).

Moreover, culture shapes control preferences: in high-trust environments, clients may rely more on relational or outcome-oriented controls, while in low-trust or high-risk settings, behavior control may be emphasized (Das & Teng, 2001; Gregory et al., 2013; Maruping et al., 2019). A collaborative culture fosters trust between clients and vendors at the project team

level, enhancing client's outcomes and behavior control mechanisms (Doney et al., 1998; Mao et al., 2008). The cultural environment shapes how control is exercised in collaborative settings (Bahli & Rivard, 2003).

2.2. Coordination technology in ISD projects

Coordination technologies enable ISD project stakeholders to manage interdependent tasks, synchronize progress, and maintain alignment despite spatial, temporal, or organizational boundaries (Bala et al., 2017; Crowston et al., 2004; Sarma, 2019). These tools, such as project management systems, document-sharing platforms, and video conferencing applications, facilitate structured interactions through embedded protocols like milestone tracking and issue resolution (Crowston, 1997; Im & Rai, 2014; Mentzas, 1993). Interpersonal relationships and clear communication are critical for success (Jassawalla & Sashittal, 2003; Smolander et al., 2016). A lack of task progress information increases performance ambiguity and disrupts collaboration (Heide & Miner, 1992). Coordination theory highlights that unmanaged dependencies between tasks and resources can result in project delays or failure, and stresses the need for mutually agreed protocols to manage them effectively (Crowston, 1997; Crowston et al., 2004).

In an outsourced ISD context, coordination technologies are critical where contract-based governance falls short (Ko et al., 2019; Kuciapski & Marcinkowski, 2023). These tools provide real-time visibility into vendor activities, supporting proactive intervention and milestone verification (Bala et al., 2017; Mao et al., 2008). Beyond communication, these systems enhance project information processing and interpretation, allowing clients and vendors to align goals and adapt workflows (Bahli & Rivard, 2003; Im & Rai, 2014). Despite their widespread use, the role of coordination technologies in shaping client's control remains underexplored. Recent studies highlight the importance of coordination in improving ISD outcomes, but fail to explain its role in enabling client's control (Xia et al., 2024).

2.3. Client's behavior and outcome controls in ISD projects

Client's control refers to approaches used by the client to influence vendor behavior and ensure that project objectives are achieved (Ouchi, 1979; Rustagi et al., 2008). Two widely recognized types of control are behavior control and outcome control (Das & Teng, 2001; Ko et al., 2019). Behavior control involves monitoring compliance with predefined processes and procedures, while outcome control focuses on results and performance metrics (Mao et al., 2008; Stump & Heide, 1996).

Although client's controls are essential in ISD projects, there is limited understanding of how client use behavior and outcome controls when managing vendors, particularly in contexts shaped by collaborative culture and coordination technologies. While prior studies have examined control modes and styles at the individual level (Remus et al., 2016) and highlighted the importance of integrating control frameworks in project settings (van Fenema, 2002), few have focused on how collaborative culture and coordination technologies shape client's controls in ISD collaborations.

2.4. Project outcomes in ISD projects

Project outcomes are typically evaluated in terms of effectiveness (meeting functional and quality goals) and efficiency (adherence to timelines and budgets) (Hoegl & Wagner, 2005; Lee & Xia, 2010). A multidimensional perspective on project outcomes is increasingly endorsed to reflect the practical realities of IT project delivery, where technical, behavioral, and organizational factors influence success (Xia et al., 2024). Effectiveness often includes the degree to which system requirements are fulfilled and project deliverables align with user expectations, while efficiency measures relate to schedule adherence and cost control (Mao et al., 2008; Xia & Lee, 2003). These dimensions reflect the client's perception of value and are particularly relevant in outsourced ISD contexts, where accountability and delivery performance are shared across boundaries.

3. Research model and hypothesis development

This research investigates how collaborative culture and coordination technology influence the types of controls client use (behavior and outcome controls), and their effects on ISD project outcomes. Figure 1 illustrates the proposed research model, showing relationships among collaborative culture, coordination technology, client behavior and outcome controls, and project outcomes.

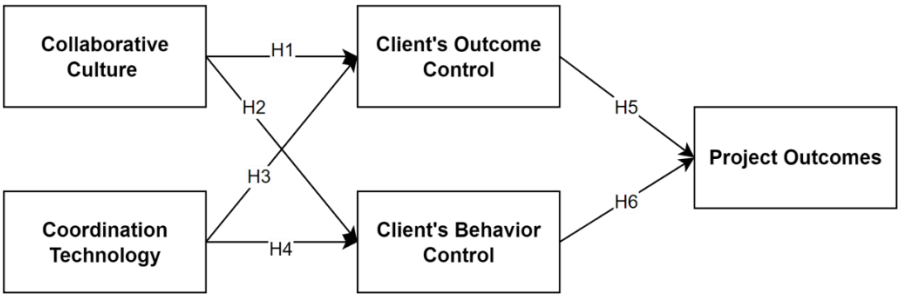

Fig. 1. Research Model

The ISD project's collaborative culture creates a team climate where the client and vendor teams can engage in effective, successful joint activities. Successful collaboration depends on mutual willingness and cannot be mandated. Instead, project management must cultivate a collaborative team culture to promote shared decision-making, joint problem-solving, trust, and respect (Dey et al., 2010; Gopal et al., 2003; Selnes & Sallis, 2003). Such a culture facilitates high morale, commitment, and alignment with strategic goals, which is particularly valuable in navigating project uncertainties (Cameron & Quinn, 2005; Gopal et al., 2003). Clients typically rely on two main types of controls to guide and motivate vendors: outcome controls, which focus on work results, and behavior controls, which dictate the processes by which work is performed (Jaworski, 1988; Kirsch, 1996).

According to Ko et al. (2019), client's outcome control emphasizes a client's control over specific desired task results. This approach focuses on setting clear targets and granting vendors autonomy to determine how to achieve those objectives (Ko et al., 2019). In a collaborative project, cultivating a collaborative culture through project management is essential to foster open communication, a sense of ownership among team members, and greater coordination and cooperation (Cameron & Quinn, 2005). This, in turn, increases the effectiveness of the client's outcome control by empowering shared decision-making and creating a collaborative environment that fosters collaboration and innovation. Client's outcome controls ensure that IS project teams align with budgets, schedules, and objectives, directing vendor teams toward successful outcomes (Ko et al., 2019). A collaborative culture will likely promote the client's outcome control by creating a collaborative environment that encourages joint activities and empowers shared decision-making. Therefore, we propose:

H1: ISD project collaborative culture positively relates to the client's outcome control.

Collaborative culture supports client's behavior control by promoting transparent adherence to predefined procedures. It assesses, monitors, and regulates how the vendor team follows agreed-upon procedures. This clarity ensures that vendors' processes remain consistent, fostering a shared understanding of task procedures (Ko et al., 2019). Client's behavior control is likely more effective in an outsourced ISD project with a collaborative culture. A lack of collaborative culture may cause misunderstandings between clients and vendors (Gregory et al., 2013). Behavior control directs vendors by specifying steps and procedures, assessing their performance on adherence, and ensuring successful outcomes by

minimizing deviations from the team culture (Ko et al., 2019). As such, collaborative culture enhances the effectiveness of behavior control by fostering procedural transparency and consistency. Therefore, we propose:

H2: ISD project collaborative culture positively relates to the client's behavior control.

Coordination technology facilitates timely information sharing, synchronization of tasks, and transparent communication between clients and vendors. It enhances the client's capability to set clear objectives and effectively monitor project performance, reinforcing the client's outcome control (Bala et al., 2017). This can help the client regulate joint activities, strengthening the client's outcome control (Ko et al., 2019). Prior research indicates that product teams may need adequate task coordination to meet budget and schedule targets despite having sufficient information and regular communication with external members (Ancona & Caldwell, 1992).

Coordination technology enhances the information transparency between clients and vendors, which is crucial for establishing mutual goals and directions. Transparency fosters a positive reinforcing cycle where vendors, as controlled entities, align with client goals, reducing vulnerability and boosting confidence; this allows clients to minimize control, giving vendors greater freedom to innovate and collaborate, creating a conducive environment for creativity and effective resource use (Liu & Chua, 2020). Such shared objectives and information transparency between clients and vendors, enabled by coordination technologies, ultimately enhance clients' control over project outcomes (Bala et al., 2017). Therefore, we propose:

H3: ISD project coordination technology use positively relates to client's outcome control.

Coordination technologies also play a crucial role in supporting behavior control by enabling client to continuously monitor vendor adherence to established procedures and standards (Bala et al., 2017). Coordination technology is pivotal in streamlining activities within the development team and externally with clients, fostering clear communication, and facilitating interactions among multiple stakeholders (Ancona & Caldwell, 1992). However, vendor deliverables may not align with client expectations when misunderstandings occur, potentially impacting project timelines and quality. In response to those concerns, the client can intensify behavior control, emphasizing procedural efficiency and timely delivery, leading to more rigorous and frequent checks (Gregory et al., 2013). As such, coordination technology enhances clients' ability to manage vendor behaviors effectively (Mao et al., 2008). Therefore, we propose:

H4: ISD project coordination technology use positively relates to client's behavior control.

Client's outcome control, focusing on clear objectives and results, enables clients to evaluate vendor performance directly related to project success criteria and influence ISD project outcomes by ensuring alignment with project objectives, quality standards, schedules, and budgets (Ko et al., 2019; Mao et al., 2008). For example, client's outcome control helps ensure the project team achieves the desired goals. The client can hold the vendor team accountable for failing to accomplish the project objectives by emphasizing and evaluating the performance related to project goals and targets. Outcome control is essential to ensure that projects are completed on schedule, within the budget, and meet the required level of quality. Outcome control enables clients to monitor progress and assess task interdependencies, facilitating timely corrective actions and optimizing alignment with desired outcomes (Ko et al., 2019). Therefore, we propose:

H5: ISD project client outcome control positively relates to the project outcomes.

Behavior control supports project outcomes by enforcing consistency, standardization, and adherence to established processes. By tracking vendor compliance with procedures systematically, clients can quickly identify and address deviations, minimizing errors, rework, and schedule disruptions. By regulating how the vendor team follows agreed-upon procedures, the client can identify potential problems early and take corrective actions to avoid delays or cost overruns. When a client employs behavior control, it implies that the vendor should consistently share updates on their adherence to set procedures (Ko et al., 2019). Recognizing this possible control increase, vendors may need to adapt their approaches to enhance project effectiveness (Gregory et al., 2013). The client may have frequently employed daily status

reviews for closer monitoring (Gregory et al., 2013). This intensified behavior control approach may make the overall management more procedural. Client's behavior control promotes establishing a shared understanding of task procedures, enhances team coordination, and ensures adherence to project specifications (Ko et al., 2019). Therefore, we propose:

H6: ISD project client's behavior control positively relates to project outcome.

4. Research methods

Our research method followed a four-stage process: (1) initial conceptual and item development, (2) refinement through pre- and pilot-testing, (3) large-scale data collection via surveys, and (4) data analysis, including measurement validation and structural model testing (Xia & Lee, 2003; Xia et al., 2024). In the first stage, we developed a conceptual framework based on a literature review to capture the key aspects of ISD project management. An initial pool of measurement items was generated, with established scales adapted from prior studies where appropriate.

We interviewed and used a Q-sorting procedure with six IT professionals in the second stage. These interviews provided critical insights into the contextual realities and challenges of ISD projects, helping to identify facets of the constructs not adequately captured by the initial survey items. The Q-sorting procedure was used to assess face validity and construct validity qualitatively (Gupta et al., 2019; Lee & Xia, 2002; Moore & Benbasat, 1991). We then did a pilot test with a sample of 66 participants drawn from the outsourcing companies involved in the earlier interviews. The pilot results confirmed that the items were clear, comprehensible, and representative of the targeted constructs, with acceptable reliability and validity (Presser et al., 2004). We then created a finalized version of the survey, incorporating improvements from the pilot test.

