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No Silver Bullet for Digital Transformation: The Role of Managerial Ambidexterity and International Context

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Background/Purpose: This study examines the role of managerial ambidexterity in enabling digital transformation within diverse national cultural contexts. It advances a more nuanced understanding of digital transformation as a managerially guided, culturally grounded process rather than a universally applicable technological solution.
Methods: An integrative literature review was conducted, combining bibliometric analysis and qualitative thematic synthesis. Data were collected from publications indexed in the Web of Science database between January 2020 and January 2026. VOSviewer software was used to identify publication trends, geographical distribution, keyword co-occurrence, and authorship network. Following the bibliometric analysis, 30 studies were purposively selected for in-depth synthesis.
Results: Study findings confirm that managerial ambidexterity plays a central role in navigating the exploration–exploitation paradox during digital transformation. Its effectiveness is shaped by national culture characteristics and managerial practices, highlighting the importance of contextual factors in shaping transformation outcomes.
Conclusion: The study highlights the need to develop more adaptive, dynamic ambidextrous capabilities that align digital transformation initiatives with diverse national cultural contexts. It contributes to the growing literature on digital transformation by proposing an integrative framework that conceptualizes managerial ambidexterity as a context-dependent micro-foundational mechanism through which digital transformation is enacted and shaped across diverse national cultural environments.

Keywords: Ambidexterity, Digital transformation, National culture, Bibliometric review

1 Introduction

Ambidexterity has become a critical managerial capability for addressing the simultaneous demands of operational stability and digital transformation within organizations. Various studies confirm that a manager's capability to balance the paradox of exploration and exploitation has an essential role in fostering innovation, growth, market value, and overall performance (e.g., Dranev et al., 2020; Niewöhner et al., 2021). As a multidimensional construct, ambidexterity is affected by national cultural context, national leadership practice, and organizational digital capabilities (Xing et al., 2020). Furthermore, it is affected by organizational bricolage and absorptive capacity (Chang et al., 2022), big data analytics capabilities (Sivarajah et al., 2024), innovation based on advanced technology such as GPT and generative AI (Cen et al., 2023; Osadchaya et al., 2024), as well as international strategic approaches such as reverse innovation (RI) and springboard strategies (Roth et al., 2024; Li et al., 2024).

Despite the growing body of literature on managers'

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ambidexterity, culture, and digital transformation, these topics have been largely studied in isolation. Rarely do studies examine the interplay between managers' ambidexterity, digital transformation, and cultural context within an international or cross-border context.

Thus, it is precisely at this crossroads that an important practical question arises: Why does digital transformation succeed in one cultural context but falter in another, and what role does managers' ambidexterity play in bridging cultural differences during digital transformation? Therefore, to address this question, this study positions managers' ambidexterity as the central mechanism that navigates the outcome of digital transformation across different national cultural contexts.

Existing research also displays a significant variation in how national cultural context, institutional configuration, and multilevel organizational dynamics affect managers' ambidexterity. These contextual differences often form different, even paradoxical, yet effective forms of ambidextrous behavior. The literature lacks an integrated explanation of how managerial ambidexterity functions as a context-sensitive mechanism linking digital transformation processes to outcomes across diverse national cultures. Therefore, this study is based on the assumption that digital transformation is not a mere adoption of digital technology. Rather, it is a more complex organizational and context-dependent process, where managers' ambidexterity functions as a core mechanism that balances global strategic priorities with local cultural demands in an international organizational context. Accordingly, this study contributes to the literature by developing an integrative framework that conceptualizes managerial ambidexterity as a context-dependent micro-foundational mechanism through which digital transformation is enacted and shaped across diverse national cultural environments. In doing so, it contributes to a more nuanced view of digital transformation as a culturally rooted and managerially directed process rather than a universally applicable technological solution.

The research adopts an integrative review design that combines bibliometric analysis with a systematic literature review (SLR). This approach integrates the comprehensive bibliometric analysis (Donthu et al., 2021) with the focused, transparent process of the SLR (Lame, 2019), offering both a general overview of the scientific field and a detailed examination of its core themes.

Bibliometric analysis was done using the VOSviewer software. VOSviewer analyzes publication patterns, keyword co-occurrence, citation relationships, and collaboration networks to help identify influential studies, dominant research themes, and rising fields of inquiry (Oladinrin et al., 2023). Furthermore, as Donthu et al. (2021) emphasize, VOSviewer software can be utilized to transform a vast amount of academic literature and bibliographic datasets into an appealing visual knowledge landscape, making it a vital component of this research.

2 Theoretical Background

Digital transformation has become a central driver of organizational change, fundamentally reshaping how firms create value, compete, and adapt in increasingly complex environments. However, it does not occur in isolation; rather, it is deeply embedded in a broader context shaped by organizational values, cultural norms, and managerial mindsets. As emphasized by Hofstede (1998; 2011), national culture forms a "software of the mind" that influences how individuals perceive uncertainty, innovation, and change. These cultural dimensions affect not only organizational structures but also the willingness to experiment, embrace transformation, and tolerate ambiguity—capabilities that are essential for successful digital transformation (Dash & Gatharia, 2015). Consequently, digital transformation is both conditioned by national culture and, over time, contributes to reshaping organizational practices and behaviors (Bozkus, 2023; Foerster-Metz et al., 2018; Hudzenko, 2023).

In this context, managerial ambidexterity is an essential capability. It refers to managers' ability to simultaneously balance exploration (innovation, experimentation) and exploitation (efficiency, refinement), as well as to alternate between opening and closing behaviors to enhance innovation performance (Alghamdi, 2018). In the context of digital transformation, when organizations face continuous pressure to innovate while ensuring operational stability, such ambidextrous behavior becomes particularly important. The effectiveness of managerial ambidexterity is determined not just by environmental uncertainty and task interdependence, but also by individual cognitive styles and organizational coordination mechanisms (Mom et al., 2009; Mom et al., 2015).

Importantly, both digital transformation and managerial ambidexterity must be understood within the framework of national culture. Cultural contexts influence managerial decision-making styles, cognitive preferences, and approaches to balancing competing demands. Empirical evidence from different countries illustrates this interplay. For instance, in Indonesia, ambidexterity plays a significant mediating role between dynamic capabilities and digital transformation, whereas in Algeria, it is essential for organizational adaptation to digital environments (Benali, 2023). Similarly, in China, managerial behavior is influenced by Confucian and Legalist traditions, shaping how leaders balance hierarchical relationships with merit-based decision-making (Xing et al., 2020). These findings suggest that the outcomes of digital transformation are not universal but depend heavily on culturally embedded managerial practices.

Moreover, research consistently demonstrates that

balanced ambidexterity— the effective integration of exploration and exploitation—enhances organizational performance (Kumalaningrum et al., 2023; Primahendra et al., 2024), while structural and leadership factors determine how digital initiatives are organized and implemented (Hoessler & Carbon, 2024). At the same time, digital transformation is influenced by broader institutional and ecosystem factors, such as government support, technological spillovers, and organizational learning processes (Li et al., 2025; Wu et al., 2021; Zhuang et al., 2026). Overall, these findings reinforce the idea that there is no "one-size-fits-all" solution and that no universal model of digital transformation can be successfully applied across all organizational and cultural contexts (Chatzistamoulou, 2023).

Therefore, digital transformation should be conceptualized not merely as a technological shift but as a multifaceted process of organizational transformation, in which managerial ambidexterity plays a pivotal role. At the same time, national culture provides the critical contextual foundation that shapes how these transformational processes unfold. Understanding this triadic relationship—digital transformation, managerial ambidexterity, and national culture—is essential for explaining how organizations navigate the tensions between innovation and operational efficiency in a global environment.

Accordingly, this study positions managerial ambidexterity as the central mechanism linking the pressures and opportunities of digital transformation to organizational outcomes across different cultural contexts. The emphasis is not placed on technology itself, but on how managers leverage ambidextrous capabilities to translate digital transformation into effective organizational practices (Liu et al., 2023). From this perspective, digital transformation creates the conditions for change, while managerial ambidexterity—shaped by national culture—determines whether organizations can successfully convert these conditions into sustained competitive advantage (Smith & Beretta, 2021).

