



Internal dynamics and innovation: A cross-disciplinary review and future research agenda

Bojana Malisić^a, Sandra Tinaj^a, Jovana Popović^a, Lidija Lukovac^a, Božidar Vlačić^{a,b,c,*}

^a University of Donja Gorica, Faculty for International Economics, Finance and Business, Podgorica, Oktoih 1, Podgorica, 81000, Montenegro

^b Universidade Católica Portuguesa, Católica Porto Business School, Portugal

^c Universidade Católica Portuguesa, Research Centre in Management and Economics (CEGE), Portugal

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ABSTRACT

Focusing on the internal dynamics of firms, this paper examines the interplay between human resource practices, absorptive capacity, and innovation. By systematically analyzing and synthesizing 100 papers from Elsevier's Scopus and Web of Science databases, this review uncovers and interprets their interconnections. We employed Multiple Correspondence Analysis to highlight the theoretical foundations and main research themes. This methodological approach facilitates the visualization of the foundational intellectual structure and the identification of new research opportunities, thereby fostering further synthesis and advancement. Following the analysis of the selected papers and in response to the need for a framework focusing exclusively on empirical studies, we developed an Antecedents-Drivers-Outcomes (ADO) framework based on empirical evidence from a sub-sample of 88 manuscripts. Based on the results of the multiple correspondence analysis and evaluations of empirical papers, this review outlines main theoretical foundations related to resource-based views, network and learning perspectives, and dynamic capabilities. It also identifies major research themes, including organizational culture, human capital empowerment, and development processes. Furthermore, the article highlights gaps and future research opportunities within these intersecting domains, acknowledges advancements in radical and process technological innovation, such as artificial intelligence and machine learning, and provides an overview of the latest developments.

1. Introduction

A firm's internal dynamics comprise diverse elements such as strategies, structures, processes, culture, and people. Together, these form the necessary resource base for efficient and sustainable organizational functioning [1]. Firms' internal dynamics, particularly human resource practices combined with absorptive capacity, largely determine organizational innovativeness and the adoption of innovative solutions [2, 3]. West and Farr [4] signaled the importance of internal dynamics, as in their perspective innovation occurs at multiple organizational levels and is based on employees' capabilities and human resource practices. In particular, human resources practices such as workgroups, planned job rotation, and changes in governance accountability, among others, represent a fundamental part of internal dynamics [5]. This recognition is associated with the critical role of individuals in adopting, assimilating, and exploiting new knowledge and technology to foster

innovation [6].

A large body of scholarly work recognized that human resources practices can enhance innovation performance [7–9]. In particular, some authors portrayed that human resources practices combined with absorptive capacity are essential dynamic capabilities that enable organizations to leverage external knowledge for innovation [10]. This is especially important because absorptive capacity relates to innovativeness as "an organization's proficiency in identifying, assimilating, and effectively applying new knowledge, information, and external resources to enhance its performance and adapt to evolving circumstances" ([11]; p. 128). Accordingly, absorptive capacity is viewed as a dynamic capability that encompasses acquiring new knowledge and information, assimilating, converting, and effectively utilizing it to drive innovation [12]. As such, noting the complementarity of internal capability and external collaboration, absorptive capacity has been pinpointed as a critical catalyst for gaining a competitive edge and

* Corresponding author. Universidade Católica Portuguesa, Católica Porto Business School and CEGE, Portugal.

E-mail addresses: Bojana.Malistic@udg.edu.me (B. Malisić), sandra.tinaj@udg.edu.me (S. Tinaj), Jovana.Popovic4@udg.edu.me (J. Popović), Lidija.Lukovac@udg.edu.me (L. Lukovac), bvlacic@ucp.pt (B. Vlačić).

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fostering innovation [13,14]. To date, empirical research has found that organizational mechanisms with coordinating capabilities (e.g., cross-functional interfaces, decision-making, and job rotation) significantly impact the acquisition and assimilation of knowledge [15]. Along those lines, Bogers et al. [16] and Yildiz et al. [17] highlighted individual absorptive capacity and goal orientation level (e.g., learning orientation, prove orientation, avoid orientation) as well as characteristics (e.g., education background) as drivers of innovations within firms.

However, despite the growing recognition of internal dynamics and the importance of integrating human resource practices and absorptive capacity toward explaining innovativeness and adoption of innovative solutions, a gap remains in scholarly efforts to synthesize, interpret, and shed light on their interconnection. Therefore, this study aims to portray scholarly contributions addressing this interplay and answer: What is the current state of research on the intersection of human resource practices, absorptive capacity, and innovation, and what gaps or future research opportunities exist in this domain providing the state of the art in these research areas?

Purposefully, this study employs a comprehensive and robust systematic literature review to address the apparent gaps in synthesizing and interpreting the interconnectedness among these domains. We have employed a combined narrative and content literature review methodology to delve into the intersection of these domains. This approach has allowed us to underscore the complex relationship between human resource practices and absorptive capacity. Additionally, through an in-depth analysis of empirical work, we demonstrate how these practices, combined with key roles at various organizational levels, enhance an organization's ability to absorb, apply, and leverage external knowledge. Furthermore, our effort uncovers the underlying themes connecting human resource practices and absorptive capacity, ultimately advancing innovation.

The remainder of this review begins with a portrayal of the intersection's emergence and positions the review within the context of prior studies. Next, the methodology section provides a detailed overview of research methods, data collection processes, and analysis techniques. The results are then presented in two main subsections: the first offers a descriptive overview, while the second provides an in-depth interpretation of the theoretical foundations, major research themes, and a synthesis of empirical studies. This section highlights practices that emerged from the literature through causal Antecedents-Drivers-Outcomes (ADO) frameworks. Following this, the review identifies numerous research gaps, suggesting theoretical and managerial implications and fruitful avenues for future investigation.

2. Emergence of the fields intersection and prior reviews

To address challenges and cope with turmoil environments, firms embrace adaptive, absorptive, and innovative practices to employ, reconfigure and redeploy competencies and resources [18,19]. As such, the notion of internal dynamics' relevance is several decades old and began to gain significant traction with seminal research developed by Cohen and Levinthal [11] (see Fig. 1). Cohen and Levinthal [11] specifically examined the communication structures among subunits and the nature and dissemination of expertise within a company. They concluded that essential aspects of innovative organizations include assimilating external knowledge and effectively managing employees, ultimately aiding in developing new products and processes. While this foundational research enhanced our understanding of knowledge assimilation within firms, subsequent studies encountered challenges in translating this concept into a practical framework applicable across various industries (see note by Ref. [20]). Duchek [21] also recognized this opportunity for further refinement. However, despite follow-up reviews and notes emphasizing the need for structured stepwise models and systematic interpretation, there remains a gap in depicting the intersection between human resource practices, absorptive capacity,

and innovation.

Furthermore, recognizing the relevance of knowledge residing outside of organizational boundaries, Cockburn and Henderson [22] explored the concept of "connectedness" among employees and the external environment (e.g., co-authorships and openness to collaborate with employees from other institutions), emphasizing employees' performance and collaborations with associates outside the organization. Furthering the relevance of connectedness and collaboration, Tsai [23] explored communication within "intraorganizational network" units and the importance of firm network position to access knowledge through networks inside the firm, highlighting the importance of sharing firm-specific knowledge within organizations. While this represented an evolutionary shift in human resource practices, emphasizing the importance of intraorganizational networks, it was still scarce to illustrate a cohesive strategy that would leverage network structures to foster and promote innovation. Recognizing the relevance of establishing connections with external sources of new knowledge and the importance of a firm's network position, Jansen et al. [15] suggest that forming a dense network of ties within units is essential for assimilating, transforming, and exploiting new knowledge through two-way interactions. Furthermore, Jansen et al. [15] demonstrated how links between specific organizational mechanisms, such as participation in decision-making, formalization, and routinization, can enhance firm performance. Even when considering specific organizational mechanisms (e.g., Ref. [15,23]), organizational antecedents like organizational culture and the development process driven by absorptive capacity have often been overlooked. Consequently, despite references to human resource practices (e.g., involvement and communication), there remains a research gap highlighting the need to develop a model, such as the Antecedent, Decision, and Output (ADO) framework.