In the third stage, we created an online survey and distributed it for large-scale data collection. A seven-point Likert scale was used for all item measurements, and items were randomly ordered to mitigate potential method bias. Data were collected through a publicly accessible online survey platform, while paper-based forms were also made available for respondents who preferred offline participation. The final stage involved rigorous data screening, validation of measurements, and assessment of the structural model, wherein the researcher evaluated the validity and reliability of the measurement items and applied various statistical methods to test the structural model rigorously.

4.1. Data collection

This study used the snowball sampling technique to approach survey participants. During the pilot phase, senior managers from outsourcing companies who had previously expressed interest in supporting academic research were invited to participate. Each pilot test respondent received a $12 (USD) digital gift card as a participation incentive and was encouraged to share the survey link with colleagues. This effort yielded 66 valid responses. We then employed snowball sampling to expand the sample. The survey link was redistributed to the 66 initial respondents, who were encouraged to forward it within their professional networks. No incentives were offered during this stage. In addition, the survey was disseminated through LinkedIn, WeChat, and iMessage. We created a public-facing research website providing project background and participation details to facilitate access and transparency. Snowball sampling is beneficial for reaching dispersed or hard-to-access populations and has been widely used in social science and information systems research to facilitate network-based participation (Biernacki & Waldorf, 1981; Johnson, 2014; Noy, 2008).

4.2. Data screening and descriptive analysis

We excluded 68 responses with more than 20% missing values to improve data quality. The remaining responses were screened for unusual patterns or careless input; none were found. Descriptive statistics for the final sample are presented in Appendix A. Our final study sample included 218 valid responses representing 91 companies across more than eight industries. Participants were involved in ISD projects with clients in the U.S., Europe, China, Japan, and other countries. Project team sizes ranged from six to over 100. Respondents included IT engineers, data development engineers, test engineers, team leaders, and project managers, who were directly involved in cross-boundary coordination and decision-making in ISD projects.

4.3. Assessment of non-response and method biases

We recorded the response submission dates to assess non-response bias and divided them into early and late respondent groups. Independent-samples t-tests revealed no significant differences across key demographic variables, project attributes, or item-level responses, indicating that non-response bias is unlikely to be a concern. To assess common method bias, we performed Harman's one-factor test on all latent constructs as recommended by Malhotra and Podsakoff (Malhotra et al., 2006; Podsakoff & Organ, 1986). The most common covariance explained by one factor is only 34.0%, which is less than the 50% threshold recommended by (Podsakoff & Organ, 1986). Therefore, common method biases are unlikely to be a serious concern. We also assessed the minimum sample size requirement recommended by Barclay et al. (1995) and Cohen (1992). Our study met these requirements.

4.4. Measures and control variables

We operationalized the constructs by adapting existing scales to fit the context of our study. The final items for measuring the constructs are shown in Appendix B. All variables in the research model are assessed as first-order constructs. Collaborative Culture, Coordination Technology, and Project Outcomes were assessed as reflective constructs. In contrast, Client's Behavior Control and Outcome Control were assessed as formative constructs. Measures of collaborative culture were adopted from the Competing Values Framework (Cameron & Quinn, 2005; Quinn & Rohrbaugh, 1983). Measures of Coordination Technology were adapted from Bala et al. (2017) and Guinan et al. (1998). Behavior Control and Outcome Control were adapted from Kirsch et al (2002) and Lee and Xia (2010). Measures of Project Outcomes were adopted from Lee and Xia (2010). We also include two control variables in the analysis. First, we controlled for project duration, the number of days spent completing the project. Prior research suggests that IS projects with longer durations tend to be associated with decreased performance. Second, we controlled for project size because the increased project team size is associated with coordination difficulties and reduced performance.

4.5. Data analysis and results

Partial Least Squares Structural Equation Modeling (PLS-SEM) using SmartPLS was employed to test our research hypotheses. PLS-SEM, which is widely utilized in the IS and business disciplines, was suitable for our data analysis due to its capability to manage complex models, non-normal data, small sample sizes, and the formative measurement of latent variables (Hair Jr et al., 2016; Shiau & Chau, 2016). PLS-SEM can analyze formative and reflective variables in complex research models, making it ideal for our research (Hair Jr et al., 2016; Lowry & Gaskin, 2014; Shiau & Chau, 2016).

5. Results

5.1. Measurement model assessment (reflective constructs)

A multivariate measurement approach was developed and implemented for the structural equation model to enhance the measurement accuracy and comprehensively represent the various facets of the concept. For variables using reflective measures, Collaborative Culture, Coordination Technology, and Project Outcomes variables, we assessed internal consistency reliability (using Cronbach's alpha and composite reliability), convergent validity (through outer loadings, average variance extracted (AVE)), and discriminant validity (Fornell-Larcher Criterion, heterotrait–monotrait (HTMT)) (Hair Jr et al., 2016). The assessment results are shown in Table 1. Measures for all three variables exhibited satisfactory reliability as indicated by Cronbach's Alpha and Composite Reliability greater than the recommended threshold of 0.70 (Chin, 1998). We then established convergent validity for all measures by the acceptable levels (>0.5) of outer loadings and average variance extracted (Hair Jr et al., 2016; Lowry & Gaskin, 2014).

Table 1. Convergent validity and reliability of reflective measures

Reflective Constructs	Indicators	Convergent Validity		Internal Consistency	
		Outer Loadings	Average Variance Extracted (AVE)	Cronbach's Alpha	Composite Reliability
Collaborative Culture (CC)	CC_1	0.834	0.735	0.880	0.917
	CC_2	0.884			
	CC_3	0.893			
	CC_4	0.816			
Coordination Technology (CT)	CT_1	0.825	0.722	0.872	0.912
	CT_2	0.860			
	CT_3	0.903			
	CT_4	0.808			
Project Outcome (PO)	PO_1	0.845	0.727	0.906	0.930
	PO_2	0.834			
	PO_3	0.878			
	PO_4	0.872			
	PO_5	0.833			

We employed two established techniques to assess the discriminant validity of the reflective measures: the Fornell-Larcker criterion and the heterotrait–monotrait (HTMT) ratio. The Fornell-Larcker criterion, widely used in the literature, is based on the square root of the average correlations' variance extracted (AVE) as the diagonal element, with non-diagonal elements representing the correlations between the latent variables (Hair Jr et al., 2016; Henseler et al., 2014; Lowry & Gaskin, 2014). If the diagonal values exceed any other correlation, adequate discriminant validity is established (Hair Jr

et al., 2016). As shown in Table 2, our assessment results suggest that the three reflective constructs met the discriminant validity criterion.

Table 2. Discriminant validity: Fornell-Larcker Criterion

Variables	*(1)*	*(2)*	*(3)*
Collaborative Culture (1)	0.857		
Coordination Technology (2)	0.465	0.850	
Project Outcomes (3)	0.576	0.498	0.853

Square root of AVE in the diagonal for reflective constructs

While the Fornell-Larcker criterion is a common approach, some scholars have argued that it is not a robust metric of discriminant validity. We used the HTMT ratio to ensure a more rigorous assessment. As shown in Table 3, the HTMT ratio values were all below the recommended threshold of 0.85, indicating acceptable discriminant validity (Asamoah et al., 2021; Hair Jr et al., 2016).

Table 3. Discriminant validity: Heterotrait-Monotrait Ratio (HTMT)

Variables	(1)	(2)	(3)
Collaborative Culture (1)			
Coordination Technology (2)	0.520		
Project Outcomes (3)	0.643	0.552	

HTMT < 0.90-Discriminant validity has been established between two reflective constructs

5.2. Measurement model assessment (formative constructs)

To validate the two formative constructs' measures, client's outcome control and client's behavior control, we assessed the collinearity between indicators using the variance inflation factor (VIF) and examined the significance of the indicators' outer loadings and weights (Cenfetelli & Bassellier, 2009; Petter et al., 2007). As shown in Table 4, all VIF values were below the recommended conservative threshold of five (Hair Jr et al., 2016). Outer loadings represent an indicator's absolute importance, whereas outer weights denote their relative importance in defining a formative construct. We tested the weights' significance through a bootstrap procedure with 5,000 samples and found that all indicator weights were significant. The collinearity test results, along with the outer loading and weight tests, suggest that the formative construct measures meet the construct validity requirements.

Table 4. Construct validity measures (formative constructs)

Formative Constructs	Formative Indicators	VIF	Outer Loadings	Outer Weight	Sample Mean	Standard Deviation	T-Statistics	P Values
Client's Behavior Control (CBC)	CBC_1	1.945	0.856	0.478	0.845	0.055	15.451	p < 0.001
	CBC_2	2.148	0.893	0.435	0.883	0.041	21.849	p < 0.001
	CBC_3	1.373	0.589	0.305	0.581	0.099	5.925	p < 0.001
	CBC_4	1.296	0.417	0.054	0.415	0.087	4.774	p < 0.001
Client's Outcome Control (COC)	COC_1	2.673	0.842	0.145	0.828	0.051	16.612	p < 0.001
	COC_2	2.482	0.892	0.398	0.88	0.047	19.105	p < 0.001
	COC_3	2.960	0.919	0.380	0.905	0.04	23.071	p < 0.001
	COC_4	1.672	0.739	0.235	0.73	0.077	9.622	p < 0.001

5.3. Structural model assessment

Our analysis of the structural model, as illustrated in Figure 2 and detailed in Table 5, shows that a collaborative culture has a significant positive impact on both client's outcome control (β = 0.449, p < 0.001) and client's behavior control (β = 0.343, p < 0.001). Additionally, coordination technology significantly influences client's outcome control (β = 0.221, p = 0.020) and client's behavior control (β = 0.393, p < 0.001). Further, client's outcome control had a significant positive effect on project outcomes (β = 0.310, p < 0.001), as did client's behavior control (β = 0.420, p < 0.001).

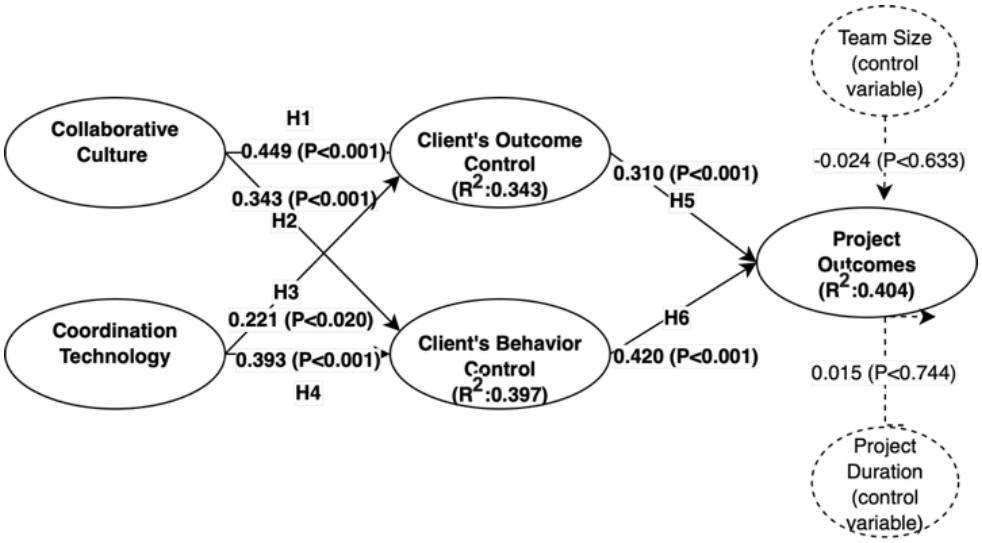

Fig. 2. Model Results

Notably, the control variables did not significantly influence the project outcomes. As shown in Table 5, all six paths without the control variables remained significant, even after including the two control variables, which provides strong evidence supporting our proposed hypotheses.