3 Research Method

This study adopts an integrative review design that combines bibliometric analysis with qualitative thematic synthesis to examine how managers' ambidexterity relates to digital transformation and national culture. This approach is particularly well-suited for multidimensional topics that exhibit high theoretical fragmentation (Torraco, 2016a, 2016b; Whittemore & Knafl, 2005). Research was conducted following a three-phase framework comprising data collection, bibliometric analysis, and integrative synthesis. This protocol was specifically developed for this study by combining a bibliometric analysis with an integrative review approach in the business and management domain, rather than by adapting an established formal systematic review-reporting framework. The overall research protocol is illustrated in Figure 1.

Data were collected from the online Web of Science (WoS) database in January 2026. The literature search covered publications indexed between January 2020 and January 2026. Because the search was undertaken in January 2026, the 2026 data represent a partial publication year rather than a full annual record. As a result, publications indexed after the search date were not included. The WoS database was selected as it provides comprehensive coverage of worldwide high-quality research in the business and management disciplines (Sánchez et al., 2017). Non-academic publications and non-peer-reviewed sources were excluded to ensure data quality, reliability, and validity (Tranfield et al., 2003).

A Topic Search (TS) was performed using the following search query:

TS=("international organizational behaviour"
OR "international organizational behavior")
AND
TS=("digital transformation")
AND
TS=("manager's ambidexterity"
OR "managerial ambidexterity"
OR "ambidexterity")

The search strategy used Boolean operators (AND, OR) to control the relationship between keywords so that search results become more systematic, relevant, and comprehensive (Booth et al., 2017; Gusenbauer & Haddaway, 2020).

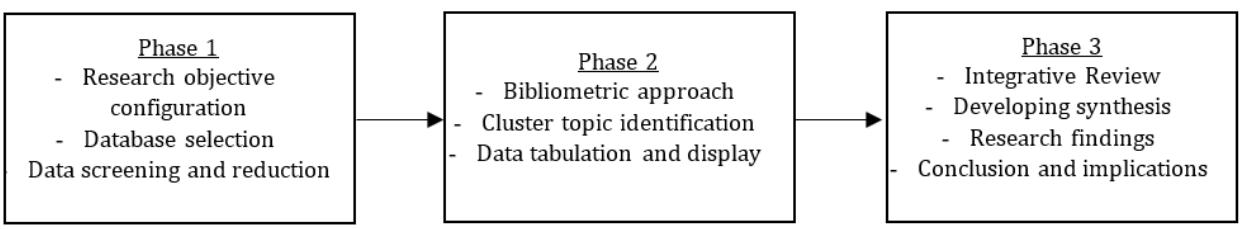


Figure 1: Research protocol

The initial search produced 6,354 results. Data filtering was done using the following inclusion criteria:

- publication years 2020– January 2026;
- English-language publications;
- Web of Science Categories: Management, Business, and Economics;
- Research Area: Business Economics;
- document types: Articles and Proceedings Papers;
- Open Access publications with full-text availability

The screening and refinement process resulted in a dataset of 649 publications. A substantial high reduction ratio from the initial search results (+/- 89,76%) was expected, due to the broad combination of keywords and Boolean operators that was intentionally designed to maximize search recall in the initial stage of data collection, resulting in a large pool of data that required significant subsequent filtering (Gusenbauer & Haddaway, 2020). Publications without full texts available were eliminated as the study required full-text analysis for the subsequent integrative synthesis. The remaining records were then carefully evaluated for conceptual relevance to international organizational behavior, management ambidexterity, and digital transformation. A final dataset of 220 publications for bibliometric analysis was produced as a result of this procedure.

Bibliometric analysis followed steps proposed by Passas (2024). VOSviewer was selected since this software is designed specifically for bibliometric map graphical visualization without the need for programming expertise, different than script-based tools such as Bibliometrix (R) or CiteSpace that require more advanced coding skills (Van Eck & Waltman, 2010). Furthermore, VOSviewer has been widely validated and used in bibliometric studies, including management research (Oladinrin et al., 2023). The results were saved in RIS (.ris) format to facilitate their import into VOSviewer. In addition, the dataset was also exported to Microsoft Excel for further processing, focusing on variables such as authors, publication titles, keywords, and citation counts.

The bibliometric analysis was carried out using the following approach: (1) Generate a map using text data as the data type; (2) The data source was read data from reference manager files, which supported RIS, EndNote, and RefWorks file formats; (3) the previously exported RIS (.ris) file was imported into VOSviewer; (4) the Title and Abstract fields were selected, but structured abstract labels and copyright statements were excluded; and (5) the full counting method was used, with a minimum threshold of 18 term occurrences. This generated 220 terms, giving a workable basis for subsequent relevance-based selection (Van Eck & Waltman, 2014); (6) the number of terms was limited to the 60% most relevant terms; (7) The selected phrases were carefully checked, and terms with a relevancy score less than 1.00, as well as those not directly linked to the research issue, were deleted; (8) A network visualization was created (Figure 4). The same approach was then used to build the co-authorship network for the examined literature (Figure 5).

The dataset was subsequently refined through an analysis of publication titles and authors' keywords. Titles represent the indication of a study's focus, while authors' keywords capture the core concepts and theoretical focus of the study (Garfield & Sher, 1993; Haggan, 2004; Gupta & Singh 2025). The analysis incorporated co-citation and co-keyword techniques (Donthu et al., 2021) and was conducted using VOSviewer. This enabled visualization of the data through network maps and thematic matrices, thereby supporting more in-depth conceptual interpretation of the field (Aria & Cuccurullo 2017), as illustrated in Figures 2 to 5.

Consequently, following the bibliometric analysis, 30 studies were purposively chosen for in-depth synthesis (Appendix 1). These studies were selected because they specifically addressed the intersection of managerial ambidexterity, digital transformation and national or international organizational context, providing the conceptual foundation for the integrative framework proposed in this study. The reduction from the full bibliometric dataset to a smaller set of studies for detailed analysis reflects a deliberate shift rather than an arbitrary exclusion. Bibliometric mapping operates primarily at the metadata level, such as titles, abstracts, keywords, and citation relationships, and is therefore able to encompass a large body of literature. In contrast, integrative synthesis is feasible only within a substantially smaller and purposively selected set of data (Suri, 2011; Zupic & Čater, 2015). Accordingly, maximum variation sampling (Suri, 2011) was employed to identify a final set of studies representing a broad diversity of topics, methods, and national contexts within the reviewed literature (Appendix 1).

The data extraction and synthesis of the 30 papers reported in Appendix 1 were based on full-text analysis rather than abstracts. Consequently, articles for which only abstracts were accessible were deemed insufficient for inclusion in the qualitative synthesis. This inclusion of open-access and full-text data was a methodological requirement rather than a selection preference, as the integrative synthesis depends on extensive data extraction from entire articles. In addition, it should also be emphasized that open-access availability varies, since many journals use delayed open-access policies with 6- to 12-month embargo periods (Laakso & Björk, 2013). As a result, certain papers that were not freely available when the literature search was conducted (January 2026) may become available at a later date. As a result, the dataset given in this study reflects the availability of publications at the time of data collection rather than their permanent access status. The reference list contains multiple sources, including the 30 studies selected for the integrative synthesis, together with additional theoretical and methodological literature

supporting the study. For each of the 30 selected studies, key variables, research methods, and key findings were extracted and then synthesized thematically.

4 Results

This section presents the bibliometric results by analyzing publication trends over examined period of time (Figure 2), geographical distribution of publications (Figure 3), the keyword co-occurrence network (Figure 4), as well as authorship network of the reviewed literature (Figure 5).