Next, Vinding [24] demonstrated that companies that value human capital and implement practices like fostering closer relationships with vertically aligned entities and knowledge institutions are better positioned to innovate. Also, Minbaeva [25] discovered that employees' abilities and incentives to absorb knowledge are important determinants in a firm's absorptive capacity and that knowledge-related human resource management strategies (e.g., staffing, training, compensation, promotion, and appraisal) can improve absorptive capacities and lead to organizational innovativeness. Von Ledebur [26] and Kang [27] argued that creating an empowering work environment improves social relations and encourages employees to increase knowledge transfer across different employee groups. This approach yielded the benefits of increased dynamic capability and innovation, ultimately enhancing the firm's productivity.

Furthermore, Weeks et al. [28] recognized the importance of outsourcing for increasing innovation. However, they cautioned that firms must maintain firm-specific business process knowledge, optimize team sizes when collaborating with suppliers, and manage legacy hiring to sustain innovativeness. Wang and Chen [29] further developed a systems approach by linking a high-performance work system of human resource practices (e.g., staffing, training, knowledge and skill-based rewards, and team development) with intellectual capital, highlighting its overall focus on development and innovation.

Concerning reviews, Lin and Sanders [30] synthesized literature on HRM—the innovation relationship through the lens of the 4I organizational learning framework (e.g., intuiting, interpreting, integrating, and institutionalizing). In particular, they portrayed a single organizational learning framework and revealed how human resource practices stimulate innovation at various levels. To illustrate this multilevel perspective, they assessed forty empirical studies. Their review highlighted that individual, team, and organizational learning moderate the relationship between HRM and innovation. In particular, they noted that a flexible human capital pool regarding resource availability and coordination is more likely to foster innovation at each level. However, Lin and Sanders noted that the aim of their review was not a systematic overview of the domain intersection and that their review is not indeed comprehensive,

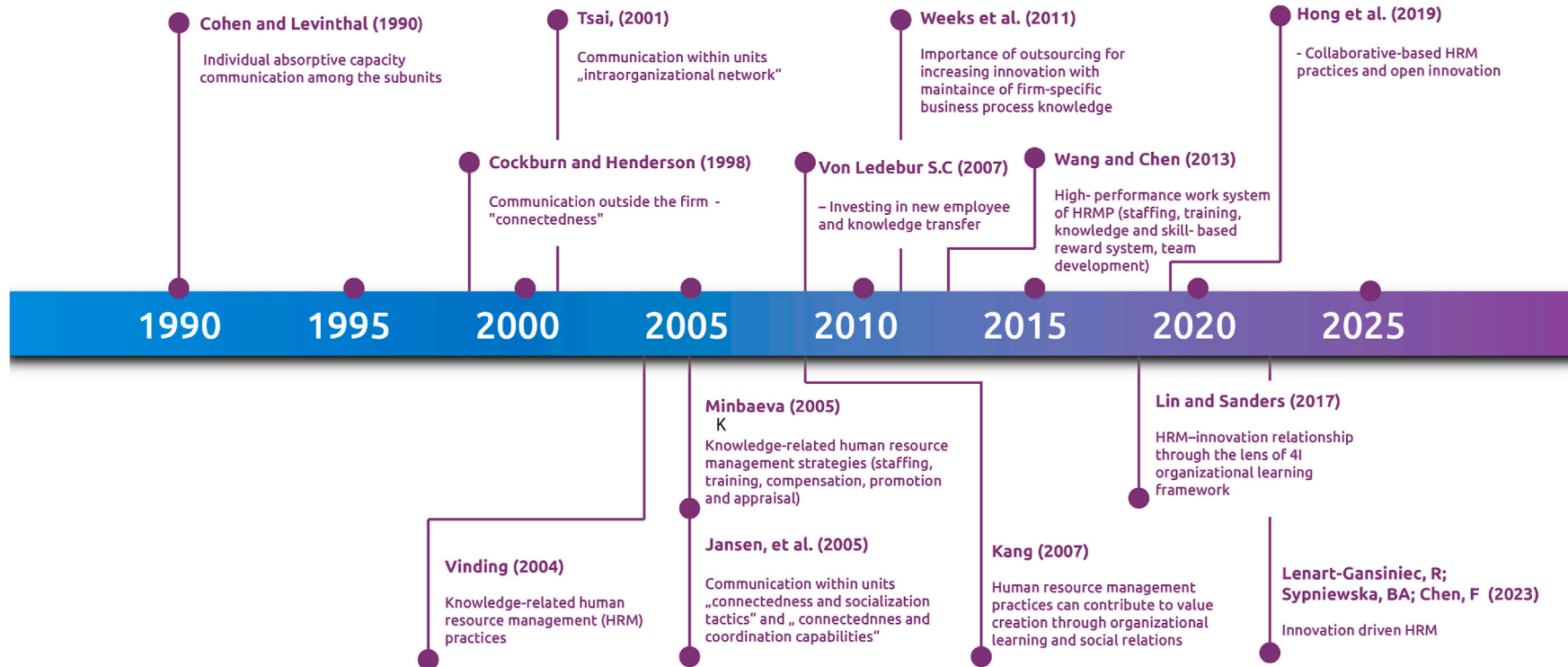


Fig. 1. Chronological Evolution of the Domain and Notable studies.

calling for further synthesis and a broader overview of the domain.

Subsequently, Hong et al. [31] conducted a literature review to illustrate how collaborative-based human resource practices help address barriers to open innovation. Their findings revealed that recruiting for teamwork, team-oriented appraisals, rewards, and other related practices foster a collaborative culture and enhance skills that promote knowledge exchange across organizational borders.

Recent evaluations underscore the significance of innovation-driven human resource practices. For instance, Lenart-Gansinieć et al. [32] organized literature on such human resource practices—including recruitment and selection, training and development, compensation, and performance appraisal—and created an integrative framework/model that encompasses key antecedents (both internal and external), mediators/moderators, and main outcomes. This study proposed a model for future research addressing a multilevel approach—considering individual, team, and organizational perspectives on innovation-driven human resource practices—providing insights into the current knowledge landscape and elucidating conceptual and methodological issues.

In their investigation into agile innovation, Martínez-Sánchez and Vicente-Oliva [33] analyzed the firm's human resource flexibility and absorptive capacity in agile innovation compared to traditional stage-gate innovation. Their findings revealed that internal human

resource practices, particularly the training of core full-time R&D employees, significantly enhance innovation. On another note, the contribution of external human resource practices, such as hiring low-knowledge temporary employees, caused adverse effects. However, the authors noted that further studies are needed to validate and explore these relationships in more depth.

Over time, scholars and practitioners have developed practices such as involvement in communication, job influence and challenge, career development, and opportunities for advancement to support innovation at various levels and influence absorptive capacity. However, while understanding internal dynamics and domains of human resource practices, absorptive capacity, and innovation intersection has progressed significantly, market dynamics and ongoing changes have caused continuous development and further complexity. Therefore, there is notable dispersion in the research field in light of the increased and continuously evolving recognition of human resource practices and their linkage with absorptive capacity and innovation. This scatteredness further highlights the need to examine the effects of human resource practices, absorptive capacity processes, and innovation interconnection, indicating a theoretical and empirical gap that warrants additional investigation.