Table 5. Path coefficients and their significance

Paths	Hypotheses	Coefficients	Sample mean	Standard deviation	T statistics	P values
CC → COC	H1	0.449	0.450	0.085	5.299	p < 0.001
CC → CBC	H2	0.343	0.347	0.085	4.016	p < 0.001
CT → COC	H3	0.221	0.227	0.094	2.351	p = 0.020
CT → CBC	H4	0.393	0.400	0.073	5.395	p < 0.001
COC → PO	H5	0.310	0.324	0.074	4.204	p < 0.001
CBC → PO	H6	0.420	0.418	0.077	5.427	p < 0.001

To assess the predictive power of our model, we used the coefficient of determination (R^2 value). We found that the project outcomes had the highest coefficient of determination (R^2=0.404) in our model, followed by Client's Behavior Controls (R^2=0.397) and Client's Outcome Controls (R^2=0.343). The high R^2 values, combined with substantial and significant structural paths (coefficients close to 0.20), meet the criteria for a robust predictive model according to the rules of thumb suggested by Lowry and Gaskin (2014) and Chin (1998) (Chin, 1998; Lowry & Gaskin, 2014).

5.4. Indirect effects

Table 6 shows the Total Indirect Effects for all the paths. Collaborative culture (β =0.166, p<0.001) and coordination technology (β =0.141, p=0.002) both had significant total indirect effects on project outcomes.

Table 6. Total Indirect Effects

Indirect Effect Path	Indirect Effects	Sample Mean	Standard Deviation	T Statistics	P Values
CC → PO	0.166	0.167	0.043	3.847	P < 0.001
CT → PO	0.141	0.149	0.043	3.288	P = 0.002

We further used mediation analysis techniques to assess mediation effects and the significance of the indirect path effects. As shown in Table 7, four out of five specific indirect effects were significant at the 5% significance level (Hair Jr et al., 2016), except for the indirect effects of coordination technology on clients' outcome control (β = 0.039, p = 0.188).

Table 7. The Significance of The Mediation Path

Indirect Paths	Indirect Effect	T Statistics	P Values
CT → COC → PO	0.039	1.320	P = 0.188
CC → CBC → PO	0.089	2.684	P = 0.008
CT → CBC → PO	0.102	3.323	P = 0.002
CC → COC → PO	0.078	2.268	P = 0.024

5.5. Additional test of common method bias using a marker variable.

A marker variable test was conducted to further evaluate the potential issue of common method bias (Lindell & Whitney, 2001; Rathor et al., 2023; Xia et al., 2024). Appendix C presents the results of this test. Employing a construct-level correction approach, we incorporated a theoretically unrelated marker variable into the PLS-SEM model (Chin et al., 2012; Tehseen et al., 2017). The comparison of path coefficients and R^2 values with and without the marker variable revealed minimal differences, with path coefficient variations ranging from 0.002 to 0.032 and R^2 differences from 0.013 to 0.033. These negligible changes indicate that the exclusion of the marker variable did not substantially influence the model outcomes (Chin et al., 2012; Lindell & Whitney, 2001; Podsakoff & Organ, 1986). As such, the test further confirmed that common method bias was not an issue for our study.

6. Discussion

This study investigates how collaborative culture and coordination technology influence client's behavior and outcome controls, and how these controls affect ISD project outcomes. Our results confirm that collaborative culture at the project level is positively associated with client's behavior and outcome controls. This suggests that when project teams operate with shared norms, open communication, and mutual trust, clients are better positioned to guide procedural adherence and achieve expected project outcomes. Additionally, coordination technology use significantly enhances both types of client's controls by improving real-time visibility, enabling structured monitoring, and supporting timely communication across stakeholders (Bala et al., 2017; Ko et al., 2019).

A collaborative culture positively impacts behavior control by promoting mutual respect and high-level joint effort, leading to greater trust and commitment between client and vendor. Additionally, a shared set of norms and values can help develop a trusting relationship between the client and the vendor (Mao et al., 2008). As a result, a collaborative culture can help organizations achieve better client outcome control, which reflects the client's ability to ensure that project deliverables meet expectations. Collaborative culture can also enhance behavior control by supporting the client in assessing vendor credibility and procedural reliability (Kirsch et al., 2002; Lee & Xia, 2010).

As hypothesized, coordination technology enhances client's controls by improving real-time visibility into project activities and enabling more effective monitoring of vendor performance (Bala et al., 2017; Guinan et al., 1998). Reducing information asymmetry facilitates behavior control by allowing clients to verify adherence to agreed-upon procedures. At the same time, it reinforces outcome control by providing timely access to performance data, enabling clients to evaluate whether deliverables align with predefined expectations. Together, these capabilities enhance clients' oversight of project execution and promote more substantial alignment with intended outcomes.

Our findings further indicate that both client's behavior control and outcome control have significant positive effects on ISD project outcomes. This highlights the critical role that client's controls play in driving successful project delivery. Notably, these results diverge from those of Lakhani et al. (2013), who argued that traditional management practices such

as formal control structures, role-based teams, and performance-based incentives are less effective than collaboration-focused approaches in dynamic environments (Lakhani et al., 2013). In contrast, our analysis suggests that client's controls remain effective even in highly collaborative project contexts when embedded within a collaborative culture and supported by coordination technology. Our research model explained 34.4% of the variance in client outcome control, 39.7% in client behavior control, and 40.4% in project outcomes. These values indicate a moderate-to-strong explanatory power for the integrated model that positions coordination technology and collaborative culture as key contextual enablers in ISD projects.

7. Contributions, limitations, and future research

7.1. Theoretical contributions

This study makes three contributions to the literature on ISD project management and the broader context of outsourced software development. First, it extends prior research on client controls in ISD projects (Kirsch et al., 2002; Ko et al., 2019; Liu & Chua, 2020; Rustagi et al., 2008; Stump & Heide, 1996) by examining how client behavior and outcome controls operate within varying project contexts, particularly under the influence of collaborative culture and coordination technology. The study offers insights into how contextual conditions, collaborative culture, and coordination technology influence how clients manage ISD projects involving external vendors (Batra et al., 2017; Hoegl & Wagner, 2005; Lemmergaard, 2008; Sundaramurthy & Lewis, 2003). Moreover, our study provides a theoretical contribution by constructing and analyzing an empirical research model that highlights the relationships between project context, technology factors, the client's controls, and project outcomes.

Second, while prior research has emphasized the role of communication technologies in facilitating project coordination (Maruping et al., 2009; Persson et al., 2012), this study extends that view by focusing on the broader category of coordination technology. This encompasses a wider range of technologies, including communication technology, project management software, and collaboration platforms to facilitate collaborative work. We identified various technologies that ISD vendors use to coordinate collaborative activities and promote clients' controls. We also identified the critical coordination technology practices that enhance project outcomes. Our findings enrich the literature by showing that coordination technology supports the implementation of controls in complex ISD environments. Coordination technology supports client's behavior and outcome control by improving project visibility and communication flow, which enables clients to manage procedural adherence better and evaluate progress.

Last, our study makes a valuable contribution to the existing literature by demonstrating the impact of the project contextual variable, specifically collaborative culture, on the client's controls and project outcomes. We examined the effect of collaborative culture and coordination technology on strengthening client's control over vendors. Based on our findings, it is evident that project teams in a collaborative environment demonstrate more cohesive actions, and the client's controls may have less impact in a collaborative setting but play a significant role in determining project outcomes. Per previous research, ISD vendors must establish a harmonious relationship between cultural considerations and the client's controls to manage ISD projects effectively (Narayanaswamy & Henry, 2005). This approach aligns with our findings and can help ensure the effectiveness of controls. Our research indicates that implementing a client's controls should be accompanied by a collaborative culture environment that balances control and collaboration.

7.2. Practical implications

This study offers four practical implications that could benefit ISD practitioners. First, practitioners should balance relationship-oriented practices with structured control approaches to ensure both flexibility and accountability. Our analysis of collaborative culture provides IS practitioners with a deeper understanding of the values and facts of the collaborative

environment. Such an in-depth analysis is necessary for even experienced project managers or team leaders to realize the total potential value of collaboration.

Second, our analysis of coordination technology helps IS practitioners leverage information technology to develop products collaboratively and effectively. Information technology has transformed how organizations facilitate interaction, collaboration, and knowledge sharing among group members and stakeholders (Bala et al., 2017). In particular, coordination technology has been implemented to address the high coordination costs associated with IT project collaboration. Understanding the enabling role of coordination technology can help ISD teams manage task dependencies more effectively.

Third, this study's results illuminate the role of collaborative culture in supporting client's behavior and outcome controls, offering valuable insights to practitioners. The findings suggest that a collaborative team culture can enhance client's control over ISD projects. However, it should be integrated into a broader project management strategy emphasizing building solid relationships and promoting effective communication and collaboration between clients and vendors.

Last, our research model can bridge the gap between IS theories and practice. The validated research model can serve as a practical tool for organizations seeking to assess their control environment. By evaluating how collaborative culture and coordination technology shape control effectiveness and project outcomes, teams can identify areas for improvement. The survey instrument developed for this study may also support professional development, team assessment, and adaptive project management interventions.

7.3. Limitations and future research

This study had several limitations that should be considered when interpreting the findings. First, we did not explicitly consider the effect of contract characteristics on our core variables, which may significantly impact the results. Future studies should explicitly consider the impact of contract terms on client-vendor collaboration. Second, the measurement perspective was mainly from the standpoint of ISD vendors, which may limit the generalizability of the findings. We recommend that future research include measures from both vendor and client perspectives and explore other project outcomes, such as team performance outcomes. Last, our findings may be limited in general to the context we studied (ISD projects involving client-vendor collaboration). Future research could expand the study to include other industries and countries.

8. Conclusion

This study investigated how collaborative culture and coordination technology influence client's behavior and outcome control, and how these controls affect project outcomes in the context of ISD projects. Building on prior research in ISD project management and project context, we developed and tested an empirical model that integrates environmental and technological enablers with client control practices. We emphasize the importance of creating a collaborative working environment and leveraging coordination technology to support client's controls. The findings confirm that both collaborative culture and coordination technology are critical contextual factors that shape the effectiveness of client control.

Collaborative culture strengthens clients' ability to apply behavior and outcome control by fostering trust, communication, and shared understanding within project teams. Coordination technology, in turn, enhances project visibility and reduces information asymmetry, enabling clients to monitor procedural adherence and assess progress toward project goals. Rather than treating control and collaboration as opposing forces, the study demonstrates that they can be complementary. Collaborative culture provides the social foundation for effective control, while coordination technology offers the structural

tools necessary to execute control in distributed ISD environments. Together, these enablers contribute to improved project performance.

This research contributes to the literature on ISD project management by empirically validating a model that connects contextual factors to client's controls and project outcomes. The results suggest that organizations seeking to improve ISD performance should invest in cultivating collaborative team environments and adopting coordination technologies that support structured yet adaptive project management practices.