The annual distribution of publications was analyzed to examine the evolution of research interest in the field. Figure 2 depicts the publication trend within the reviewed dataset. Research output increased steadily from 2020 to 2026. In 2020, there were more than 60 papers, increasing to more than 70 in 2021. The number increased to more than 100 papers in 2022 and 2023. The number of papers

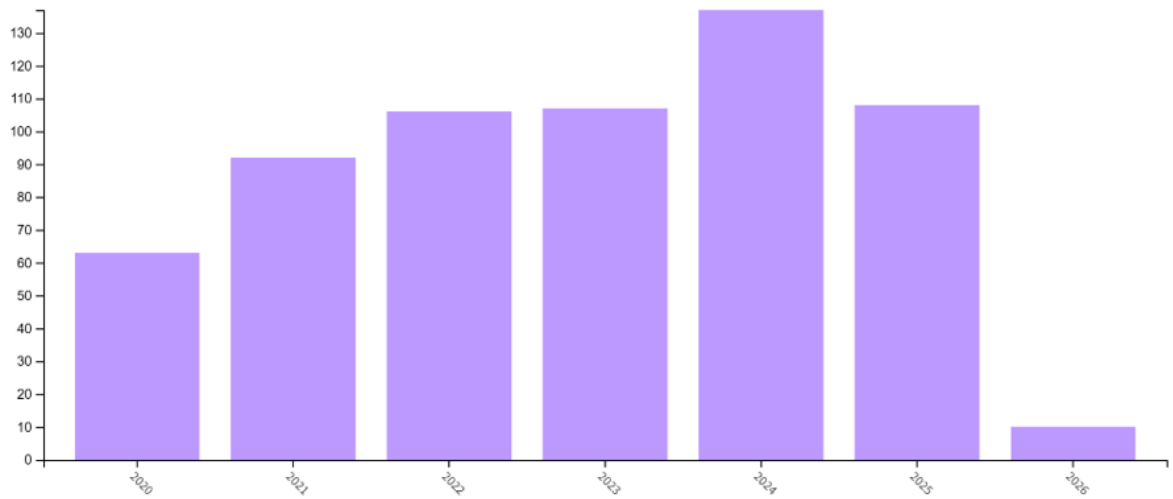


Figure 2: Annual distribution of publications (2020– January 2026)
Source: Authors' bibliometric analysis based on the Web of Science dataset (n = 220).

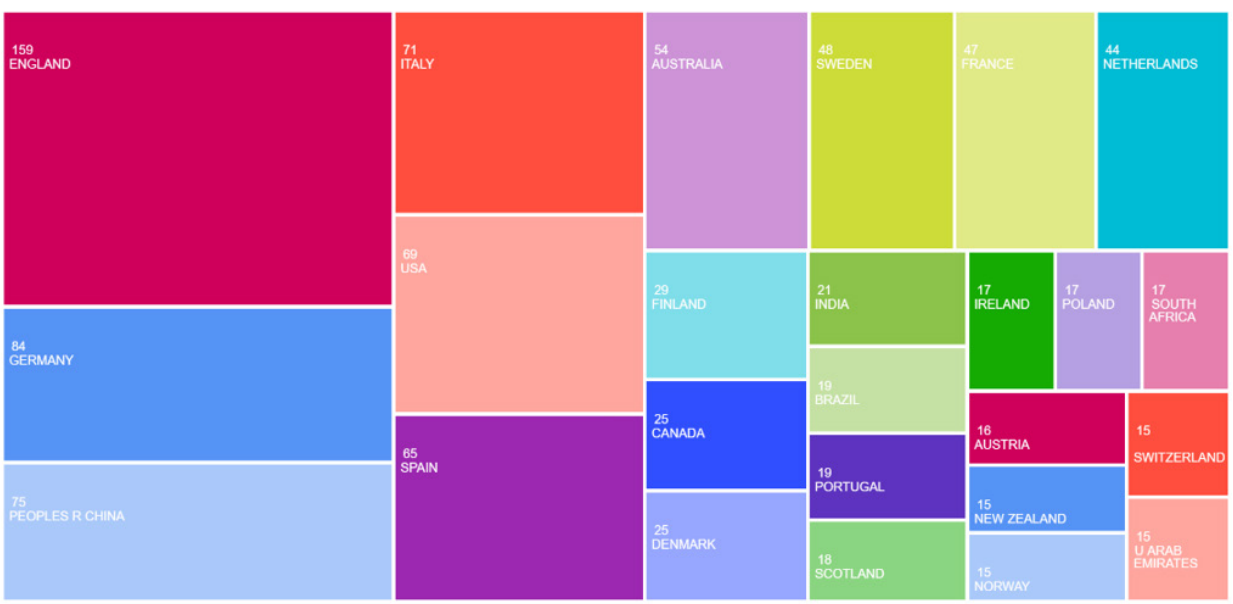


Figure 3: Distribution of publications by country
Source: Authors' bibliometric analysis based on the Web of Science dataset (n = 220).

increased rapidly in 2024, exceeding 130, but then slightly decreased to fewer than 110 in 2025. At the beginning of 2026, the decrease in registered publications reflects data coverage at the time of collection, not an actual decline in research activity. Because the literature search was undertaken in January 2026, the results for that year only cover a portion of the publishing period and so cannot be directly compared to previous years' complete annual records. This interpretation is also consistent with the WOS database's year-round indexing process crawling (Liu, 2021).

The geographical distribution of the reviewed publications was examined to identify the countries contributing most actively to this research field. Figure 3 presents the distribution of publications by country. While the majority of the papers originate from European countries, it is also important to note that the reviewed literature spans five continents, demonstrating the global relevance of research in this field, making it a global topic. Among the European countries the majority of papers comes from England (159 publications), Germany (84 publications), and Italy (71 publications). Outside Europe, the USA produced the most publications in America, with 69 publications, followed by Brazil with 19 publications. In Asia, the People's Republic of China produced the most, 75 publications, followed by India with 21 publications, and the United Arab Emirates with 15 publications. South Africa contributed 17 publications, representing the largest output from Africa, while Australia and New Zealand contributed 54 and 15 publications, respectively. This geographical distribution demonstrates the great international interest in the topic while also showing that research output remains concentrated in a small number of countries.

A keyword co-occurrence analysis was performed using VOSviewer to determine the dominant research themes and the relationships among them. Figure 4 depicts the conceptual organization of the literature using clusters of frequently occurring keywords.

The analysis shows that the multifaceted structure of the area is reflected in the grouping of research on managerial ambidexterity, digital transformation, and international organizational contexts into a number of interrelated theme clusters. Different colors indicate different theme regions, and each cluster indicates a collection of closely linked concepts.

The keyword co-occurrence network analysis reveals a dense and highly interconnected research field centered on managerial ambidexterity, digital transformation, and related organizational concepts. Innovation ambidexterity, which connects organizational, performance, and strategic topics, becomes the central idea of the network. Its close ties to leadership and digital transformation imply that these ideas form the field's intellectual cornerstone.