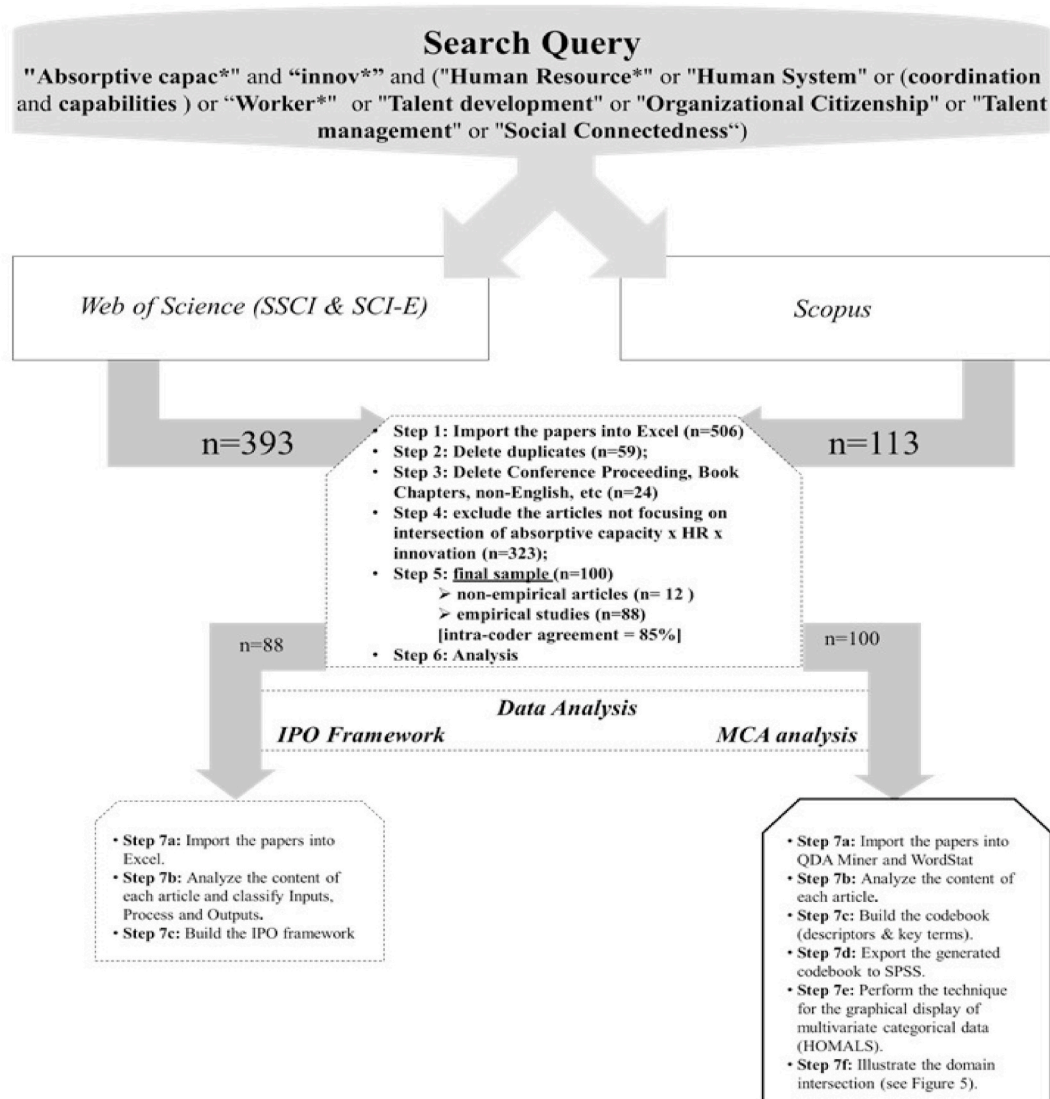


Fig. 2. Methodology Protocol.

3. Methodology

3.1. Research method and data collection process

This review paper addresses the gaps in synthesizing and interpreting the interconnectedness between human resource practices, absorptive capacity, and innovation (Fernandes et al., 2018). To achieve this, we have adopted a hybrid-narrative approach that allows us to generate new theoretical perspectives and implications at the intersection of these domains [34].

Our systematic literature review process began with examining previous reviews and conceptualizations on the topic (e.g., Ref. [5,30,32]). To conduct a comprehensive cross-disciplinary review, we designed a research query to identify papers discussing the interconnectedness among human resource practices, absorptive capacity, and the innovation domain. Additionally, to ensure the robustness and quality of the review, we focused our search on peer-reviewed journals [35]. As a result, the search query has been structured around key terms in human resource practices, absorptive capacity, and innovation (the exact search query is provided in Fig. 2). We included articles, reviews, and editorials as relevant contributions on the topic that have been published in various forms without any restriction on the publishing year. We ran the first collection process in databases Elsevier's Scopus and Web of Science [36] on the July 27, 2023, with regular updates until the 31st of December of 2023, retrieving a raw dataset of five-hundred and six papers [Steps 1–3 in Fig. 2]. After eliminating duplicates and mis-indexed manuscripts from database providers, we conducted an in-depth screening and annotation of the initial selection of four hundred and twenty-three papers. This process involved primarily reading the abstracts, followed by full-text reading. Through informed discussions among the authors, we selected a final sample of one hundred papers. The inter-rater reliability during the paper development, from the initial selection of manuscripts to the content analysis and codebook development, was 82 %, indicating an adequate agreement among the authors.

3.2. Data analysis

To review the literature, we employed several complementary approaches by combining a narrative review [37] with content analysis [38] and incorporating a framework to guide future research directions (e.g., Ref. [39]). In order to highlight the theoretical foundations and principal research themes, which in turn helps researchers visualize the underlying intellectual structure and identify further research opportunities, we adopted Multiple Correspondence Analysis. Our multi-review hybrid approach enables further synthesis and development of the research domain [40].

Considering the need for a guiding framework in our analysis, and after having re-read the one hundred selected papers, we constructed an Antecedents-Drivers-Outcome framework [39] grounded on the empirical scholarly evidence of a restricted sample containing eighty-eight manuscripts. Our illustration of the intellectual domain (see Fig. 5) and ADO framework (see Fig. 6), presented and discussed in the next section, allowed the analysis of the literature and served as a springboard for further development of the field. The authors assigned each paper to the constituents of the ADO framework by reading the restricted sample of articles focused on empirical studies. Finally, once the eighty-eight papers had been allocated inside the framework, the authors discussed the fundamental characteristics of the papers included in each segment, summing up the shared vital similarities of the studies [41].

3.3. Multiple correspondence analysis

To map the intersection of research fields and highlight their theoretical foundations and principal research themes, we employed

Multiple Correspondence Analysis (MCA) [36]. MCA is a methodological approach used to discover links between dichotomous variables by assigning a value of "1" if a term occurred and "0" otherwise [42]. In line with the goals of this study, we conducted Homogeneity Analysis by Means of Alternating Least Squares (HOMALS) using SPSS software (v. 26). This allowed us to illustrate the intellectual structure of the research field. The proximity of descriptors in the 2x2 map (see Fig. 5) corresponded to shared components [43]. Essentially, the most frequent descriptors (i.e., those researched in a larger number of articles) were positioned closer to the center of the map, while similar descriptors—referring to a large proportion of articles involving similar topics—were positioned near each other [44]. This method is recognized as a reliable approach to content analysis, enabling the mapping of the structure of various research domains and their intersections, such as cooperation and innovation [45], and artificial intelligence and marketing [38], among others.