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Appendix A: Sample Characteristics

Project Background

Customer Country

Country	Frequency	Percent
China	164	74.50%
Japan	23	10.50%
US, Canada	12	5.50%
Europe	9	4.30%
Australia	2	1.00%
Hong Kong	2	0.90%
South America	1	0.50%
Others	5	2.80%
Total	218	100.00%

Respondent Position

Job Position	Frequency	Percent
IT Development Engineer	55	25.23%
Data Development Engineer	11	5.05%
Test Engineer	9	4.13%
Sales and Marketing	12	5.50%
Project Manager	42	19.27%
Senior IT Development Engineer	6	2.75%
Department Manager	32	14.68%
Senior Management	15	6.88%
Others	36	16.51%
Total	218	100.00%

Project Team Size

Members	Frequency	Percent
1-6	26	11.93%
7-15	67	30.73%
16-30	49	22.48%
31-50	34	15.60%
51-80	4	1.83%
81-100	5	2.29%
100+	23	10.55%
Missing	10	4.59%
Total	218	100%

Project Domain

Domain	Frequency	Percent
Education	30	13.76%
Transportation	5	2.29%
Finance	22	10.09%
Insurance	8	3.67%
E-Commerce	21	9.63%
Telecomm	8	3.67%
Manufacturing	15	6.88%
IT and Software Application Development	54	24.77%
Life Sciences	2	0.92%
Healthcare	4	1.83%
Construction	4	1.83%
Entertainment	2	0.92%
Other	40	18.35%
Missing	3	1.38%
Total	218	100.00%

Appendix B: Variables and Measures

Variables	Measures	Key References
Collaborative Culture	1. Our team is a very personal place. It is like an extended family. People seem to share a lot of themselves. 2. The management style of our team is characterized by teamwork, consensus, and participation. 3. The glue that holds our team together is loyalty, organizational commitment, mutual trust, and teamwork. 4. Our team emphasizes human development. High trust, openness, and participation persist.	(Cameron & Quinn, 2005)
Coordination Technology	1. The coordination tools we use enable us to resolve task dependencies in the project. 2. We use software tools to coordinate with our client on project changes in a timely manner. 3. Our client can use project coordination tools to evaluate our work-in-progress software product. 4. Our client can use project coordination tools to regularly monitor our work progress.	(Guinan et al., 1998)
Client's Outcome Controls	1. Our client emphasized timely project completion. 2. Our client emphasized completing the project to their satisfaction. 3. Our client emphasized predefined quality indicators for the project. 4. Our client emphasized completing the project within budget.	(Henderson & Lee, 1992; Kirsch et al., 2002; Lee & Xia, 2010)
Client's Behavior Controls	1. Our client expected us to follow an agreed upon written sequence of steps in doing the project. 2. Our client assessed the extent to which we followed existing written procedures and practices during the project. 3. Our client explained to us how the project jobs should be done. 4. Our client actively controlled how our team human resources were planned and managed.	(Henderson & Lee, 1992; Kirsch et al., 2002; Lee & Xia, 2010)
Project outcomes	1. Our project was completed on time according to the original schedule. 2. Our project was completed within budget according to the original budget. 3. Our client was satisfied with the project quality. 4. The completed system met its scope of requirements. 5. The completed system delivered practical value and benefits to the client.	(Kirsch et al., 2002; Lee & Xia, 2010)

Appendix C: Marker Variable Test

	Without Marker Variable		With Marker Variable	
Paths	Path Coefficients	P Value	Path Coefficients	P Value
CBC -> PO	0.420	P < 0.001	0.394	P < 0.001
COC -> PO	0.310	P < 0.001	0.278	P < 0.001
CC-> CBC	0.342	P < 0.001	0.340	P < 0.001
CC -> COC	0.449	P < 0.001	0.424	P < 0.001
CT -> CBC	0.393	P < 0.001	0.368	P < 0.001
CT-> COC	0.221	P = 0.020	0.209	P = 0.028

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RESEARCH ARTICLE

Leveraging artificial intelligence for project risk management: insights from evidence-based analyses and case studies

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Abstract

Artificial Intelligence (AI) has emerged as a transformative force in project risk management (PRM), transitioning traditional methods into dynamic, proactive frameworks capable of addressing modern project complexities. This evolution enables PRM to align more effectively with strategic goals while addressing uncertainties across diverse industries. Despite its promise, AI adoption in PRM varies significantly across sectors, presenting gaps in application and understanding. This study explores AI's role in enhancing PRM, focusing on its impact on risk management elements, emerging trends, and real-world applications. Using a qualitative and evidence-based methodology, the research integrates insights from academic literature, industry reports, and consulting publications, supplemented by case studies of leading organizations. Findings reveal substantial advancements in PRM through AI, highlighting improved decision-making, operational efficiency, and enhanced resilience. Case studies from Siemens, JPMorgan Chase, and Turner Construction demonstrate AI's effectiveness in tackling challenges, optimizing processes, and achieving objectives. This study expands academic discourse on AI adoption in PRM and provides actionable insights for organizations, offering guidance to overcome barriers and maximize technological investments.

Keywords

artificial intelligence; project risk management; risk mitigation; evidence-based analysis; case studies.

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1. Introduction

Project management has always been a critical discipline, underpinning the successful execution of tasks across various industries. From construction to software development, effective project management ensures that objectives are met within the constraints of time, budget, and resources. One of the most fundamental components of project management is risk management, which is the process of identifying, assessing, and mitigating risks that could jeopardize project success (Muriana & Vizzini, 2017; Rahi et al., 2021). Projects are inherently uncertain and can be affected by various risks, including financial constraints, technical issues, resource shortages, and external factors such as market fluctuations and regulatory changes (Ulusoy & Hazır, 2021). As projects become increasingly complex, the ability to effectively manage risks is a critical determinant for their success. Traditional methods of risk management, often based on qualitative assessments and historical data, are proving insufficient and can be limited by human biases and the inability to process large volumes of data. This inadequacy is driving the search for more robust and dynamic approaches, with Artificial Intelligence (AI) emerging as a transformative technology offering the potential to reshape project risk management (PRM) practices through greater accuracy, efficiency, and proactivity (Li et al., 2024).

Artificial Intelligence has the potential to revolutionize PRM by providing advanced tools for data analysis and decision-making. AI's capabilities in data processing, pattern recognition, and predictive analytics offer promising solutions to the challenges of traditional risk management. Project managers can leverage these capabilities to analyze vast amounts of data from diverse sources, identify patterns that may indicate potential risks, and predict future risks with higher accuracy (Yazdi et al., 2024). AI-driven approaches enhance proactive risk identification and mitigation while also facilitating continuous monitoring and dynamic adjustments to address emerging uncertainties in projects. AI encompasses a range of technologies and techniques, each offering unique advantages for PRM. Machine learning algorithms, for instance, can learn from historical project data to make accurate predictions about future risks (Hamada, 2024). Natural Language Processing (NLP) can analyze textual data from project documents, emails, and reports to uncover hidden risks (Gao et al., 2024). Predictive analytics can forecast the likelihood of risks occurring and their potential impact on the project (Jahan, 2024). These AI-driven techniques can provide a more comprehensive and proactive approach to risk management compared to traditional methods, significantly improving overall project outcomes.

The integration of AI into project management is already yielding positive results in various industries. For example, in the construction industry, the use of AI has shown significant improvements in managing risks (Kelemu et al., 2023). One notable case is that of the construction firm Skanska, which has implemented AI tools to analyze project data and predict potential delays and cost overruns. These tools analyze factors such as project schedules, financial records, and weather forecasts, enabling project managers to take corrective actions before risks materialize. This proactive approach has resulted in more timely project completions and reduced costs (Sarahrudge, 2024). Similarly, the banking industry has embraced AI to enhance risk assessment, mitigation, and decision-making processes. AI has been applied in credit scoring models, fraud detection systems, stress testing tools, and cybersecurity risk management (Dewasiri et al., 2024). For instance, JPMorgan Chase has adopted AI to enhance its risk management processes. The company uses machine learning algorithms to detect and mitigate fraudulent activities by analyzing transaction patterns in real-time. This implementation has significantly improved overall risk management efficiency and led to a 50% reduction in false positives and a 30% increase in the detection rate of actual fraudulent activities (Wick, 2024). In the transportation sector, Erfani et al. (2023) demonstrated the use of AI in analyzing risks across 11 major U.S. transportation projects. Their framework revealed that 64% of initially identified risks were realized, while 50% of total risks emerged during project execution. Teams using proactive risk monitoring achieved better cost and schedule performance, showcasing the importance of AI in real-time risk tracking and adaptive management. Further case studies and industry examples demonstrate the broad applicability of AI in addressing the evolving challenges of PRM, making it a cornerstone of innovation in the field. Despite its potential, the integration of AI into PRM is not without challenges. Issues such as data quality, algorithm bias, and the need for skilled personnel to manage AI systems must be addressed to fully harness the benefits of AI (Wasike, 2024).

Developing a comprehensive framework for AI integration into PRM is essential to overcoming these challenges. This framework should provide guidelines for various aspects of this integration such as data collection and analysis, AI tool selection, and the implementation and monitoring of AI-driven risk management processes.

While existing literature acknowledges the general limitations of conventional PRM techniques, a more structured gap analysis reveals specific methodological and conceptual constraints that hinder their effectiveness in dynamic project environments. Widely used approaches such as Monte Carlo simulations, Delphi techniques, and statistical modeling suffer from critical weaknesses. Monte Carlo analysis depends heavily on predefined probability distributions, making it vulnerable to inaccurate or outdated input assumptions (Muriana & Vizzini, 2017). The Delphi method is time-intensive and reliant on expert consensus, which introduces subjectivity and inconsistency (Beaudrie et al., 2016). Traditional statistical models, while useful for forecasting, often assume linearity and lack the flexibility to handle unstructured, incomplete, or real-time data, characteristics increasingly present in complex projects (Seddik & Rachid, 2023). To better articulate the need for AI in this context, these limitations can be categorized into three dimensions. Theoretically, traditional methods lack the adaptive, learning-based capabilities necessary to reflect the evolving nature of project risks. Methodologically, they are constrained by rigid structures and limited in processing diverse data formats or dynamic feedback loops. Contextually, these tools often underperform when applied across varying industries or scaled to more complex project settings. AI techniques directly address these challenges: machine learning offers adaptive, data-driven risk forecasting; NLP enables the extraction of insights from unstructured textual sources; and reinforcement learning facilitates continuous, real-time decision-making in uncertain conditions.

Given the transformative potential of AI and the existing challenges in traditional risk management approaches, this study aims to explore and analyze how AI can be leveraged to enhance PRM. To guide this investigation, the following research question is posed: How can AI be leveraged to enhance PRM and what are its impacts on the key elements of risk management? Specifically, the research focuses on the trends shaping AI adoption in PRM, evidence of its effectiveness, and insights drawn from real-world case studies to inform best practices and future research directions. The specific objectives of this study are:

- Identify the trends in the adoption of AI technologies for PRM across various industries.
- Evaluate the current state of evidence regarding the effectiveness of AI in addressing challenges related to risk identification, assessment, mitigation, and monitoring in project management.
- Examine real-world case studies to extract key insights that inform best practices.
- Discuss implications and future research directions for AI-driven PRM.

This study offers both theoretical and practical contributions. Theoretically, it contributes to the growing literature by synthesizing how AI is being adopted in PRM across industries and categorizing its use across key risk functions. Practically, it provides actionable insights for project professionals by illustrating AI applications through real-world case studies, enabling informed adoption and implementation. These dual contributions aim to bridge the current gap between academic research and managerial practice in AI-driven PRM.

The remainder of this paper is structured as follows. Section 2 reviews the relevant literature. Section 3 outlines the methodology employed in this study. Section 4 presents the results, including findings from the case studies and evidence-based analysis of AI's effectiveness in PRM. Finally, Section 5 concludes the paper by summarizing the key insights and suggesting directions for future research.

2. Related literature

2.1. Traditional approaches to project risk management: key elements and limitations

PRM is a critical discipline aimed at identifying, assessing, mitigating, and monitoring risks that could negatively impact the success of a project. Traditional approaches to PRM have been the cornerstone of this process, providing structured methods to address uncertainties within projects. However, as project complexity has increased, the limitations of these methods have become apparent, highlighting the need for more advanced and dynamic approaches (Uzzafer, 2010).