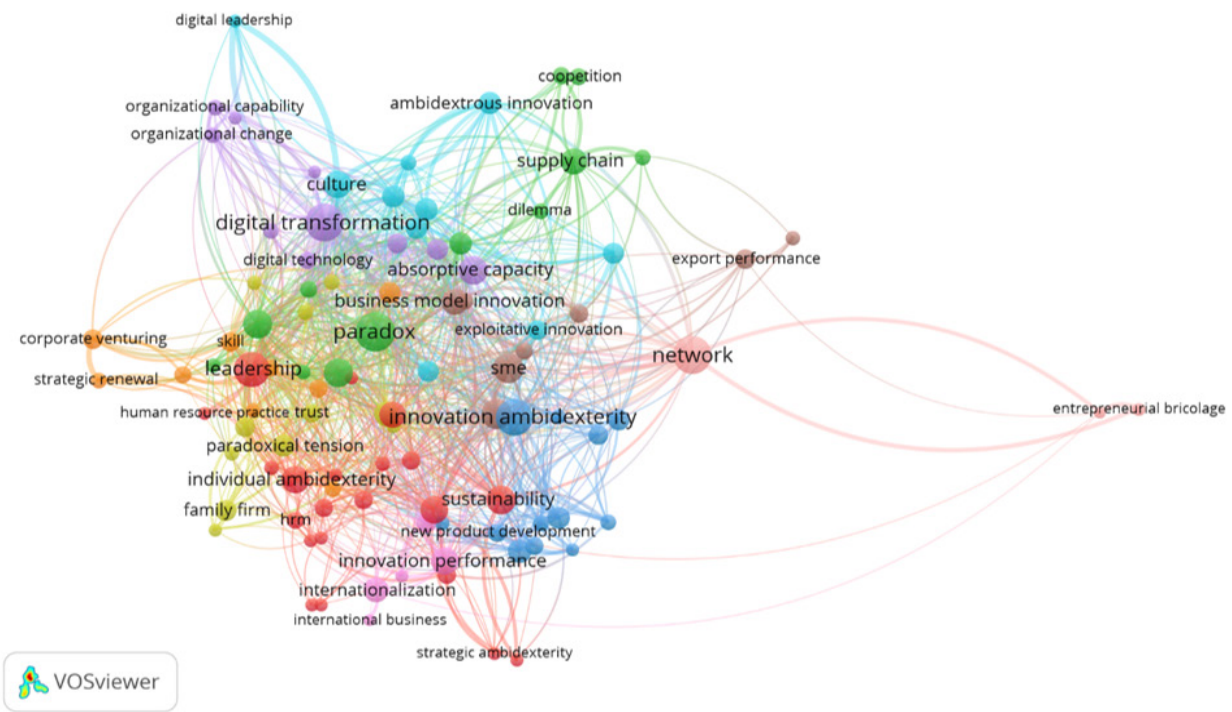


Figure 4: Keyword co-occurrence network generated using VOSviewer
Source: Authors' bibliometric analysis based on the Web of Science dataset (n = 220).

Several distinct, yet linked thematic clusters can be identified. The first cluster focuses on innovation capabilities, including absorptive capacity and the balance between exploration and exploitation. A second cluster focuses on strategic and operational concerns, such as business model innovation and supply chain management. A third cluster connects ambidexterity to outcomes like innovation performance, sustainability, and internationalization. Organizational culture and change appear in a separate but related cluster, emphasizing their role in facilitating digital transformation. Leadership and human resource management practices form another group, underlining the importance of managerial competencies in driving ambidexterity and facilitating successful digital transformation across varied organizational contexts.

Although culture is represented within the network, it is mainly addressed at the organizational level, while the influence of national culture remains relatively peripheral and underexplored. This finding suggests that existing research has not yet fully integrated macro-level cultural influences into the study of managerial ambidexterity and digital transformation. Overall, the network highlights well-established relationships between leadership, managerial ambidexterity, and digital transformation, while revealing a clear gap regarding the role of national culture. Addressing this gap represents an important opportunity for further research, particularly by examining how macro-level cultural contexts shape managerial behaviors and organizational transformation processes.

Further on, a co-authorship network analysis was conducted to investigate researcher collaboration. Figure 5 presents the links between authors and indicates the primary collaboration groups in the field.

The co-authorship network created with VOSviewer displays multiple separate yet interconnected research communities in the topic. Authors typically collaborate within their particular clusters, with a small number of researchers serving as bridges between diverse research communities. Authors such as De Massis, Kraus, Tarba, and Kumar, in particular, hold central positions that connect multiple clusters, implying a critical role in fostering knowledge sharing throughout the discipline. Although collaboration happens across multiple study groups, the network shows that scholarly cooperation is still localized among relatively well-defined communities rather than establishing a single, fully integrated collaboration network.

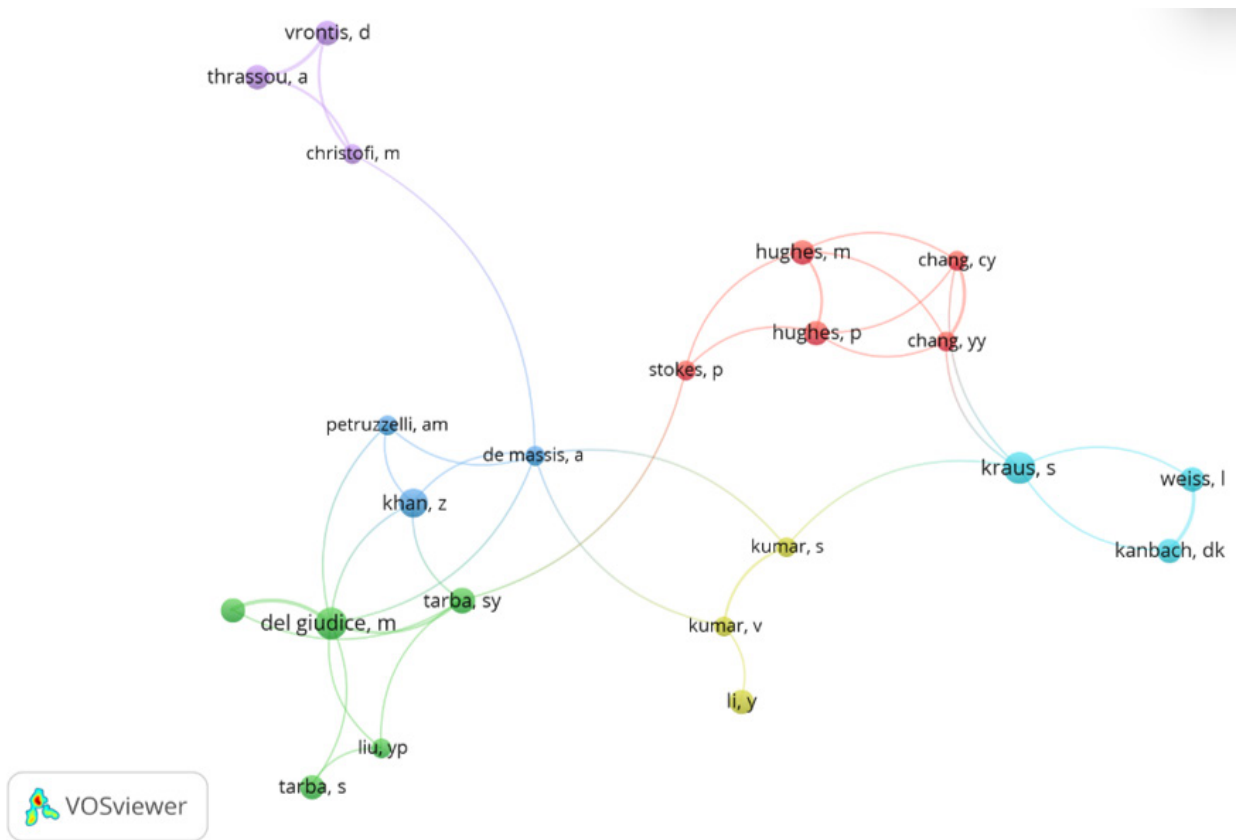


Figure 5: Author collaboration network of the reviewed literature

Based on the data identified through the bibliometric analysis, 30 studies (Appendix 1) were selected to be discussed in depth, representing the variety of topics, methods, and national contexts within the corpus frame. Furthermore, the nexus center was identified as a major topic, while the branches were determined using the author's keywords as a reference point. This approach was used as, in general, keywords are considered core elements that summarize and represent the research content (Kwon, 2018), while also reflecting the topics that authors consider most relevant to their research (Huang & Zhao 2019).