The initial step in MCA analysis involves the codebook generation (see Fig. 2 – step MCA 7a.), which consists of identifying the main descriptors and assigning values "1" and "0". In line with Lopez-Duarte et al. ([46], p.512) procedure, using QDA Miner v.5 and Wordstat v.8 software, this stepwise process consists of "(I) extracting the key content from the articles' titles, abstracts, and keywords; (II) classifying it in order to build a reduced list of the core descriptors; (III) revising the codebook by merging the similar categories in order to obtain a meaningful list of descriptors in terms of content and frequency". Building upon the pivotal studies and reviews in Section 2, the authors developed the final codebook, which comprised 231 terms categorized into fourteen descriptors. Following multiple informed discussions among the authors and consultation with an external expert in the field, these descriptors were categorized into two primary groups based on their characteristics: theoretical approaches and frameworks and major research themes and topics. A comprehensive list of keywords and descriptors is provided in the supplementary material.

4. Results

4.1. Descriptive overview of relevant literature

Over the past years, there has been a noticeable academic interest in the intersection of human resource practices, absorptive capacity, and innovation among scholars from various domains. For example, the manuscripts were primarily published in journals within the domain of innovation (e.g., *Technovation*), Human Resources (e.g., *Human Resource Management* and *International Journal of Human Resource Management*) and broad management journals (e.g., *Journal of Business Research*; *Journal of Knowledge Management*; *Management Decision*) with around 60 % of articles being published in the period from 2018 to 2023, which in turn calls for a systematic organization of the intersection of the fields [47] (see Fig. 3).

Specifically, numerous studies have highlighted the importance of human resources practices, alongside individual knowledge development, learning, and absorptive capacity, as key drivers of organizational innovativeness. Recognizing that the domain intersection builds upon established fields and in light of the increasing interest among practitioners, the literature does exhibit a predominance of quantitative and qualitative studies (see Fig. 4).

The increased interest can be partly explained by special issues published in academic journals, such as *Management Decision* [48], and the recognition of human resources practices as well as the need to transition from Industry 4.0 to Industry 5.0, which focuses more on being human-centered. The ongoing globalization and intensification of technology development and diffusion processes have also increased the importance of the necessity for innovation-driven human resources practices and knowledge transfer within and among firms. Namely, the new paradigm encouraged practitioners and researchers to study this topic from different perspectives, focusing on specific and

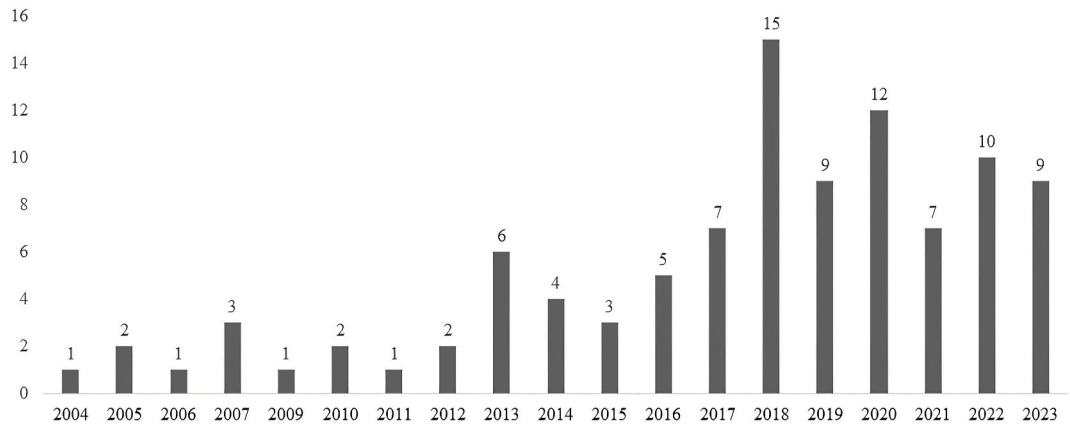


Fig. 3. Distribution of studies by years.

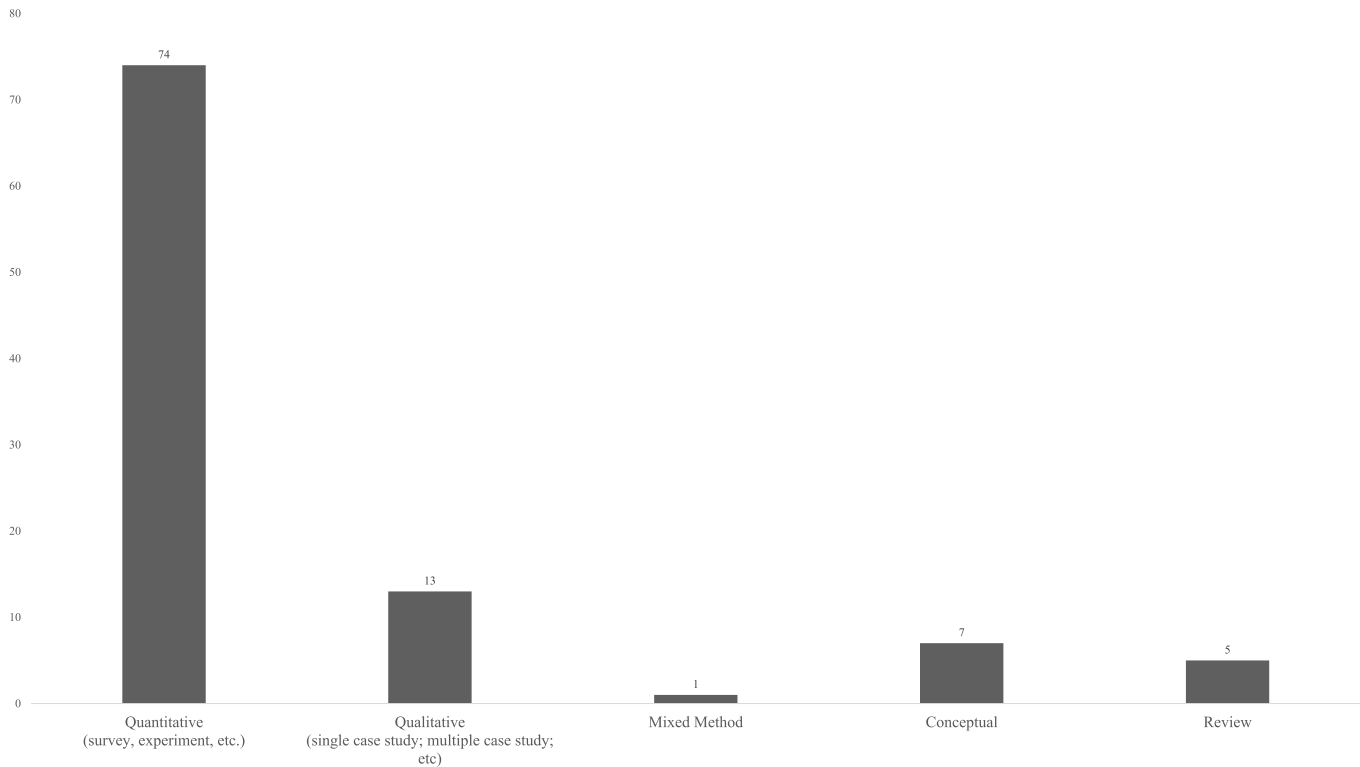


Fig. 4. Distribution of studies by method.

collaboration-based human resources practices that enhance organizational innovativeness and openness.