Traditional risk management revolves around four core elements: risk identification, assessment, mitigation, and monitoring (Larson & Gray, 2014; Rahi, 2019). These elements provide a systematic framework to manage risks throughout a project's lifecycle. The literature emphasizes that PRM is not a linear process, as it might initially appear, but rather a cyclical one, with feedback loops interconnecting its various elements (Pym, 1987). These feedback loops facilitate the continuous refinement of risk strategies, allowing adjustments based on updated information and evolving project conditions.

- Risk identification involves systematically identifying uncertainties that could affect project objectives. Traditional techniques such as brainstorming sessions, checklists, and expert judgment are commonly used (Mojtahedi et al., 2010; Yim et al., 2015). However, critiques in the literature highlight their reliance on stakeholder input and experience to compile a list of potential risks. While effective for basic identification, they often miss hidden or emerging risks due to their dependence on subjective perspectives (Beaudrie et al., 2016).
- Risk assessment focuses on evaluating the likelihood and potential impact of the identified risks. Traditional risk assessment employs both qualitative and quantitative methods. Qualitative tools such as risk matrices and probability-impact charts categorize risks to help prioritize responses. Quantitative methods, such as Monte Carlo simulations and decision trees, use data to calculate probabilities and model potential outcomes (Beaudrie et al., 2016; Larson & Gray, 2014; Liu et al., 2017; Micán et al., 2020). Although these methods offer valuable insights, they can be constrained by the availability and quality of historical data, as well as the inherent uncertainty in predictions. Monte Carlo analysis, in particular, relies heavily on predefined probability distributions, making it less effective in fast-changing or poorly understood risk environments.
- Risk mitigation focuses on strategies to reduce the likelihood or impact of risks. Common approaches include risk avoidance, transfer (e.g., through insurance), reduction, or acceptance. Mitigation planning often involves creating contingency plans or adjusting project schedules and budgets (Bhoola et al., 2014). However, scholars often critique these methods for being reactive rather than proactive, addressing risks only after they materialize. They also tend to lack real-time adaptability, which can reduce their usefulness in dynamic or high-velocity projects.
- Risk monitoring is an ongoing process that tracks identified risks, evaluates the effectiveness of mitigation strategies, and identifies new risks. Traditional approaches rely on regular updates to risk registers, progress reports, and periodic review meetings (Kaur & Singh, 2018). These methods, while essential, are often static and may fail to adapt to dynamic changes in project environments.

While traditional approaches provide a robust foundation for managing risks, they face significant limitations that reduce their effectiveness in modern, complex projects. Recent literature critiques their static nature, noting that they capture risks at a specific point in time but fail to adapt to evolving project conditions (Fridgeirsson et al., 2021). Qualitative techniques, despite their utility, are prone to human biases, which can compromise the accuracy and reliability of risk evaluations (Shang, 2017). Similarly, quantitative approaches are heavily dependent on historical data, which may not always be relevant or available, particularly for innovative or unprecedented projects (Seddik & Rachid, 2023). Furthermore, as project complexity increases, traditional methods struggle with scalability, often proving inadequate for processing large volumes of data and addressing interconnected risks (Fridgeirsson et al., 2021).

In addition to these widely recognized limitations, specific methodological tools such as the Delphi technique have been critiqued for being time-consuming and subject to participant bias. Statistical models often presume linear relationships and fail to accommodate uncertainty inherent in unstructured or incomplete datasets. These constraints become especially problematic in complex projects that generate high-frequency or high-volume data, where adaptability and responsiveness are essential. To synthesize these challenges, limitations in traditional PRM methods can be categorized into three dimensions:

- Theoretical gaps refer to the inability of traditional methods to adapt or learn over time. For instance, methods like Monte Carlo simulation are built on predefined assumptions and do not evolve as new risk data emerges. In contrast, machine learning algorithms continuously update their risk models based on ongoing data streams.
- Methodological gaps arise from traditional methods' reliance on structured inputs, often numerical or expert-driven, and their limited ability to handle unstructured data or automate updates. Delphi, for example, is highly qualitative and labor-intensive. By contrast, NLP allows the automated extraction of risk signals from large volumes of textual data (e.g., reports, emails).
- Contextual gaps relate to how well a method generalizes across industries or scales. A risk matrix used in construction may not suit agile software projects or supply chain disruptions. However, AI models, particularly those using transfer learning, can be fine-tuned for different domains, enhancing cross-context applicability.

These gaps reveal the need for a new generation of risk management solutions that can accommodate complexity, uncertainty, and speed. Emerging technologies, such as AI, offer transformative potential by enabling real-time analysis, predictive insights, and proactive risk mitigation, which will be explored in subsequent sections.

2.2. Key trends of AI in project risk management

AI has emerged as a transformative force in PRM, offering advanced capabilities that extend beyond the limitations of traditional approaches. The growing complexity and dynamic nature of modern projects have necessitated innovative solutions to enhance the identification, assessment, mitigation, and monitoring of risks (Uzzafer, 2010). The literature increasingly highlights the integration of AI technologies, such as machine learning (ML), natural language processing (NLP), and predictive analytics, as pivotal in reshaping risk management practices. These technologies provide real-time insights, automate processes, and enable proactive decision-making (Yadav et al., 2024). This section explores the key trends driving the adoption and integration of AI into PRM. These trends collectively highlight the transformative potential of AI in overcoming traditional PRM limitations, paving the way for a more adaptive, data-driven, and proactive approach to managing risks.

2.2.1. Widespread adoption of predictive analytics

One of the most significant trends in AI-driven PRM is the adoption of predictive analytics to anticipate potential risks and outcomes. Predictive analytics leverages historical and real-time data to forecast the likelihood of risks occurring and their potential impacts. For example, AI algorithms can analyze past project performance data to identify patterns and correlations, enabling project managers to predict delays, cost overruns, or resource shortages with greater accuracy (Moussa et al., 2024). This trend is particularly prominent in industries such as construction and manufacturing, where large datasets are readily available, and predictive insights can drive strategic decision-making (Khodabakhshian et al., 2024; Sahli et al., 2023). Recent comparative analyses, such as the work of Yazdi et al. (2024), further reinforce this trend by emphasizing that machine learning-based models significantly enhance the accuracy and reliability of risk identification and prediction compared to traditional qualitative and probabilistic methods. Their findings highlight AI's capacity to improve early risk detection, manage uncertainty, and support more proactive risk mitigation strategies across complex projects.

2.2.2. Integration with Big Data and IoT

The convergence of AI with big data analytics and the Internet of Things (IoT) is another notable trend. Modern projects often generate vast amounts of data from diverse sources, including sensors, devices, and systems. AI-powered tools are increasingly being integrated with IoT platforms to process and analyze this data in real-time (Jahan Karamthulla et al., 2024). For instance, in infrastructure projects, AI systems can monitor equipment performance and environmental conditions through IoT sensors, providing early warnings of potential failures or risks (Villegas-Ch et al., 2024). This integration enhances the ability to monitor complex projects dynamically and make data-driven decisions.

2.2.3. Enhanced text and document analysis with NLP

NLP is revolutionizing the way textual data is analyzed in PRM. NLP algorithms can extract meaningful insights from unstructured data, such as project reports, meeting minutes, and contractual documents (Turner, 2023). Through identifying keywords, phrases, and sentiment patterns, NLP tools can uncover hidden risks and provide project managers with actionable insights (Gao et al., 2024). For example, an NLP system can analyze communication logs to detect early signs of conflict or misalignment among stakeholders, enabling timely interventions (Goncharenko, 2024).

2.2.4. Automation of risk management processes

AI is driving the automation of routine and labor-intensive risk management tasks, allowing project managers to focus on strategic activities. Tasks such as updating risk registers, generating risk reports, and monitoring compliance with mitigation plans are increasingly being automated through AI-driven platforms (Yazdi et al., 2024). Automation improves efficiency while reducing the likelihood of human error in repetitive processes, ensuring a more consistent and reliable approach to risk management (Jahan Karamthulla et al., 2024; Soares et al., 2020).

2.2.5. AI-augmented decision-making

The role of AI in supporting and augmenting human decision-making is a growing trend. AI systems are not intended to replace human expertise but to complement it by providing data-driven recommendations and simulations (Mariani & Mancini, 2024). Decision support systems powered by AI can present project managers with multiple scenarios, along with the associated risks and opportunities, enabling informed choices. These tools also enhance collaboration by providing a shared platform for stakeholders to visualize risks and agree on mitigation strategies (Taheri Khosroshahi, 2024).

2.2.6. Industry-specific applications and customization

AI applications in PRM are becoming increasingly tailored to industry-specific needs. For instance, in the finance sector, AI is widely used for fraud detection and cybersecurity risk assessment (Gautam, 2023), while in healthcare, AI-driven tools help manage clinical trial risks by predicting patient outcomes and resource requirements (Mohammed et al., 2024). Customization of AI tools to address the unique risk profiles of different industries is a growing focus, enhancing their effectiveness and adoption (Csiszar et al., 2020).

2.3. Emerging research streams in AI for project risk management

The integration of AI into PRM is redefining traditional approaches, transforming how risks are identified, assessed, and mitigated, particularly in increasingly complex and dynamic project environments (Li et al., 2024). Through a detailed analysis of the literature, several interconnected research streams have emerged, showcasing how AI is being leveraged to address critical challenges and enhance decision-making processes in PRM. These streams collectively reflect a shift towards more intelligent, adaptive, and domain-specific risk management strategies, facilitated by cutting-edge technologies.

Several review studies have laid foundational insights into the evolution of AI in PRM. Tian et al. (2024) conducted a comprehensive bibliometric and systematic literature review on AI in construction risk management, identifying dominant

themes, research clusters, and collaboration networks that shape the field's intellectual structure. Afzal et al. (2021) provided a comprehensive classification of AI techniques used for risk assessment in construction, emphasizing complexity-risk interdependencies. Khatib et al. (2021) highlighted the trajectory of AI applications in both project and risk management, mapping key developments and research gaps. Sousa et al. (2021) and Secundo et al. (2024) reviewed how machine learning has enabled new strategic capabilities in PRM and shifted it toward predictive and autonomous models. These reviews informed the current research landscape by highlighting methodological advances, implementation barriers and the potential of AI to enhance risk responsiveness.

One of the most transformative advancements in this field is the application of machine learning (ML) to analyze vast datasets, uncover hidden patterns, and predict risks with high accuracy. For instance, Gondia et al. (2020) demonstrated the efficacy of ML models such as Decision Trees and Naive Bayes in forecasting project delays within the construction industry, while Haghighi & Ashrafi (2024) proposed an ML-integrated framework for software projects that ranks risks and predicts project success or failure based on risk profiles. The Engineering Machine-learning Automation Platform (EMAP) developed by Choi et al. (2021) further exemplifies how ML enhances contractor decision-making in engineering projects, predicting risks at various project stages. These findings are echoed by Sousa et al. (2021), who claimed that ML-enabled tools provide superior risk detection and response rates compared to traditional methods. These applications highlight the central role of ML in enabling proactive risk management and fostering resilience in project execution.

In parallel, AI-driven decision support systems (DSS) are proving instrumental in elevating risk mitigation strategies. These systems leverage advanced modeling techniques to provide real-time, actionable insights for project managers. Bayesian networks, as presented by Xiaocong & Ling (2010), have proven effective in capturing the interdependencies among risks, facilitating real-time assessments and informed decision-making. Similarly, Zaouga & Rabai (2021) developed an ontology-based DSS that employs NLP to generate tailored recommendations, addressing specific risk scenarios. Furthermore, simulation-based models, such as those introduced by Fang & Marle (2012), integrate network-based risk evaluations, enabling dynamic prioritization and mitigation of interconnected risks. The synthesis by Al-Saffar et al. (2024) further supports the integration of DSS tools, especially within high-uncertainty domains like construction, where traditional assessment models underperform. These advancements indicate the growing sophistication of DSS tools, which are increasingly designed to tackle the intricacies of modern project ecosystems.