5 Discussion

Managerial ambidexterity is widely recognized as a critical dynamic capability that enables organizations to simultaneously pursue exploitation of existing resources and exploration of new opportunities. This duality is essential for sustaining competitiveness, as it allows firms to efficiently utilize current knowledge while continuously engaging in innovation. Prior studies consistently emphasize that balancing these paradoxical activities is not merely an operational task but a managerial capability rooted in leadership, cognition, and strategic intent (Cen et al., 2023; Chang et al., 2022; Del Giudice et al., 2021; Li et al., 2024). Managers play a central role in orchestrating this balance, for instance by addressing paradoxes related to generative AI adoption (Osadchaya et al., 2024), fostering strategic agility and global talent management in multinational contexts (Vrontis et al., 2024), and ensuring organizational adaptability in dynamic environments (Siala et al., 2025). At the organizational level, empirical evidence further demonstrates that ambidexterity positively influences innovation performance, internationalization, and organizational success, through mechanisms such as tacit knowledge development, networking capabilities, and knowledge exchange (Christofi et al., 2024; Cui et al., 2025; Dzenopoljac et al., 2024; Dzenopoljac et al., 2025; Kolte et al., 2022). Additional studies reinforce the importance of ambidexterity across diverse contexts, including service innovation (Akter et al., 2024), cross-border M&A (Zhang et al., 2020), SME innovation performance (Dzenopoljac et al., 2025), GPT innovation (Cen et al., 2023), and reverse innovation processes (Roth et al., 2024).

Building on this perspective, ambidexterity becomes particularly salient in the context of digital transformation, where organizations must integrate new digital technologies while maintaining existing operations. Digital transformation is therefore not merely a technological shift but a complex organizational and strategic process that depends heavily on managerial ability to manage exploration–exploitation tensions (Dzenopoljac et al., 2024). Studies highlight that capabilities such as absorptive capacity—both potential and realized—are crucial for acquiring, assimilating, and applying new digital knowledge (Mazzelli et al., 2020; Xing et al., 2020). At the same time, technological enablers such as big data analytics (Sivarajah et al., 2024), data integration and technological capabilities (Akter et al., 2024), generative AI and human–AI coupling (Ameen et al., 2024; Osadchaya et al., 2024), ICT systems, and supply chain integration (Rahman et al., 2025) serve as key drivers of digital transformation. Network development and ecosystem collaboration further enhance firms' ability to innovate and respond to environmental changes (Strobl et al., 2025). At the micro-foundational level, cognitive frameworks and social embeddedness shape how ambidexterity translates into performance outcomes (Mazzelli et al., 2020). Thus, digital transformation both relies on and reinforces managerial ambidexterity by creating a context in which organizations can simultaneously exploit existing capabilities and explore new digital opportunities (Akter et al. 2024; Roth et al., 2024).

However, the effectiveness of managerial ambidexterity and digital transformation is strongly influenced by the national cultural contexts in which organizations operate. Prior research demonstrates that cultural dimensions and institutional environments shape managerial behavior, strategic decision-making, and organizational responses. For example, in India, cultural characteristics such as power distance, masculinity, and uncertainty avoidance influence how organizations implement ambidextrous strategies both in domestic and international markets (Kolte et al. 2022; Liu et al. 2023). In China, Confucianism and Legalism shape managerial preferences for balancing relationships and performance within a merit-based relational system (Xing et al., 2020). Similarly, studies conducted in the UAE highlight how national culture influences knowledge sharing and ambidexterity dynamics in international contexts (Dzenopoljac et al., 2024). Differences across European contexts, such as the Netherlands and Germany, further illustrate how national institutions and cultural norms affect responses to stakeholder pressures and the adoption of digital technologies (Annosi et al., 2024; Osadchaya et al., 2024). These findings are reinforced by research on multinational companies, demonstrating that national culture plays a key role in areas such as cross-jurisdictional decision-making (Balachandran et al., 2025), corporate venturing strategies (Heiduk et al., 2025), communication and network management (Strobl et al., 2025), and cross-cultural knowledge management (Cen et al., 2023; Tehseen et al., 2024). Moreover, balancing global integration and local responsiveness requires sensitivity to cultural and institutional differences (Pereira et al., 2021).

Overall, the literature reveals a consistent pattern in which managerial ambidexterity serves as the central mechanism, digital transformation functions as both a driver and a contextual enabler, and national culture acts as a boundary condition shaping their interaction (Akter et al., 2024; Chang et al., 2022). While managerial ambidex-

terity is generally associated with positive outcomes such as innovation performance, supply chain integration, and international growth (Christofi et al., 2024; Rahman et al., 2025; Sivarajah et al., 2024), managers continue to face challenges in balancing exploration and exploitation, particularly in technologically disruptive environments (Osadchaya et al., 2024). These challenges are further amplified by cross-cultural differences, which influence how ambidextrous strategies are designed and implemented across countries and levels of economic development (Kolte et al., 2022; Strobl et al., 2025). For example, reverse innovation has been identified as a mechanism through which multinational organizations achieve ambidexterity across both developed and emerging markets (Roth et al., 2024), highlighting the need for context-specific approaches.

In this context, successfully managing the interplay between managerial ambidexterity and digital transformation requires not only structural and strategic alignment but also a deep understanding of cultural diversity. Approaches such as integrating human and AI capabilities, fostering knowledge exchange and synergy, and adopting adaptive strategies can help organizations navigate these complexities (Cui et al. 2025; Osadchaya et al. 2024). Ultimately, the evidence supports the view that achieving ambidexterity in the digital age is a context-dependent and dynamic process, where managerial capabilities must be continuously aligned with technological developments and adapted to the specific cultural environments in which organizations operate.

This study proposes an integrative conceptual framework that links managerial ambidexterity, digital transformation, and national culture as a boundary condition, as presented in Figure 6. While the bibliometric analysis identified the field's dominating intellectual structure, the integrative synthesis of the 30 core studies enabled the development of a higher-order conceptual framework. Rather than merely summarizing existing relationships, the framework integrates the key themes identified through the bibliometric analysis to provide a coherent explanation of how digital transformation translates into organizational outcomes via managerial ambidexterity across diverse international organizational contexts. As such, it is the study's fundamental conceptual contribution.

This integrative framework explains why digital transformation cannot be approached as a universal, one-size-fits-all solution across different national settings. Synthesizing the findings of the reviewed literature, Figure 6 illustrates a consistent pattern: managers' ambidexterity serves as the central mechanism (Clauss et al., 2021; Del Giudice et al., 2021), digital transformation acts as both a driver and contextual enabler (Ameen et al., 2024; Osadchaya et al., 2024), and national culture functions as a boundary condition shaping their interaction (Akter et al., 2024; Chang et al., 2022; Rao-Nicholson et al. 2020, Xing et al. 2020).

The proposed framework conceptualizes managerial ambidexterity as the primary mediating capability through which organizations translate digital transformation activities into long-term organizational outcomes. While digital technologies provide the necessary infrastructure, organizational performance is dependent on managers' ability to balance exploratory and exploitative activities. The framework further implies that international organizational behavior, such as national culture, institutional environments, and workforce diversity, serves as a contextual condition influencing how management ambidexterity is produced and implemented. As a result, identical digital transformation initiatives can produce diverse organizational outcomes depending on the international context in which they are implemented.

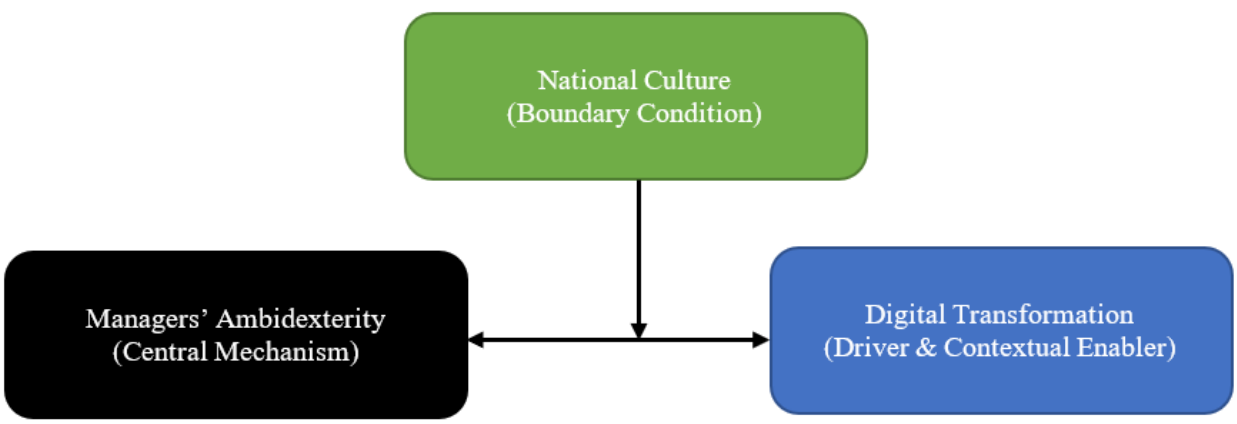


Figure 6: Proposed integrative framework linking digital transformation, managerial ambidexterity and national culture

6 Research Implications and Limitations

This study challenges the conventional perspective of technological determinism in digital transformation studies by conceptualizing digital transformation as an organizational phenomenon rather than merely a process of technological adoption. The outcomes of digital transformation do not depend on digital technologies as a universal solution, but rather they depend on managers' ability to balance paradoxical demands and adjust strategies to diverse environments shaped by different national cultures. This perspective has important implications for international organizational behavior, as well as for management practices and strategic decision-making in a rapidly changing business environment.