4.2. Theoretical approaches

A literature review reveals that research in the intersection of these domains is dominated by single-level and single-industry contexts, guided by divergent theories and frameworks [30]. This disparate literature leaves researchers with a fragmented understanding, highlighting the need for systematic analysis and a comprehensive perspective across various disciplinary fields.

The need for a structured approach is addressed by graphically depicting the intellectual structure, starting with labeling the poles outlined by López-Duarte et al. [49]. This labeling process, based on informed discussion among authors, relies on the most extreme-located descriptors and their frequency within each category. Table 1 shows the

labels, representative descriptors, and manuscripts illustrating the poles.

The variance explained by each pole is 25.24 %. However, this can be misleading as the map combines fourteen descriptors into two dimensions [49]. According to Hair et al. [61] and Furrer et al. [62], variance can distort MCA results, and the overall mean of keywords per article — should be above 1—is more significant. In our study, it was 1.24.

4.2.1. Resource-based view

The resource-based view (RBV) is the most frequently employed theory in research on firm internal dynamics, focusing on the intersection of human resource practices, absorptive capacity, and innovative performance. The RBV attributes differences in performance across firms to the heterogeneity of their resources and capabilities [63]. Several studies have found a positive relationship between human capital—such as knowledge, skills, and experiences—and human

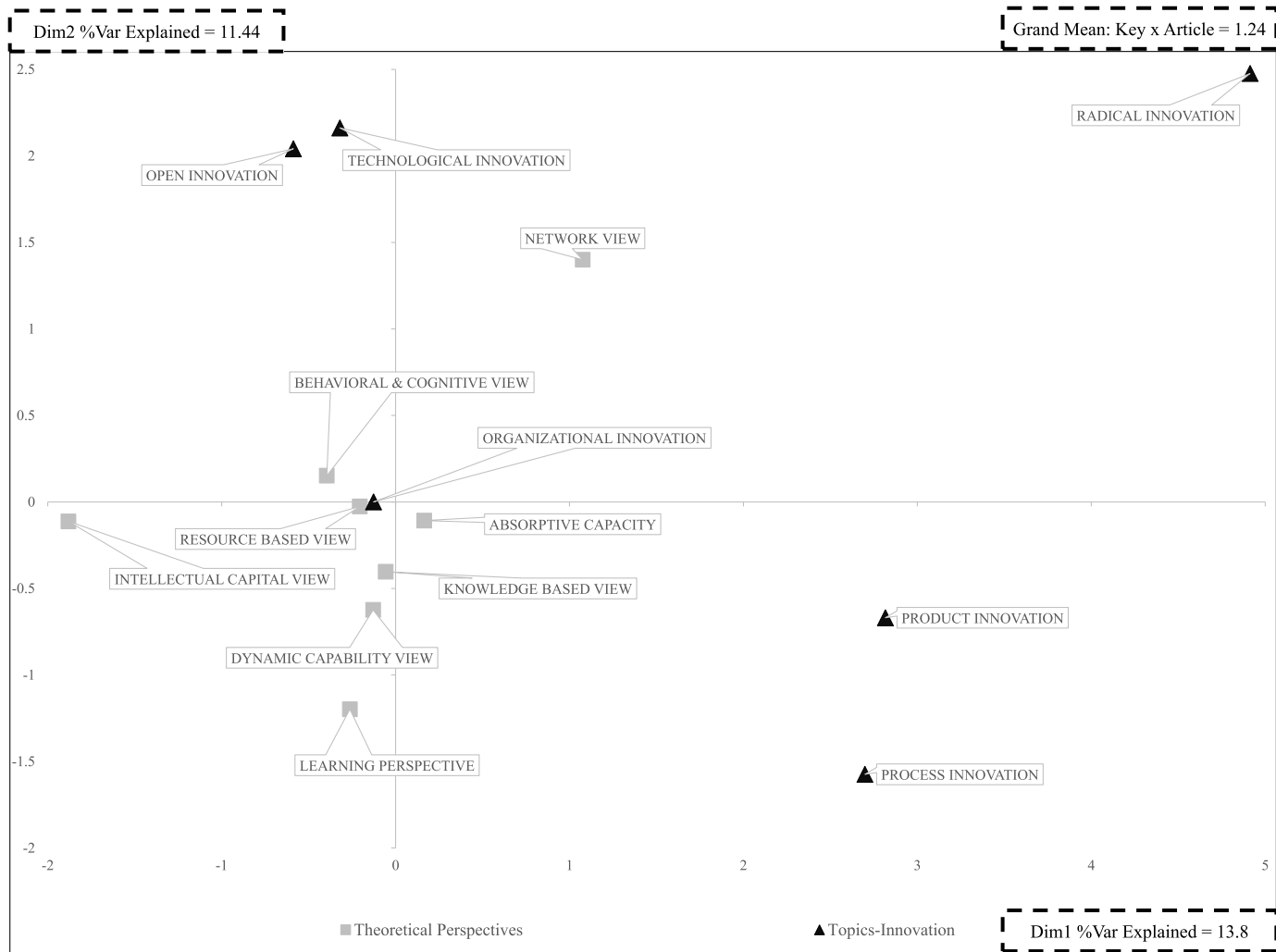


Fig. 5. Map of the theoretical perspectives and major research topics within the domain.

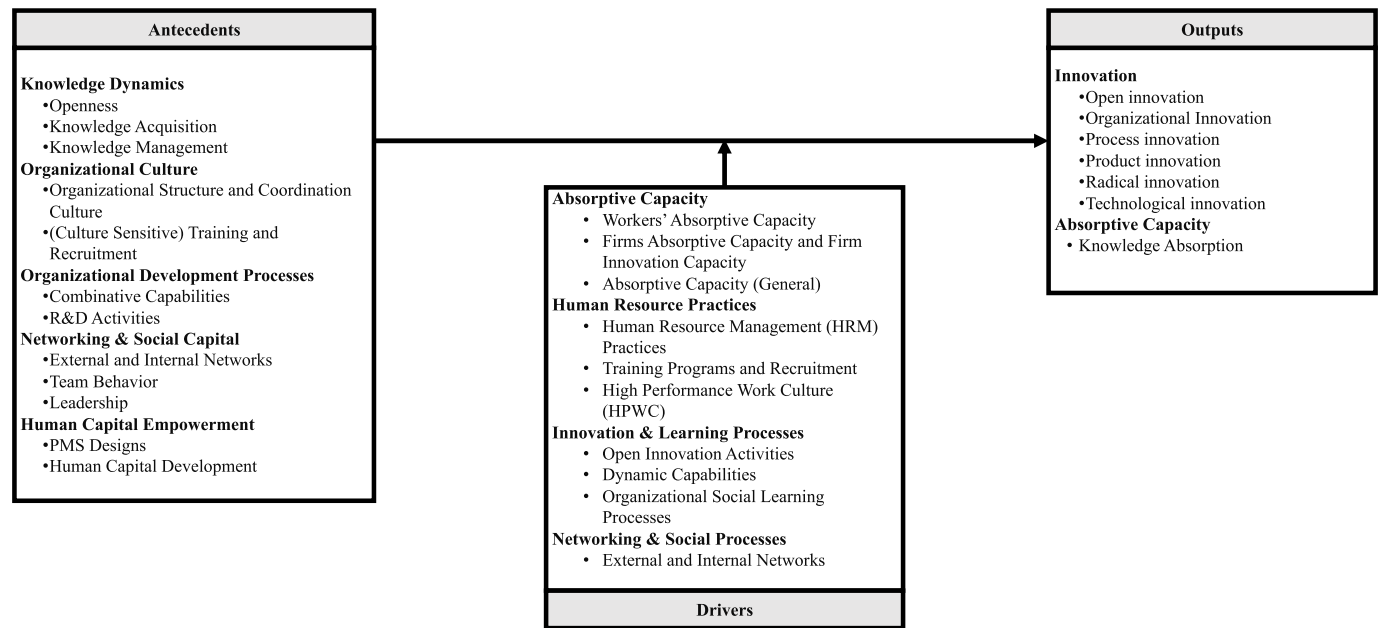


Fig. 6. ADO framework.