Beyond generic applications, AI has found significant traction in domain-specific contexts, where tailored approaches address unique challenges. For example, in the construction industry, AI supports planning, simulation, and material sourcing, as highlighted by Makaula et al. (2021), while Gondia et al. (2020) focused on predictive analytics for construction project delay risks. In software development, Haghighi & Ashrafi (2024) combined ML with decision-making frameworks to handle uncertainty. Afzal et al. (2021) also noted that industry-focused models are necessary to capture sector-specific risk interactions, especially in high-stakes environments. These domain-focused innovations reflect the adaptability of AI in addressing sector-specific nuances and optimizing project outcomes.

A key strength of AI lies in its cognitive capabilities and real-time adaptability, which have revolutionized how risks are managed during project execution. By leveraging predictive analytics and big data, Elkhatib et al. (2023) demonstrated AI's ability to proactively identify risks even in highly complex environments, enabling timely interventions. Similarly, Nyqvist et al. (2024) showcased GPT-4's ability to generate comprehensive risk management plans, significantly outperforming human experts in certain aspects. Fridgeirsson et al. (2023) contribute to this view by contextualizing PRM within volatile, uncertain, complex, and ambiguous environments, advocating for real-time intelligent systems to dynamically adapt to project complexity. These advancements emphasize AI's potential to enhance agility and responsiveness in project management.

As AI becomes a mainstay in PRM, it brings ethical and societal considerations to the forefront. Transparency and accountability in AI-driven decision-making, as emphasized by Li et al. (2024), are critical to ensuring stakeholder trust and adoption. Additionally, Makaula et al. (2021) addressed societal concerns such as job displacement, advocating for

collaborative frameworks where AI augments rather than replaces human expertise. Secundo et al. (2024) similarly suggested that organizations must not only adopt AI tactically but align it with ethical governance and cross-functional learning practices to ensure sustainable transformation. Such considerations are pivotal in balancing technological advancement with societal well-being.

Lastly, the integration of emerging technologies, such as drones, robotics, and IoT, in conjunction with AI solutions, is significantly enhancing PRM practices. During the COVID-19 pandemic, El khatib et al. (2023) illustrated how drones, powered by AI-driven analytics, effectively mitigated unknown-unknown risks by reducing infection risks with high accuracy. Similarly, Qasim et al. (2022) emphasized the utility of drones for safety and risk assessments in construction projects, particularly during restricted site access. These technologies, when combined with AI capabilities such as real-time data processing and predictive analytics, serve as valuable extensions of AI's functionality, bridging gaps in physical accessibility, operational efficiency, and decision-making precision. This synergy between AI and emerging technologies emphasizes the holistic potential of integrated systems to effectively address complex risk management challenges.

3. Research methodology

This study adopts a qualitative and evidence-based research methodology (Robinson et al., 2021) supported by a triangulated approach (Mishra & Rasundram, 2017) to explore the transformative role of AI in PRM. The choice of methodology is driven by the exploratory nature of the research objectives, which aim to understand both the conceptual contributions and the practical applications of AI across PRM functions. This section outlines the philosophical foundation, design rationale, and implementation of the research methods employed in this study.

3.1. Research philosophy and design

This study adopts an inductive reasoning approach that allows patterns, themes and insights to emerge through the integration of multiple data sources (Jebreen, 2012). The exploratory nature of this research, together with its objective to draw generalizable insights from qualitative data and understand emerging phenomena such as AI-driven PRM, makes the inductive approach highly suitable. Furthermore, the study's philosophical stance is aligned with constructivism (Guba & Lincoln, 1994), which posits that knowledge is co-constructed through interaction, experience and interpretation. This paradigm supports the integration of academic theory, industry expertise, and practical case experiences to capture the multidimensional nature of AI's role in PRM.

Given this orientation, a qualitative design was adopted to capture the complexity, diversity and dynamic characteristics of AI applications in PRM. Triangulation was employed to enhance the validity and richness of findings through the integration of three complementary streams of evidence: (1) academic literature, (2) industry and consulting firm reports, and (3) real-world case studies. This approach enables a comprehensive and multi-perspective understanding of the research problem, allowing for convergence of evidence and cross-validation of insights (Patton, 1999). The overall research methodology framework is summarized in Figure 1.

3.2. Mapping study of AI's role in PRM

The initial phase of the research involves a mapping study to systematically analyze the influence of AI technologies on key elements of PRM. This mapping exercise is structured to identify the ways AI enhances risk identification, assessment, mitigation, and monitoring, as well as its ability to overcome the limitations of traditional methods.

The mapping study commenced with the design of comprehensive search keywords related to AI technologies and PRM functions. A structured search was conducted using major academic databases such as Scopus and Web of Science, covering publications from 2010 to 2024. The following Boolean search string was applied: ("Project" AND ("Risk management" OR "Risk identification" OR "Risk assessment" OR "Risk mitigation" OR "Risk monitoring" OR "Contingency

plan") AND ("Artificial intelligence" OR "Machine learning" OR "Predictive analytics" OR "Natural language processing" OR "AI" OR "ML" OR "NLP")). Articles were included if they were peer-reviewed, focused on the application or impact of AI in PRM, and provided empirical or conceptual insights. The filtration process involved three stages: (1) an initial screening of titles and abstracts to exclude irrelevant or duplicate records; (2) a full-text review to assess alignment with the research objectives; and (3) classification of eligible articles based on the PRM components they address (e.g., identification, assessment, mitigation, or monitoring). Inclusion criteria required studies to demonstrate a clear link between AI applications and project risk functions, while exclusion criteria eliminated articles that were not in English, lacked peer-review, or addressed AI in non-project contexts. Identified sources were then categorized based on the PRM components they address, and synthesized to reveal trends, technological enablers, and use cases.

3.3. Evidence-based analysis

The second phase involves evidence-based analysis using insights derived from industry and consulting firm reports. This phase bridges the gap between academic theories and real-world applications of AI in PRM by leveraging data and insights from authoritative industry sources. To ensure the relevance and reliability of the findings, sources were selected based on the following criteria:

- Publications by reputable consulting firms and organizations, such as Gartner, KPMG, Project Management Institute, among others.
- Provision of quantitative or qualitative evidence of AI's impact on PRM outcomes.
- Coverage of various project management sectors.

Reports were retrieved through targeted searches on official websites, practitioner databases, and public business intelligence platforms. The extracted data included metrics, success factors, challenges, and best practices associated with AI adoption in PRM. These findings complemented the academic mapping study by validating observed patterns and contributing practical insights regarding the implementation and value realization of AI technologies.

3.4. Case study selection and analysis

The third phase of the research involves in-depth analysis of selected real-world case studies to illustrate the practical and tangible application of AI in PRM. These case studies provide concrete examples that connect theoretical understanding with industry practices. They serve to contextualize the insights from the mapping study and evidence-based analysis, demonstrating the practical benefits and limitations of AI in diverse project environments. Case study selection was based on the following predefined criteria:

- Alignment with PRM components: The case studies must address one or more core PRM elements (e.g., risk identification, assessment, mitigation).
- Integration of AI technologies: Selected cases should showcase the application of AI techniques, such as predictive analytics or NLP, in risk management.
- Industry diversity: To capture AI's cross-sectoral relevance, cases represent industries such as construction, finance, and supply chain management.
- Documented outcomes: Each case study includes measurable outcomes or qualitative insights regarding the challenges faced, strategies implemented, and results achieved.
- Innovative practices: The studies highlight unique approaches and actionable lessons.

Following these criteria, Siemens, JPMorgan Chase, and Turner Construction were selected as representative cases due to their industry leadership, documented application of AI in PRM, and publicly available information regarding their AI-driven risk management initiatives. Each case study was analyzed through thematic analysis, focusing on how AI

technologies were integrated, what challenges were encountered, what benefits were realized, and what lessons could be generalized for broader organizational contexts.

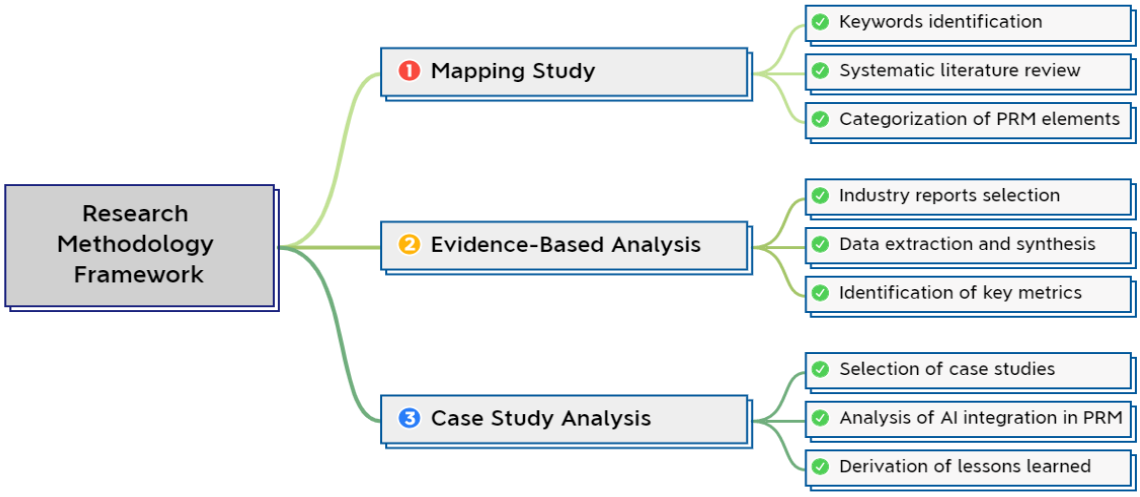

Fig.1. Research methodology framework

4. Results and Discussion

This section outlines the results obtained through the three methodological approaches: the systematic mapping study, analysis of industry-based evidence, and the assessment of case studies.

4.1. Key insights from the mapping phase

The mapping study serves as the foundational phase of this research, systematically analyzing the transformative impacts of AI on key elements of PRM. Synthesizing insights from academic literature and industry applications, the study identifies how advanced AI technologies are reshaping risk management practices and the specific benefits each area can derive from these trends. Each component was examined to highlight the specific AI technologies leveraged, their resulting impacts, and the practical implications. This detailed examination provides a structured framework that outlines the relationship between AI and PRM, highlighting opportunities for optimization and innovation.

AI has enabled significant advancements across all elements of PRM, including risk identification, assessment, mitigation, and monitoring. For instance, in the domain of risk identification, AI technologies such as ML, NLP, and RPA have automated the early detection of potential risks by analyzing historical project data and extracting risk-related information from project documents. Similarly, in risk assessment, tools like predictive analytics and Bayesian networks provide nuanced insights into the likelihood and impact of risks, while automating the evaluation process to reduce manual effort. The integration of simulation models, decision support systems, and workflow automation has further optimized risk mitigation, enabling real-time scenario modeling and effective execution of mitigation plans. Finally, in risk monitoring, the use of real-time data analytics and anomaly detection algorithms ensures continuous surveillance of project progress, with automated reporting tools streamlining stakeholder communication. Table 1 presents a structured summary of several impacts, detailing the AI solutions employed, their contributions to enhancing PRM practices, and practical examples of use cases. These advancements emphasize the ability of AI to enhance accuracy, efficiency, and responsiveness in risk management, aligning with recent trends in data-driven decision-making and proactive risk mitigation.