The bibliometric mapping and integrative synthesis demonstrate that prior studies have mostly focused on digital transformation, ambidexterity, and multinational organizational behavior as distinct research areas. The framework proposed in this study integrates these streams by identifying managerial ambidexterity as the mechanism through which digital transformation influences organizational performance in international organizational settings. This integrative perspective extends previous research by providing a comprehensive explanation of how technological, managerial, and contextual elements interact to influence organizational adaptation.

This study has, however, several limitations. The most significant limitations is that analysis covers only the period from 2020 to January 2026 and relies on single academic database for data collection. Although the search included papers indexed until January 2026, 2026 is only a partial publication period. As a result, publication numbers for 2026 shouldn't be taken as representing the total annual research output, but rather as a snapshot of the literature available at the time of data collection. Future research should update the bibliometric analysis once the complete 2026 publication record is available. Furthermore, the chosen methodology may limit the ability to generalize findings and does not allow causal relations to be studied in a more rigorous manner.

Despite these limitations, this study highlights several important directions for future research concerning the interplay between managers' ambidexterity, digital transformation, and national culture. First, there is a clear need for multi-level theoretical integration, that connects managerial cognition (micro level), organizational transformation processes (meso level), and cultural or institutional contexts (macro level), as these dimensions are often examined separately. Within this integrative perspective, national context and culture should be treated as a boundary condition, and not just a background factor. Future research should explicitly examine how cultural dimensions influence the effectiveness and manifestation of ambidextrous strategies across different contexts. Second, greater attention should be devoted to the micro-foundations of managers' ambidexterity, particularly the cognitive and behavioral mechanisms that enable managers to balance exploration and exploitation in digital environments. Future studies should explore ambidexterity in relation to specific digital technologies, such as AI and big data, with particular focus on the interaction between human judgment and technology-driven decision-making. Third, the field would benefit from more longitudinal and comparative studies, especially across countries, to better capture the dynamic evolution of ambidexterity and the influence of diverse cultural contexts. Overall, these implications point toward the need for more integrative, dynamic, and context-sensitive research to advance understanding of ambidexterity in the digital era.

7 Conclusion

This research confirms that digital transformation is not a silver bullet, but rather a complex organizational process, where managers' ambidexterity plays a central role in a dynamic environment. This study emphasizes the importance of strategic adjustment in alignment with the national cultural context. This is because local cultural characteristics and management practices influence how organizations implement ambidextrous approaches and utilize digital tools in both domestic and international markets. Moreover, this study highlights the ability of multinational companies to leverage diverse strategies to achieve ambidexterity across different markets and to use this approach as a strategic mechanism for managing digital transformation in various national contexts.

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Ni univerzalne rešitve za digitalno preobrazbo: vloga menedžerske ambidekstrnosti in mednarodnega konteksta

Izhodišča/Namen: Digitalna preobrazba ne predstavlja univerzalne tehnološke rešitve, ki bi enako učinkovito delovala v vseh organizacijah in okoljih. Uspeh preobrazbe je v veliki meri odvisen od sposobnosti vodstva, da hkrati spodbuja inovacije ter učinkovito izkorišča obstoječe vire in zmogljivosti. Namen prispevka je pojasniti vlogo managerske ambidekstrnosti pri izvajanju digitalne preobrazbe v različnih nacionalnih kulturnih okoljih.
Metode: Raziskava temelji na integrativnem pregledu literature, ki združuje bibliometrično analizo in kvalitativno tematsko sintezo znanstvenih objav, indeksiranih v podatkovni bazi Web of Science v obdobju 2020–2026. Analiza je omogočila identifikacijo raziskovalnih trendov, tematskih področij in ključnih povezav med koncepti digitalne preobrazbe, menedžerske ambidekstrnosti in nacionalne kulture.
Rezultati: Ugotovitve kažejo, da je managerska ambidekstrnost eden ključnih dejavnikov uspešne digitalne preobrazbe. Vodje, ki znajo uravnotežiti raziskovanje novih digitalnih priložnosti in učinkovito izrabo obstoječih virov, lažje obvladujejo izzive preobrazbe. Pri tem imajo pomembno vlogo značilnosti nacionalne kulture in prevladujoče vodstvene prakse, saj vplivajo na hitrost sprejemanja sprememb, organizacijsko prilagodljivost ter končne rezultate preobrazbe.
Sklep: Uspešna digitalna preobrazba zahteva razvoj prilagodljivih in dinamičnih ambidekstrnih vodstvenih zmogljivosti, ki upoštevajo specifike posameznega kulturnega okolja. Organizacije morajo digitalne pobude prilagajati institucionalnim, kulturnim in vodstvenim značilnostim trgov, na katerih delujejo. Predlagani okvir poudarja vlogo menedžerske ambidekstrnosti kot ključnega mehanizma za usmerjanje in uspešno izvajanje digitalne preobrazbe v mednarodnem okolju.

Ključne besede: *Managerska ambidekstrnost, Digitalna preobrazba, Nacionalna kultura, Vodstvene zmogljivosti, Bibliometrični pregled*

Appendix 1: Summary of the examined publications

No	Author/s	Article Title	Author Keywords	Year	Countri/es	Variables	Method	Key Findings
1	Arora, SK; Li, Y; Youtie, J; Shapira, P	Measuring dynamic capabilities in new ventures: exploring strategic change in US green goods manufacturing using website data	Dynamic capabilities; Entrepreneurship; SMEs; Big data; Website analytics; Text mining	2020	USA	Dependent Variable, Key Independent Variables, Control Variables, & Instrument Variables	Latent Dirichlet allocation (LDA)	Firms experiencing greater strategic change, as measured through website content variation and enhanced R&D intensity, achieved higher sales growth
2	Clauss, T; Kraus, S; Kallinger, FL; Bican, PM; Brem, A; Kailer, N	Organizational ambidexterity and competitive advantage: The role of strategic agility in the exploration-exploitation paradox	Strategic agility; Firm innovation; Ambidexterity; Competitive advantage; Strategy	2020	Germany	Organizational ambidexterity, Strategic agility	Mixed-method approach	The relationship between organizational ambidexterity and competitive advantage is mediated through strategic agility
3	Mazzelli, A; De Massis, A; Petruzzelli, AM; Del Giudice, M; Khan, Z	Behind ambidextrous search: The microfoundations of search in family and non-family firms	Search; Family firms; Microfoundations; Ambidexterity; Exploitation; Exploration; Social context	2020	Global	Search Scale, Search Effort, Performance Feedback, Knowledge Base Components, Distant search, Search Proficiency, Decision Maker Parameters	MATLAB	The balance between local knowledge reinterpretation and external knowledge acquisition) operates differently across family firm configurations, with decision-maker parameters varying significantly based on founder involvement and generational succession, demonstrating important microfoundations of ambidexterity
4	Rao-Nicholson, R; Khan, Z; Akhtar, P; Tarba, SY	The contingent role of distributed leadership in the relationship between HR practices and organizational ambidexterity in the cross-border M&As of emerging market multinationals	Emerging economies; HR practices; organizational ambidexterity; mergers and acquisitions; distributed leadership	2020	(BRICS Countries) Brazil, Russia, India, China, South Africa	Dependent Variable, Independent Variables, Control Variables, & Moderating Variables	Case survey method	Distributed leadership serves as a critical contingency factor. This moderates the relationship between formalized HR practices implemented post-acquisition and the acquirer's ability to achieve organizational ambidexterity.
5	Xing, YJ; Liu, YP; Tarba, S; Wood, G	A cultural inquiry into ambidexterity in supervisor-subordinate relationship	Ambidexterity; career; Chinese philosophies; culture; Guanxi; supervisor-subordinate	2020	China	Three key dimensions of ambidextrous Guanxi: Loyalty, Dependence on supervisors, & Work priority	Qualitative research using storytelling and narrative interviews with 28 Chinese middle- and senior-level managers in state-owned enterprises (SOEs)	Organizational ambidexterity in Chinese contexts is fundamentally grounded in culturally embedded relationship dynamics. Three critical dimensions (loyalty, dependence on supervisors, and work priority) shape how managers simultaneously balance competing demands within the supervisor-subordinate dyad.