Table 1

Descriptors that represent the poles of the axes.

Axes	Descriptor	Origin of the axes descriptor	Exemplary studies
Axis X Right	Absorptive and Innovative Capability	Absorptive capacity, Radical Innovation, Product Innovation, Process Innovation	Gebauer et al. [50] Lavie and Rosenkopf [51], Cheng and Chen [52] Beck and Schenker-Wicki [53]
Axis X Left	Resource and Behavioral-Cognitive Perspectives	Resource Based View, Intellectual Capital View, Behavioral and cognitive view	Wang and Chen [29] Soo et al. (2017) [54] Bedford et al. [55] Mehralian et al. [6].
Axis Y Upper	Networking and Sharing Processes	Open Innovation, Network view	Lopez and Estevez [46] Kratzer et al. (2017) [56] Fisser and Qualls [57] Natalicchio et al. (2018) [58]
Axis Y Lower	Knowledge and Learning View	Knowledge Based View, Learning Perspective, Dynamic Capability View	Maes and Sels (2014) [59] Simao and Franco [60]; Sung and Choi [3]

resource practices, indicating that implementing human resource practices like R&D cooperation, high-performing work systems, learning-oriented processes, and training can enhance innovation performance [7–9].

Furthermore, within the RBV framework, human resource practices focus on key knowledge personnel, such as project team members who contribute to project performance, supporting previous findings in relevant contexts [64]. Mehralian et al. [6] stated, "an effective HR system should recognize employees as valuable resources for innovation and translate these resources into enduring and competitive capabilities for the firm." Through our literature review and MCA analysis, we observed that the resource-based view is often paired with the absorptive capacity perspective and the behavioral-cognitive view, which facilitate an understanding of human resource practices and their influence on organizational innovation (see Fig. 5). Broadly, RBV underscores the significance of cultivating unique employee skills and competencies to attain a competitive advantage. In alignment with this perspective, human resource practices prioritize investment in training and development to enhance human capital and promote a supportive organizational culture. Organizations foster innovative solutions and sustain a competitive edge by developing distinctive resources through a skilled workforce and a positive work environment.

4.2.2. Knowledge-based view

In this era of rapidly changing technology, firms are making significant efforts to expand their knowledge reservoirs, allowing them to gain an advantage through increased creativity and the generation of new ideas and innovations. By confirming a significant relationship between a company's knowledge stock and innovation strategy, Sung and Choi [3] demonstrated the importance of aligning management systems with business strategy. Results on the map (Fig. 5) showed that the knowledge-based view is close to the intellectual capital view, the absorptive capacity perspective, the dynamic view, and organizational innovation. This statement demonstrates that the knowledge-based perspective is frequently a crucial foundation, integrated with the intellectual capital framework and absorptive capacity, to reveal knowledge-intensive human resource practices and knowledge transfer. For example, in the Khaksar et al. [65] study, knowledge workers were greatly influenced by knowledge-based dynamic capabilities. This indicates that managers must develop norms and routines to sustain external knowledge absorption among their knowledge workers. Furthermore, a key concept of the knowledge-based perspective is that teams and organizations working in knowledge-intensive environments can improve performance through human resource systems tailored to their specific knowledge needs and performance demands. In particular, human resources practices designed for knowledge-intensive settings enhance knowledge exploration, supporting team knowledge exploitation [66,67].

The Knowledge-Based View highlights knowledge sharing and collaboration as crucial for innovation. Human resource management within this framework develops systems to capture and share knowledge, promoting continuous learning and adaptability. By fostering collective intelligence, organizations boost creativity, generate new ideas, and improve problem-solving, enhancing innovation and adaptability in dynamic markets.

4.2.3. Learning perspective

Organizational learning is a dynamic process propelled by individual learning and robust social relationships. This process results in structural and cultural modifications that enhance adaptability and promote innovation. In particular, Bornemann et al. [68] assert that organizational learning originates from individual learning processes, leading to organizational structure and culture changes to ensure survival in a dynamic environment. The authors examine how managers and technical experts manage organizational learning mechanisms and absorptive capacity to foster firm innovativeness. In their view, the organization's capacity for learning and transformation is crucial, with employee learning processes significantly generating new ideas and innovation [69,55]. These learning processes interact with combinative capabilities, explaining how a company organizes, shares, and manages knowledge [70].

Kang et al. [27] emphasized that organizational learning is a key driver of value creation, discovering that strong employee social relationships enable effective knowledge transfer and enhance organizational learning. Scholars largely agree that organizational learning in knowledge management can influence dynamic capabilities—such as absorptive capacity, information sharing, and change management—and ultimately enhance firm performance [71–73]. By efficiently managing knowledge-sharing mechanisms and absorptive capacity, organizations can improve their ability to generate new ideas and ultimately enhance value creation.

4.2.4. Network view

From a network perspective, a firm's absorptive capacity can be enhanced through investments in human capital, organizational routines, and network development and ties [9,69,74]. Specifically, this involves how well an organization is positioned within its network to access knowledge and its capability to learn and effectively utilize that knowledge from inter- and intra-firm relationships [75]. As portrayed in Fig. 5, the network view is often associated with technological and open innovation research, particularly regarding how it affects a firm's ties and overall degree of openness and performance. This implies that from a network perspective, human resource practices focus on improving employee interactions, balancing power dynamics, and facilitating R&D collaboration while implementing human resource practices that increase employee value and innovation potential. These efforts drive

technological and open innovation by enabling organizations to leverage networks, share knowledge, and foster collaboration, enhancing performance and developing innovative products, processes, and services.

4.2.5. Behavioral and cognitive view

Scholars regard human resources practices as the primary means by which firms shape and develop employees' skills, attitudes, and behaviors. These practices help employees perform effectively, innovate successfully, and achieve the organization's intended goals, enhancing their innovative performance [5,69,76]. As illustrated in Fig. 5, the literature emphasizes both cognitive and non-cognitive human capital elements and behaviors in influencing organizational competitiveness and innovation [77–81]).

From a cognitive perspective, human capital integrating advanced cognitive components—such as knowledge, skills, and experiences—and sufficient non-cognitive attributes—such as personality, values, and interests—is essential for fostering the complete array of organizational capabilities required for sustained competitive advantage and innovative performance. By strategically aligning human resource practices to optimize these elements, organizations enable employees to perform optimally, drive successful innovation, and contribute to long-term competitive advantage and innovation.

4.2.6. Dynamic capability view

Dynamic capability has been defined as "the firm's ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments" ([18], p. 516) or as "the firm's processes that use resources—specifically, the processes to integrate, reconfigure, gain, and release resources—to match or even create market change" ([82], p. 1107). Additionally, Cheng and Chen [52] describe dynamic innovation capabilities as operational capabilities encompassing organizational learning processes and routines based on innovation knowledge. These involve transforming a firm's resources and routines associated with innovation knowledge. The results of our analysis (see Fig. 5) show that the dynamic capability view is closely related to other theoretical approaches—the knowledge-based view, learning perspective, intellectual view, and resource-based view. From the dynamic capability perspective, individuals are seen as drivers of firm human capital development by maximizing education and skills development to achieve career success—a process facilitated by organizational structures and behaviors, including a learning-oriented culture [6,55,83]. In this view, human resource practices are crucial in cultivating a supportive, learning-oriented culture. Specifically, these practices enhance the capacity to respond effectively to dynamic environments by unlocking the intrinsic value of knowledge. The perspectives of dynamic capability and absorptive capacity collectively highlight human resource practices as a vital enabler of innovation.