Table 1. Key AI technologies and their impacts across PRM elements with use cases

PRM component	AI technologies leveraged	Key impacts of AI on PRM	Use cases	Supporting references
Risk Identification	- Machine Learning - Natural Language Processing - Robotic Process Automation (RPA)	- Automated risk detection: AI models analyze historical project data to identify potential risks early in the project lifecycle. - Document analysis automation: NLP techniques extract risk-related information from project documents, while RPA automates the data extraction process.	- AI-generated risk logs provide project managers with a list of potential risks based on project context. - Automated systems review contracts and communications to flag potential risk factors.	(Al Zarooni & El Khatib, 2023; Erfani, 2023; Fujii et al., 2022; Kestenholz, 2023; Odejide & Edunjobi, 2024; Parekh & Olivia, 2024; Takyar, 2024)
Risk Assessment	- Predictive Analytics - Bayesian Networks - Process Automation Tools	- Enhanced risk evaluation: AI assesses the probability and impact of identified risks by analyzing large datasets. - Causal relationship modeling: Bayesian Networks identify relationships between risk factors. - Automated data collection: Automation tools gather and process data for risk assessment, reducing manual effort.	- AI models predict project delays by evaluating factors like resource availability and task dependencies. - AI systems determine how specific risks influence project outcomes. - Automated systems compile real-time data from various sources to continuously update risk profiles.	(Afzal et al., 2021; Atif & Qureshi, 2024; Baryannis et al., 2019; Basrai & Ben Ali, 2024; Iacono et al., 2024; Li et al., 2024; Pal et al., 2023; Wiesweg et al., 2020)
Risk Mitigation	- Simulation Models - Decision Support Systems - Workflow Automation	- Optimized mitigation strategies: AI suggests effective risk response strategies by simulating various scenarios. - Automated decision-making: AI systems provide actionable insights for risk response planning. - Streamlined risk response execution: Workflow automation implements mitigation actions promptly.	- AI recommends resource reallocation to address potential bottlenecks, ensuring project continuity. - AI evaluates the effectiveness of different mitigation plans. - Automated systems trigger predefined responses to emerging risks, minimizing delays.	(Kestenholz, 2023; Li et al., 2024; Odejide & Edunjobi, 2024; O'Neill, 2024; Yaseen, 2021; Yazdi et al., 2024; Öztemel & Tuncer, 2024)
Risk Monitoring	- Real-Time Data Analytics - Anomaly Detection Algorithms - Automated Reporting Tools	- Continuous risk surveillance: AI monitors ongoing project activities to detect deviations from the plan. - Proactive Issue Resolution: AI anticipates potential problems before they escalate. - Automated Risk Reporting: Tools generate and distribute risk reports without manual intervention.	- AI identifies schedule slippages by analyzing real-time progress data, enabling prompt corrective actions. - AI alerts project managers to emerging risks based on data trends. - Automated systems compile and send daily risk summaries to stakeholders.	(Algheetany et al., 2024; Chenya et al., 2022; Harish & Mansurali, 2024; Li et al., 2024; Loftus, 2003; O'Neill, 2024; Prasanth, 2024; Soravito, 2023)

4.2. Evidence-based analysis of AI role in PRM

Building upon the insights from the mapping study, this section examines the tangible impacts of AI integration into PRM by analyzing data from industry reports and consulting firm publications. These sources provide empirical evidence of how AI technologies enhance risk management practices, leading to measurable improvements in project outcomes. The market for AI in trust, risk, and security management was valued at $1.7 billion in 2022 and is expected to grow to $7.4 billion by 2032, with a compound annual growth rate of 16.2% (Allied Market Research, 2023). This exponential growth highlights the increasing adoption of AI in PRM, as organizations recognize its potential to deliver cost savings, efficiency gains, and more proactive risk management strategies. Key evidence-based metrics demonstrating the benefits of AI integration into PRM are summarized in Figure 2.

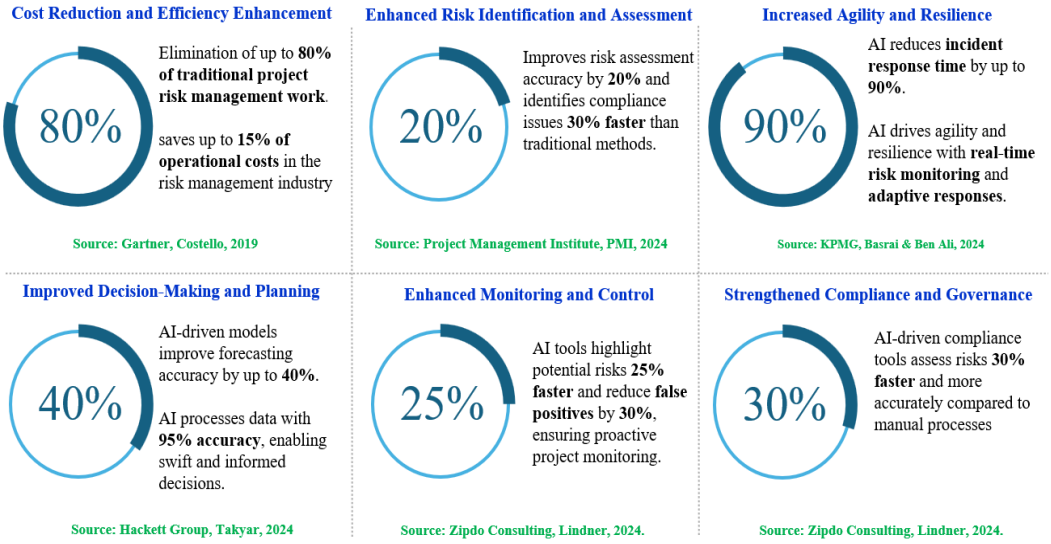

Fig. 2. Evidence-based metrics from industry leaders

4.2.1. Cost Reduction and Efficiency Enhancement

The adoption of AI in PRM has been shown to significantly reduce costs and improve efficiency. According to a report by Gartner (Costello, 2019), AI can automate routine tasks in project management including risk management processes, potentially eliminating up to 80% of traditional project management work, thereby allowing project managers to focus on strategic activities. Additionally, AI-driven predictive analytics enable more accurate forecasting of project risks, which can lead to a reduction in contingency costs and more efficient resource allocation. Furthermore, the adoption of AI in PRM has led to significant cost reductions and efficiency improvements across various industries. For instance, according to a report by Zipdo Consulting (Lindner, 2024), AI can save up to 15% of operational costs in the risk management industry, improve the efficiency of claims processing by up to 60% in the insurance industry, and reduce the time needed for credit risk analysis by up to 70% for banks.

4.2.2. Enhanced Risk Identification and Assessment

AI technologies, such as ML and NLP, enhance the ability to identify and assess risks by analyzing large volumes of data to detect patterns and anomalies. The Project Management Institute (PMI) notes that AI can assist in risk identification, analysis, and provide general recommendations for risk mitigation, thereby improving the comprehensiveness of risk

assessments (PMI, 2024). This leads to earlier detection of potential issues and more effective mitigation strategies. Notably, 61% of risk professionals report that AI adoption has increased their ability to forecast risk scenarios (Lindner, 2024). AI-powered risk models can process data from multiple sources simultaneously, improving risk assessment accuracy by 20%. Moreover, AI-driven risk assessments can identify compliance issues 30% faster than traditional methods, with an overall improvement in predictive analytics accuracy by 25%. Furthermore, Takyar (2024) indicates that predictive analytics models driven by AI can reduce project delays by as much as 30% and ensure timeline adherence, especially in sectors such as IT and software development.

4.2.3. Improved Decision-Making and Strategic Planning

AI significantly enhances decision-making and strategic planning by providing data-driven insights derived from complex datasets. Leveraging AI for PRM allows organizations to identify trends, optimize resource allocation, and prioritize risk mitigation efforts effectively. According to a report by Hackett Group (Takyar, 2024), organizations implementing AI-enhanced risk models report an increase in forecasting accuracy by up to 40%. Additionally, AI's ability to process structured and unstructured data sources with 95% accuracy has enhanced decision-making capabilities. This capability reduces decision-making cycles by synthesizing large volumes of data in real time, ensuring swift and informed risk responses (Lindner, 2024).

4.2.4. Increased Agility and Resilience

AI enables organizations to build more agile and resilient project management practices by providing real-time risk monitoring and adaptive response mechanisms. According to a KPMG report, AI and machine learning techniques are transforming risk management in the financial services sector by enabling real-time risk identification and response, which can be extrapolated to project management contexts (Basrai & Ben Ali, 2024). This agility allows for quicker adaptation to changing project conditions and external factors, thereby enhancing overall project resilience. For instance, according to Zipdo Consulting report (Lindner, 2024), AI can reduce incident response times by up to 90%, enabling swift containment and resolution of issues.

4.2.5. Enhanced Monitoring and Control

AI facilitates continuous project monitoring through real-time data analytics and anomaly detection, enabling prompt corrective actions. Automated reporting tools provide stakeholders with up-to-date information, improving transparency and communication. For example, according to a Zipdo Consulting report (Lindner, 2024), AI can reduce cyber incident response times by up to 90%, highlight potential risk cases 25% faster than traditional methods, and reduce false positives by 30%. These capabilities ensure that risk monitoring and control remain proactive and precise.

4.2.6. Strengthened Compliance and Governance

AI enhances compliance management by automating the identification and monitoring of regulatory risks. According to Lindner (2024), AI-driven tools can assess compliance-related risks 30% faster and with greater accuracy compared to manual processes, ensuring adherence to standards and mitigating regulatory penalties. Moreover, AI systems equipped with NLP can continuously scan regulatory updates, flagging potential impacts on ongoing projects and ensuring proactive adjustments. Integrating ML algorithms allows organizations to predict areas of non-compliance before they occur, allowing for preventive action and improved governance frameworks.

4.3. Case studies of AI-enabled risk management breakthroughs

This section showcases real-world applications of AI in PRM, focusing on notable organizations and their transformative journeys. Each case study delves into the specific challenges faced by the company in risk management, the AI-driven solutions deployed, the tangible outcomes achieved, and the key lessons that can inform broader adoption and innovation in managing project risks.

4.3.1. Siemens - mitigating supply chain risk with AI-powered intelligence

In today's volatile global landscape, supply chain disruptions pose a significant challenge to businesses across industries. Siemens, a global technology powerhouse, recognized the need for proactive risk management and turned to AI to enhance supply chain resilience and optimize operations. This case is developed based on insights from AI Expert Network (2023), Acain (2023), Perry (2024), and Siemens Press (2023).

Siemens manages an intricate supply chain that spans multiple industries and regions. This complexity presents significant challenges in risk management, particularly in predicting and mitigating disruptions. Traditional methods often fall short in processing the vast and diverse data impacting supply chains, such as geopolitical events, natural disasters, and fluctuating market demands. Maintaining real-time visibility into component availability, potential bottlenecks, and emerging risks is crucial for informed decision-making but remains a persistent challenge (Perry, 2024). Ensuring business continuity by minimizing downtime and production delays due to supply chain disruptions is essential to meet customer demands and maintain profitability.

To address these issues, Siemens acquired "Supplyframe" in 2021, integrating its AI-powered Design-to-Source Intelligence platform with Siemens "Xcelerator". This integration enabled real-time insights into global component availability, demand, cost, and compliance during the design phase (Siemens Press, 2023). Advanced AI algorithms analyze extensive data from supplier databases, logistics networks, and market trends to identify potential disruptions and predict their impacts. This proactive approach allows Siemens to implement mitigation strategies, such as securing alternative suppliers or adjusting production schedules, thereby enhancing supply chain resilience and ensuring business continuity (Acain, 2023).