Appendix 1: Summary of the examined publications (continues)

No	Author/s	Article Title	Author Keywords	Year	Countri/es	Variables	Method	Key Findings
6	Zhang, XT; Liu, YP; Tarba, SY; Del Giudice, M	The micro-foundations of strategic ambidexterity: Chinese cross-border M&As, Mid-View thinking and integration management	Cross-border mergers and acquisitions; communication; organizational; control; post-; acquisition; integration; strategic ambidexterity; Mid-View thinking; micro-foundation	2020	Germany	Communication approach (direct and indirect), Organisational control (delegation via informal control and centralised formal control), Mid-View thinking (micro-foundation of strategic ambidexterity), Knowledge exploration and exploitation	Comparative case analysis design with in-depth semi-structured interviews	Chinese firms employ both direct communication approaches (to build trust and convey intentions) and indirect communication approaches (providing flexibility in integration management and multiple interpretations)
7	Del Giudice, M; Scuotto, V; Papa, A; Tarba, SY; Bresciani, S; Warkentin, M	A Self-Tuning Model for Smart Manufacturing SMEs: Effects on Digital Innovation		2021	Italy	Exogenous Variables & Endogenous Variables	SEM	Positive effects of organisational agility, adaptability, and ambidexterity on digital innovation
8	Pereira, V; Del Giudice, M; Malik, A; Tarba, S; Temouri, Y; Budhwar, P; Patnaik, S	A longitudinal investigation into multilevel agile & ambidextrous strategic dualities in an information technology high performing EMNE	Organizational agility and ambidexterity; Change management; Indian IT-BPO Industry; High-Performance Work Systems (HPWSs); Organisational development; Socio-technical theory; EMNEs	2021	India	High-performance work systems (HPWSs), Organisational development (OD), Strategic agility, Organisational ambidexterity (OA), Socio-technical systems (STS)	Pettigrew's processual approach	OD initiatives were identified as an effective mechanism for embedding and enhancing strategic agility during both periods of exponential growth and in response to an impending recession
9	Chang, CY; Chang, YY; Tsao, YC; Kraus, S	The power of knowledge management: how top management team bricolage boosts ambidexterity and performance	Top management team; Bricolage; Performance; Ambidexterity; Absorptive capacity; Knowledge-based theory	2022	Taiwan	Firm-level TMT bricolage, Unit-level unit ambidexterity, Firm-level potential absorptive capacity, Firm-level realized absorptive capacity	Quantitative research by collecting multi-source and multi-level data	Unit-level ambidexterity mediates the effect between firm-level TMT bricolage and unit-level performance. Firm-level potential absorptive capacity positively moderates the effect between firm-level TMT bricolage and unit-level ambidexterity, and Firm-level realized absorptive capacity positively moderates the indirect relationship between firm-level TMT bricolage and unit-level performance through unit-level ambidexterity.
10	Del Giudice, M; Scuotto, V; Ballestra, LV; Pironti, M	Humanoid robot adoption and labour productivity: a perspective on ambidextrous product innovation routines	Artificial intelligence; labour productivity; contextual ambidexterity; International HRM; product innovation; explorative routines; exploitative routines	2022	24 European countries	Dependent, Independent, and Control Variables	OLS estimation	Labour productivity is positively and significantly associated with exploitative and explorative routines of product innovators

Appendix 1: Summary of the examined publications (continues)

No	Author/s	Article Title	Author Keywords	Year	Countri/es	Variables	Method	Key Findings
11	Kolte, A; Festa, G; Rossi, M; Thrassou, A; Vrontis, D; Christofi, M	Ambidexterity's influence on export strategy development-The case of the Indian pharmaceutical industry	ambidexterity; AYUSH; India; pharmaceutical industry; R&D	2022	India	Business ambidexterity, Export performance	Quantitative research using secondary data from institutional databases, business reports, corporate websites, and white papers.	Indian pharmaceutical companies practicing ambidexterity, i.e., simultaneously exploiting existing generic drug capabilities and exploring new drug innovations, can achieve better export outcomes
12	Weiss, L; Kanbach, DK	Toward an integrated framework of corporate venturing for organizational ambidexterity as a dynamic capability	Organizational ambidexterity; Corporate venturing; Corporate innovation; Dynamic capabilities; Strategic management; Corporate entrepreneurship; M1; M10; M13	2022	Global	DC, OA, CV	Systematic Literature Review	Corporate venturing may take a solely explorative or exploitative role, or balance both, to directly enable organizational ambidexterity
13	Akter, S; Hossain, MA; Hani, U; Vrontis, D; Thrassou, A; Arslan, A	Addressing the grand challenges of poverty with data-driven creative service offerings	big poverty data; creativity; dynamic capability; quality of life; service performance	2023	Bangladesh	Independent Variables, Dependent Variables	Mixed-methods research design with Delphi and survey data	Creative service offerings partially mediate the relationships between BPDA capability and both economic (new service performance) and social (quality of life) outcomes.
14	Cen, J; Fu, F; Yang, Y; Yan, JX; Li, J	Distant or Local? The Roles of Knowledge Search on General Purpose Technology Innovation in Emerging Industries	Distant local and balanced search; General purpose technology; Industry alliance heterogeneity	2023	China	Independent, Dependent, Control Variables	Hierarchical regression analysis	There is an inverted U-shaped relationship between distant search and GPT innovation, indicating an optimal level of distant search for maximizing GPT innovation in emerging industries.
15	Weiss, L; Kanbach, DK	Leveraging new business innovation for strategic renewal: An organizational framework for strategic corporate venturing	continuous innovation; corporate innovation; corporate venturing; corporate venturing units; dynamic capabilities; innovation management; new business innovation; organizational ambidexterity; strategic corporate venturing; strategic renewal	2023	Europe	Qualitative Case Study	Capabilities, Resources, Ambidexterity, Structures	Common characteristics appearing in all cases include strategic objectives, while differentiating characteristics included incremental vs. non-incremental innovation types

Appendix 1: Summary of the examined publications (continues)