4.2.7. Absorptive capacity perspective

Absorptive capacity refers to an organization's ability to effectively assimilate and utilize transferred knowledge. A higher absorptive capacity empowers an organization to understand received knowledge and unlock its intrinsic value. As a critical dynamic capability, absorptive capacity allows organizations to leverage external knowledge for innovation [10]. According to the results in Fig. 5, the absorptive capacity perspective is closely aligned with other theoretical approaches, including resource-based, knowledge-based, dynamic capability, intellectual capital, and organizational innovation.

From the resource-based perspective, firms must recognize their resources and capabilities, particularly employees' abilities to learn, assimilate, and acquire new knowledge. Scholars have noted that by adopting innovation-oriented human resources practices, firms significantly enhance their competitive advantage and innovative behavior [12,84]. This implies that organizations must implement internal management system changes to adapt to turbulence and foster new ideas

among employees.

Numerous researchers have explored the interplay between absorptive capacity and intellectual capital from a knowledge-based view. This perspective relates to knowledge transfer—such as team members acquiring and sharing external knowledge within the organization—which affects organizational innovativeness [55,60,85]. From the standpoint of organizational learning, "organizational learning" encompasses the methods by which organizations gather, generate, and disseminate knowledge to enhance performance and respond to evolving environments. It involves the acquisition, interpretation, and integration of new knowledge, as well as the modification of existing knowledge structures [27]. Studies from this perspective explore absorptive capacity concerning commitment-based human resources practices, organizational structures and routines, and knowledge creation in ambidextrous organizations [13,71].

From the network view, researchers focus on the social aspects of learning and innovation, particularly how social integration mechanisms—such as job rotation, participation in decision-making, team meetings, short-term visits, mobilities, and training—influence a network's ability to acquire and utilize new knowledge [10,46]. Furthermore, Fisher and Qualls [57] investigate absorptive capacity in the context of acquiring, managing, and integrating external knowledge and collaboration between firms to produce innovations.

The behavioral and cognitive views emphasize individual-level characteristics—such as abilities and motivations to absorb knowledge—which play a crucial role in a firm's absorptive capacity [17,86]. Findings in this area suggest that both organizational and individual characteristics impact creative work behavior, both directly and indirectly.

Finally, Table 2 presents the division of dominant theoretical underpinnings and their subtopics to outline the intellectual structure of the domain's intersection. Additionally, Table 2 highlights exemplary references for each theoretical perspective as a summary of the above sections.

4.3. Research themes through antecedents – drivers – output framework

In addition to the theoretical approaches identified in the full sample, this review employed targeted analysis of empirical papers to develop an Antecedents-Drivers-Outcome (ADO) framework [39,103]. Based on empirical evidence from a restricted sample of 88 empirical manuscripts, in this section, we present and discuss the main research topics integrated through the ADO framework (see Fig. 6). The development of the ADO framework follows the causal focus. As Ciuchta et al. [103] mention, the causal focus approach is a preference among scholars and is not inherently superior to other organizational methods. While this grouping might suggest that these studies focus exclusively on inputs, processes, or outcomes - and may impose a structure that does not fully align with how the original authors view their work - the aim is to present the main research topics and their interrelations transparently (see Fig. 6).

4.3.1. Antecedents

Inputs or antecedents refer to factors that precede a specific action. Earlier research has identified many inputs that alter internal organizational dynamics, which can lead to innovation. From our review, these antecedents can be divided into five major research groups: knowledge dynamics, organizational culture, organizational development processes, networking and social capital, and human capital empowerment.

4.3.1.1. Knowledge dynamics. Altering knowledge dynamics and fostering an organizational culture that values openness, learning, and experimentation with novel ideas are paramount. Herrmann, Gassmann, and Eisert [101] underscored the importance of such a culture in enabling the creation of absorptive capacity for radical innovations.

Table 2
Exemplary references regarding theoretical cornerstones.

Resource Based View	Knowledge Based View	Learning View	Network View	Cognitive – Behavior View	Dynamic View	Absorptive Capacity Perspective
Organisational Resources [12,58,87–89]	Intellectual capital [13,29,54]	Learning Capability [69,55,90]	Network Interorganizational [28,9,10,77,91]	Behavior [6,17,25,32,86,92].	Dynamic capability [74,93,10,87,94]	AC and RBV [85,95,96]
Organizational capability [15,17,26,97]	Knowledge Transfer [3,60,85] Knowledge-Intensive HRMP [66,67];	Learning Process [98]	Network Intraorganizational [46,69,53].	Cognitive [27,77,78,99,100];	Knowledge Dynamic [101,102,87].	AC and KBV [55,60,85] AC and OLV [13,25,27,71,93]

Pihlajamaa [102] further elucidated that robust knowledge documentation and storage mechanisms safeguard existing knowledge and facilitate its transformation and application, enhancing knowledge creation and expanding a firm's cognitive capacity to innovate.

As Alavi and Leidner [104] noted, knowledge management involves comprehensive processes that identify and leverage an organization's collective knowledge across activities such as creation, storage, transfer, sharing, and application. This process is integral to innovation, serving as a precursor to enhanced innovation performance by fostering the development and exchange of new ideas [99,105]. Nowacki and Bachnik [106] and Lee and Suh (2003) emphasize the strategic establishment of infrastructures that support implementing new ideas. These infrastructures ensure the functional application of accumulated data and the preservation of invaluable tacit knowledge, even after employee departure [107]. Hence, knowledge management is a core organizational strategy that leverages internal and external knowledge sources to spur innovation and performance.

Furthermore, Davenport and Prusak [108] emphasize that knowledge sharing is essential and necessitates the presence of knowledgeable individuals within an organization to enhance its knowledge base. This process demands additional support from organizational coordination mechanisms and continuous human capital allocation and reallocation. Consequently, incorporating these elements within the framework of knowledge dynamics constitutes critical antecedents in our model. By improving innovativeness and absorptive capacity through strategic human resource practices, organizations are better equipped to succeed in dynamic environments.

4.3.1.2. Organizational culture. A literature review highlights the crucial impact of organizational culture and coordination on improving knowledge transfer, a process significantly shaped by human resources practices. Cohen and Levinthal [11] elaborated that a firm's absorptive capacity hinges on individual abilities and organizational competence to foster knowledge exchange across various levels. This structured exchange is critical for nurturing a firm's expertise in knowledge management and innovation [109,110]. Empirical research by Demirkan [84] establishes a positive relationship between increased investment in employee training and enhanced product innovation capabilities within small and medium-sized enterprises (SMEs) in Germany. The study found the following: (1) industries with a higher proportion of university-educated employees demonstrate a weaker correlation between employee training and innovation capabilities; (2) the impact of training investments is less significant in larger SMEs compared to smaller ones; and (3) ongoing research and development activities reduce the effect of training expenditure on innovation capabilities. These findings contribute to the ongoing discussion about the necessity of employee training by affirming its importance while also highlighting the variable effects of such investments across different sizes of organizations under specific conditions.