This AI-driven approach to supply chain risk management has yielded significant benefits, including enhanced resilience through improved anticipation and response to disruptions, which minimizes operational impacts. While specific figures are not publicly available, Siemens reports significant reductions in downtime due to proactive risk mitigation (AI Expert Network, 2023). Additionally, the company has achieved increased efficiency by optimizing processes, reducing costs, and improving on-time delivery. Real-time data and AI-powered insights have empowered teams to make informed decisions and proactively manage risks. This case exemplifies the trend highlighted in the literature (e.g., Yazdi et al., 2024; Khodabakhshian et al., 2024) where predictive analytics and AI-powered monitoring substantially enhance early risk detection, resilience, and proactive decision-making in complex project environments. Siemens' experience demonstrates the practical realization of these AI-driven benefits, as emphasized in recent academic studies.

The company's integration of AI into its supply chain risk management offers valuable lessons for organizations aiming to enhance resilience in complex, global operations. A key takeaway is the importance of proactive risk identification and mitigation to foresee potential disruptions and implement appropriate strategies. Another critical lesson is the value of integrating AI solutions within existing digital infrastructures. The incorporation of Supplyframe's platform into its Xcelerator ecosystem exemplifies how such integration can provide a cohesive digital framework that unifies various operational facets.

4.3.2. JPMorgan Chase – enhancing risk management with AI-driven strategies

JPMorgan Chase & Co., a leading global financial services firm, operates across investment banking, financial services, and asset management sectors, serving millions of clients worldwide. The firm manages a vast array of financial products and services, necessitating robust risk management practices to safeguard assets and maintain regulatory compliance. This case is developed based on insights from Palakurti (2024), Nimmagadda (2022), Moses (2024), DigitalDefynd (2024), and JPMorgan (2023).

The company faces multifaceted risk management challenges due to the dynamic nature of financial markets. Traditional fraud detection methods often struggle to keep pace with sophisticated fraudulent activities, leading to potential financial

losses and reputational damage (Nimmagadda, 2022). Navigating complex and evolving regulatory landscapes requires meticulous monitoring and reporting to avoid legal penalties. Additionally, manual processes in risk assessment and compliance are time-consuming and prone to human error which impacts the overall operational efficiency (Palakurti, 2024).

To address these challenges, JPMorgan Chase has implemented advanced AI-driven solutions across various operational areas. In fraud detection, the bank utilizes machine learning algorithms to analyze vast datasets, enabling real-time transaction monitoring and the identification of anomalous patterns indicative of fraudulent activity. This proactive approach enhances the bank's ability to prevent financial crimes and minimize associated losses (DigitalDefynd, 2024). For regulatory compliance, AI systems automate the monitoring and reporting processes, ensuring adherence to complex and evolving legal requirements (JPMorgan, 2023). By systematically analyzing legal documents and transactions, these systems reduce the risk of non-compliance and the potential for legal penalties. Additionally, the integration of AI into operational workflows streamlines risk assessment and compliance tasks, significantly reducing manual effort and the likelihood of human error, thereby improving overall efficiency (Palakurti, 2024).

JPMorgan Chase's integration of AI into its risk management framework has yielded significant benefits. The deployment of AI-driven fraud detection systems has enhanced the bank's ability to identify and prevent fraudulent activities, thereby reducing financial losses and bolstering customer trust (Nimmagadda, 2022). In regulatory compliance, AI has streamlined monitoring and reporting processes, ensuring adherence to complex legal requirements and minimizing the risk of penalties (JPMorgan, 2023). Operational efficiency has improved through the automation of manual tasks, leading to faster and more accurate risk assessments (Moses, 2024). Notably, the bank's AI-driven Contract Intelligence (COiN) platform has automated the review of complex legal documents, reportedly saving over 360,000 hours of manual work annually (DigitalDefynd, 2024). These advancements have collectively strengthened JPMorgan's resilience against financial crimes and operational risks. This practical deployment aligns with the observations of Mariani and Mancini (2024), who highlight that AI-driven decision support systems play a pivotal role in enhancing project performance by enabling faster, data-informed responses to emerging risks and fostering resilience in complex and dynamic environments. Moreover, JPMorgan's use of machine learning to monitor and detect fraud aligns with Yazdi et al. (2024)'s findings on the superiority of AI models in handling predictive risk identification compared to traditional qualitative methods.

The bank's experience offers valuable lessons for organizations aiming to enhance risk management through AI. A proactive approach to AI adoption is crucial, involving significant investment in technology and talent to effectively develop and implement AI solutions. Ensuring robust AI and model risk governance is essential to maintain the integrity and reliability of AI systems. Additionally, fostering a culture of continuous learning and adaptation enables organizations to keep pace with technological advancements and evolving risk landscapes.

4.3.3. AI-driven risk management in Turner Construction projects

Turner Construction Company, a leading North American builder, operates across diverse market segments, including healthcare, education, commercial, and sports facilities. With a vast portfolio of large-scale projects, Turner faces significant challenges in identifying and mitigating risks that could lead to project delays, cost overruns, and safety incidents. Traditional risk management approaches often fall short in proactively addressing potential issues, necessitating more advanced solutions. This case is developed based on insights from Subramanian & Singh (2024), Ghodsian (2024), Hyscaler (2024), and Psico-smart Editorial Team (2024).

Turner Construction Company faces multifaceted challenges in PRM. Ensuring worker safety amidst heavy machinery, heights, and electrical hazards is paramount, as traditional safety measures are often reactive, addressing issues only after they occur. Unforeseen factors such as weather conditions, labor shortages, and supply chain disruptions can lead to project delays and increased costs, impacting timelines and profitability. Additionally, handling vast amounts of project

data manually is time-consuming and prone to errors, affecting decision-making processes. These challenges necessitate a proactive and integrated approach to effectively mitigate risks and ensure successful project delivery.

To address these challenges, Turner Construction integrated AI-driven strategies into its PRM processes. Implementing AI systems that analyze real-time data from construction sites enables the identification of potential safety hazards before they escalate, allowing for timely interventions and reducing the likelihood of accidents (Hyscaler, 2024). Additionally, employing AI algorithms to analyze historical project data allows Turner to predict high-risk areas, facilitating early detection of issues and timely mitigation strategies (Ghodsian, 2024). Furthermore, AI facilitates efficient handling of large datasets, streamlining processes such as document classification, archiving, and retrieval, thereby enhancing regulatory compliance and reducing manual effort (Psico-smart Editorial Team, 2024). These applications reflect the trends identified in recent literature (e.g., Gao et al., 2024; Erfani et al., 2023), where AI-driven text analysis and predictive modeling significantly improve real-time risk monitoring, compliance management, and proactive issue detection in complex project environments. Turner's experience highlights the operational benefits of adopting these advanced AI-enabled techniques, including safer and more efficient project delivery.

The implementation of AI in Turner Construction's risk management processes has led to notable advancements in project delivery. AI-powered safety management systems have achieved a remarkable 22% reduction in accident rates, as reported in industry case analyses (Hyscaler, 2024). Furthermore, AI-enabled proactive risk assessment and mitigation strategies have driven a 12% decrease in project overruns, resulting in more predictable schedules and budgets (Ghodsian, 2024). Lastly, the automation of data management processes has streamlined workflows, reducing document search time by 30%, enabling project teams to concentrate on critical tasks and optimize resource allocation (Psico-smart Editorial Team, 2024).

Turner Construction's experience offers valuable lessons for the construction industry. It highlights the importance of proactive risk identification; utilizing AI for early detection of potential issues allows for timely interventions, preventing minor problems from escalating into major setbacks. Furthermore, seamless integration of AI solutions within existing project management frameworks ensures a cohesive and effective risk management strategy, making AI-driven insights readily available and actionable for project teams.

4.3.4. Comparison of AI-driven PRM practices with traditional frameworks

The findings from the case studies presented in this research reveal a notable evolution in PRM practices compared to traditional frameworks such as PMBOK. While PMBOK emphasizes structured, linear processes for risk identification, assessment, mitigation planning, and monitoring, AI-driven approaches introduce dynamic, real-time capabilities that enhance adaptability and predictive foresight. In particular, the Siemens and Turner Construction cases illustrate how AI-powered predictive analytics and monitoring go beyond static risk registers, enabling continuous reassessment based on live data streams. Similarly, JPMorgan Chase's use of machine learning algorithms exemplifies how AI facilitates proactive risk mitigation compared to the more reactive nature of traditional qualitative assessments. These AI-enabled advancements complement and extend the foundational risk management principles of PMBOK by promoting more data-driven, adaptive, and anticipatory risk practices, thereby addressing some of the limitations of traditional frameworks in complex and rapidly evolving project environments.

5. Conclusion and future research directions

The integration of AI into PRM has proven transformative across diverse industries, addressing the complexities of modern projects while enhancing risk identification, assessment, mitigation, and monitoring. This study aimed to investigate the role of AI in PRM through three core objectives: (1) identifying trends in AI adoption for PRM, (2) evaluating its effectiveness through evidence-based insights, and (3) analyzing real-world case studies to derive practical insights. Leveraging a qualitative and evidence-based approach, this research synthesized insights from academic literature, industry and

consulting firm reports, and case studies of leading organizations including Siemens, JPMorgan Chase, and Turner Construction. The findings revealed significant advancements driven by AI, highlighting its capacity to improve decision-making, operational efficiency, and resilience in PRM. Case studies demonstrated AI's ability to proactively address risks, streamline processes, and deliver measurable outcomes such as reduced safety incidents, cost overruns, and enhanced compliance.

This study contributes to the academic literature by providing a structured synthesis of how AI is applied across key PRM functions, thereby addressing a critical gap in understanding its role. From a practical perspective, it offers actionable and evidence-based insights to support project professionals in informed decision-making regarding the adoption and implementation of AI technologies. Together, these contributions help bridge the gap between scholarly discourse and real-world application, advancing both theoretical understanding and managerial practice in AI-enabled PRM.

Despite its contributions, this study is not without limitations. It primarily focused on successful applications of AI, potentially overlooking instances where adoption faced barriers or did not meet expectations. Furthermore, the case studies predominantly examined large organizations, leaving gaps in understanding the challenges and opportunities for small and medium-sized enterprises (SMEs). Finally, much of the analysis emphasized immediate benefits, with limited exploration of AI's long-term impacts on project outcomes, adaptability, and sustainability. In addition to these considerations, several methodological limitations associated with AI-driven PRM practices must be acknowledged. Algorithm bias remains a significant concern, as AI systems trained on historical project data may inadvertently reinforce outdated patterns or overlook novel risks. Data quality issues also pose challenges, as the effectiveness of AI-based predictions depends heavily on the accuracy, completeness, and timeliness of input data. Furthermore, governance concerns related to AI transparency, accountability, and ethical oversight continue to evolve, posing risks for organizations seeking to deploy AI-based risk management solutions at scale. Addressing these challenges through robust governance frameworks, continuous validation, and ethical design will be essential to fully realizing the potential of AI-driven PRM systems.

To build on these insights, several future research directions are proposed. First, exploring cases of AI adoption challenges or failures could offer valuable lessons for navigating barriers and setting realistic expectations. Second, developing tailored AI frameworks for SMEs could promote wider adoption and inclusivity across organizational contexts. Third, investigating the ethical and societal implications of AI in PRM will ensure its responsible use. Fourth, longitudinal studies examining AI's sustained impact on PRM practices could provide a deeper understanding of its role in fostering innovation and resilience in the face of evolving project complexities. Finally, investigating strategies to mitigate algorithm bias, enhance data quality, and develop comprehensive governance frameworks for AI-driven PRM systems would be valuable to ensure ethical, transparent and sustainable deployment of AI technologies in project environments.

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