No	Author/s	Article Title	Author Keywords	Year	Countri/es	Variables	Method	Key Findings
16	Ameen, N; Tarba, S; Cheah, JH; Xia, SM; Sharma, GD	Coupling Artificial Intelligence Capability and Strategic Agility for Enhanced Product and Service Creativity		2024	China	AI capability, Strategic agility, Orientations	Quantitative Survey	Government institutional support moderated the relationships between the coupling of AI capability and strategic agility and both outcomes
17	Christofi, M; Stylianou, I; Hadjielias, E; De Massis, A; Kastanakis, MN	Tackling pandemic-related health grand challenges: The role of organizational ambidexterity, social equality, and innovation performance	COVID-19 pandemic; health care's grand challenge; innovation; organizational ambidexterity	2024	USA	Innovation Performance, Organizational Ambidexterity, Control Variables	The Poisson maximum likelihood regression	Both the balanced and combined dimensions of organizational ambidexterity have a strong positive effect on firms' innovation performance related to the COVID-19 pandemic, and the interaction of these two dimensions further enhances innovation performance
18	Dzenopoljac, A; Dzenopoljac, V; Muhammed, S; Abidi, O; Kraus, S	Intra-organizational knowledge sharing, ambidexterity and firm performance: evaluating the role of knowledge quality	Knowledge sharing; Knowledge quality; Organizational ambidexterity; Organizational performance	2024	United Arab Emirates (UAE)	Knowledge Sharing, Knowledge Quality, Organizational Ambidexterity, Organizational Performance	SEM	The results indicate that tacit knowledge sharing has a significant, direct impact on the exploitative and explorative capabilities of the organization and indirectly impacts both dimensions of ambidexterity.
19	Li, Y; Fan, D; Kumar, V; Ananthram, S	Configuring International Growth of Emerging Market Multinational Enterprises: A Compositional Springboarding View in the Context of India	compositional springboarding view; EMNEs; fsQCA; India; international growth	2024	India	Outcome Variable, Amalgamation Factors, Ambidexterity Factors	Fuzzy-set qualitative comparative analysis (fsQCA)	Five equifinal configurations of amalgamation, ambidexterity, and adaptability factors enable the rapid international growth of Indian multinational enterprises (MNEs)
20	Osadchaya, E; Marder, B; Yule, JA; Yau, A; Lavertu, L; Stylos, N; Oliver, S; Angell, R; de Regt, A; Gao, LY; Qi, K; Zhang, WZ; Zhang, YW; Li, JY; Alrabiah, S	To ChatGPT, or not to ChatGPT: Navigating the paradoxes of generative AI in the advertising industry	ChatGPT; Generative AI; Paradoxes; Advertising; Chatbots	2024	13 different countries	Interviews with professionals involved in brand communication across a range of industries	Qualitative approach using interviews	Text-to-text generative AI, such as ChatGPT, presents both opportunities and challenges for the advertising industry. There are four paradoxes identified.
21	Roth, L; Corsi, S; Hughes, M	Ambidexterity within a multinational context: how organisations can leverage explorative and exploitative reverse innovation		2024	Italy, China, Germany, UK, Brazil, Japan, Indonesia	Four types of RI based on the dichotomies of exploration vs. exploitation and new product vs. innovative contributions	Qualitative abductive research approach with semi-structured interviews	RI can occur not just in the form of new products, but also as innovative contributions from EE-based R&D activities towards the development of new products within the MNE's global R&D network.

Appendix 1: Summary of the examined publications (continues)

No	Author/s	Article Title	Author Keywords	Year	Countri/es	Variables	Method	Key Findings
22	Sivarajah, U; Kumar, S; Kumar, V; Chatterjee, S; Li, J	A study on big data analytics and innovation: From technological and business cycle perspectives	Big data analytics; Technological cycle; Technological innovation; Firm performance; Business cycle; Incremental change	2024	India	Independent, Dependent Variable	CFA & SEM	Reciprocal relationship, where BDA positively impacts FIP, and FIP also positively impacts the development of BDA capabilities.
23	Tehseen, S; Kayani, UN; Haider, SA; Aysan, AF; Johara, F; Hossain, SM; Khalid, S	Unpacking the mechanisms of entrepreneurial bricolage for new venture growth: the mediating roles of new venture adaptiveness and innovative ambidexterity	Entrepreneurial bricolage; new venture growth; new venture adaptiveness; innovative ambidexterity; ready-made garment industry	2024	Bangladesh	Entrepreneurial bricolage (EB), New venture adaptiveness (NVA), Innovative ambidexterity (IA), New venture growth (NVG):	PLS-SEM	Entrepreneurs in Bangladesh's RMGI can leverage EB to enhance their ventures' adaptability and innovative capabilities, ultimately driving business growth.
24	Vrontis, D; Shams, R; Thrassou, A; Kafouros, M	Global strategy evolution, devolution or revolution: Disruptions to globalization and international business introversion	Globalization; De-globalization; International business; Disruption; Remote working; Global talent management; Stakeholder relationships; Multicountry operations	2024	Cyprus, Lebanon, Singapore, the UK, the US, the EU, China, India, Brazil	Topic of global strategy evolution, devolution or revolution in light of disruptions to globalization and international business introversion	SLR	Seven critical contexts that influence the future directions of international business (IB) research and practice on global strategy
25	Balachandran, B; Bhagawan, P; Krishnamurti, C; Zhou, Y	Intensity of exploitation-exploration innovation strategies and credit ratings	Corporate innovation; Exploration; Exploitation; Credit ratings; Patents	2025	USA	Innovation Strategy, Credit Rating, Control Variables	OLS	Firms with higher intensity of exploration (exploitation) innovation strategies tend to receive lower (better) credit ratings
26	Dzenopoljac, V; Dzenopoljac, A; Ognjanovic, J; Kraus, S; Puumalainen, K	From sharing to shaping: Role of knowledge quality and ambidexterity in SME innovation performance	Innovation performance; Knowledge sharing; Quality of knowledge sharing; Organizational ambidexterity	2025	Serbia	Independent, Dependent Variable, Mediating Variables	CFA & SEM	Exploitative ambidexterity and explorative ambidexterity mediate the relationship between QKS and innovation performance. The ability to balance refinement and exploration is essential for translating high-quality knowledge into innovation success.
27	Heiduk, L; Frey, P; Weiss, L; Kanbach, DK	External corporate venturing for strategic renewal: A comparative study of corporate venture capital and corporate venture clienting	Venture clienting; Corporate venture capital; Strategic renewal; Corporate innovation; Strategic corporate venturing; Open innovation	2025		Organizational Interlinks, Dynamic Capabilities, Innovation Process Activities, Ambidextrous Orientation	FPMA	CVC and VCL create a distributed ambidexterity system that balances exploration and exploitation activities across the organization, thereby supporting strategic renewal across both current and future business domains.

Appendix 1: Summary of the examined publications (continues)

No	Author/s	Article Title	Author Keywords	Year	Countri/es	Variables	Method	Key Findings
28	Rahman, MK; Hossain, MA; Piprani, AZ; Abdullah, AR	Impact of tech-driven integration, flexibility, and ambidexterity on supply chain integration and performance in manufacturing firms: moderating role of uncertainty and agility	Tech-driven integration; Supply chain; Uncertainty; Flexibility; Ambidexterity; Agility; Integration; Performance	2025	Malaysia	Independent, Dependent, Moderating Variables	PLS-SEM	Tech-driven integration (TDI) and organizational ambidexterity (ORA) have a significant positive impact on supply chain integration (SCI), while supply chain flexibility (SCF) does not significantly influence SCI
29	Siala, H; Kutsch, E; Gupta, S; Sivarajah, U; Nyuur, R; Shin, MM; Seo, M	Theorizing Synchronization of Organizational Resources in Dynamic Environments	dynamic environments; resource orchestration; resource synchronization; strategic initiatives; sunset resource-based view	2025	EU, North America	Resource orchestration (RO) mechanisms and actions, Synchronization of resources across different organizational levels and time periods, Innovation benefits across technical, business model, and social domains, Differences in RO approaches	Qualitative longitudinal case study	Identified four specific resource synchronization mechanisms that organizations use to adapt their strategic initiatives over time in dynamic environments: refocusing, descoping, substituting, and deferring. These mechanisms enable continuous realignment between strategic benefit realization and organizational capability development.
30	Strobl, A; Shepherd, NG; Hughes, P	Unleashing R&D networks for ambidexterity: The interplay between internal and external networking capabilities	Ambidexterity; R & D networks; Internal networking capabilities; External networking capabilities; Exploration; Exploitation; SMEs; SMEs	2025	Switzerland, Austria, Liechtenstein	Independent, Dependent, Control Variables	OLS Regression	SMEs need to understand the value of different types of R&D network partnerships to create and nurture meaningful relationships and interactions with their R&D network partners.