Furthermore, employee training is recognized as a component of high-performance work systems that significantly enhance goal achievement in startups and SMEs [111]. Aligning with previous

research, Hatch and Dyer [112] and Beugelsdijk [113] underscore the crucial role of employee training as an essential mechanism for developing the knowledge and skills vital for new product development. Sung and Choi [3] argued that organizational investments in training and development foster a learning-oriented environment, facilitating knowledge and idea exchanges among employees and enhancing knowledge creation and innovation. Moreover, although sometimes underestimated by SME managers, employee training as an integral part of total quality management is positively associated with non-financial performance outcomes, including innovation and growth [114]. Consequently, this paper advocates for strategic investment in employee training to further develop employee skills and bolster product innovation capabilities in SMEs.

Addressing the nuances of language in multinational contexts, Peltonkorpi [115] highlighted the significance of language-sensitive recruitment and training in enhancing inter-unit knowledge transfer and bolstering a subsidiary's absorptive capacity. Such practices bridge language barriers and facilitate a more profound integration of knowledge across cultural divides, enhancing global coordination and innovation capabilities (Lester, 1994; [84,116]). Our review shows that organizational structures and practices are key components in the ADO model, summarizing the crucial elements that build a firm's capabilities. By developing these elements, organizations can drive innovation and gain a strong competitive position globally.

4.3.1.3. Organizational development processes. Our review revealed that this input is structured into two critical and interrelated components: combinative capabilities and research and development activities. Together, these elements form a synergistic input that enhances a firm's absorptive capacity and innovation outcomes. Combinative capabilities are fundamental to strategic innovation, encapsulating a firm's ability to systematize, coordinate, and socialize knowledge. These capabilities enable organizations to integrate existing knowledge with new insights, fostering an environment where learning and innovation can thrive. As Santoro and Usai [117] pointed out, combinative capabilities facilitate a balance between knowledge acquisition, exploration, and exploitation—processes essential for innovation management. Robles (2016) highlighted the critical role of these capabilities in empowering employees to manage their environments effectively and achieve organizational goals.

Similarly, Gebauer et al. [50] and Zollo and Winter [70] emphasized that adapting these capabilities is vital for successful strategic innovation. They argued that understanding the interaction between learning processes and combinative capabilities can explain differential competitive advantages among firms in similar contexts, suggesting a profound influence on converting external knowledge into strategic innovations. Author Gebauer [50], using multiple case study of two electricity providers, explored positive socialization effects of learning processes and absorptive capacity on product and process innovation.

Complementing combinative capabilities, research and development (R&D) activities play a dual role in building absorptive capacity and generating new knowledge and innovations. R&D efforts serve as a

channel for acquiring and integrating external knowledge within the firm's existing knowledge base. Schmidt [85] elaborated that while R&D intensity may not directly influence the absorptive capacity for intra- and inter-industry knowledge, integrating R&D with skilled labor and knowledge management tools is crucial for effectively exploiting external knowledge. Ghebrihiwet [118] and Martínez-Sánchez [119] highlighted that continuous investment in R&D significantly enhances the likelihood of introducing new and imitative innovations, while human resources practices related to R&D efforts positively influence innovation performance. Roy [9] adds that cooperative R&D, supported by effective human resource practices, strongly facilitates incremental and new-to-market innovations.

By synchronizing combinative capabilities with R&D activities, firms can implement various strategies to improve their absorptive capacities and innovation outcomes. Combinative capabilities ensure that the knowledge generated through R&D is effectively integrated and utilized across the organization. This interaction supports the development of new products and processes and improves the firm's strategic behaviors and efficiency in the competitive landscape. Such an approach to innovation and development is important for firms aspiring to maintain and enhance their market position through continuous improvement and strategic innovation.

4.3.1.4. Networking & social capital input. Networking and Social Capital are vital for fostering an environment conducive to innovation, encompassing three critical areas: External and Internal Networks, Team Behavior, and Leadership. To begin with, strategically configuring both external and internal networks enhances knowledge acquisition and appropriation [46]. These networks enable seamless knowledge flow and integration, fostering continuous innovation and improvement. Next, team dynamics significantly impact an organization's absorptive capacity - the ability to assimilate and apply new knowledge [11]. For example, positive team behaviors are linked to innovative outcomes [120], while negative interactions can hinder performance and morale [121–123]. Equally important, effective leadership is paramount in promoting knowledge sharing and innovation. In particular, supportive leadership enhances performance by encouraging knowledge-sharing behaviors [124]. Thus, empowering and transformational leadership styles stimulate participation in innovation processes [125,126]. Next, training managers in participative leadership further improve receptiveness to employee ideas [69]. Collectively, well-structured networks, positive team dynamics, and strong leadership enhance an organization's innovative capabilities explored within Taiwan's high, medium, and low-technology firms [69]. Integrating these elements into strategic human resource practices positions organizations to thrive in dynamic environments.

4.3.1.5. Human capital empowerment. Empowering employees and enhancing their ability to innovate and embrace an innovative culture are critical inputs, encompassing performance management systems (PMSs) and human capital development. PMSs enhance employees' capacity to assess organizational activities within their context, enabling decisions that optimize the firm's long-term performance ([127,128], 2000). Studies have explored the effects of PMS design on organizational outcomes, including capability development [129], effectiveness [130], innovativeness [55], and performance [131,132]. Although some conceptualize PMSs as singular practices, numerous design decisions contribute to their construction, each potentially having different impacts (Homburg et al., 2012). Earlier studies concentrate on specific performance measurement system (PMS) characteristics [133,134]. PMSs are formal information collection tools that promote organizational learning [129]. Previous research underscores the importance of environmental factors in shaping the impact of PMSs [93,135,136] and in affecting the precursors and consequences of absorptive capacity ([14,137]; Roberts, 2015). Bedford et al. [55] argue that environmental

dynamism moderates the connection between PMS design choices and potential absorptive capacity within this framework.

Organizations adopting a commitment-based HR approach view human resource practices as long-term investments in employees [138]. This aligns with a knowledge-based employment model, where human capital is considered a crucial strategic asset. Consequently, human resource practices focus on acquiring and enhancing employee skills and competencies (Lepak & Snell, 2002). This underscores the importance of knowledge-based employment models and performance measurement design systems—such as the scope and integration of performance measures—in highly dynamic situations. These systems enable members to obtain relevant metrics from external information recognized through scanning and evaluation systems. By optimizing these elements, firms can improve internal processes and enhance their competitive position through better knowledge management and innovation outcomes. In particular, our review highlights performance-driven incentives, flexible training schedules, and learning activities, alongside strategic recruitment and selection, as key factors in promoting knowledge acquisition and innovation.

4.3.2. Drivers

Our review has identified factors that can facilitate, and challenge innovations driven by human resource practices. Specifically, we have identified notable moderators or drivers and clustered them into categories linked to absorptive capacity, specific human resource practices, innovation and learning processes, and networking and social processes.

Absorptive capacity is vital for empowering workers and boosting an organization's innovation capabilities. It refers to the ability to recognize the significance of new knowledge, assimilate it, and apply it to specific issues [72]. Peltokorpi [115] describes absorptive capacity as the ability of employees in overseas subsidiaries to absorb added information from the internal sources of multinational firms. Schmidt [85] also refers to it as a company's capacity to detect, integrate, and leverage knowledge from its surroundings. Additionally, Lopez and Esteves [46] discuss the significance of internal and external networks in knowledge acquisition. These insights highlight the importance of prior knowledge when utilizing the latest information for business objectives. Enhancing a company's dynamic innovation capabilities can improve its absorptive capacity, enabling the identification of new knowledge and the development of innovative technologies.

Innovation and learning processes, as drivers within the antecedents-drivers-outcomes (ADO) framework, stress the role of knowledge, creativity, competence, experience, skills, training, and attitude in building human capital within businesses. Blundell et al. [139] and Lenihan et al. [140] identify education as crucial in improving employee competency. Furthermore, Malisic and Tinaj [141] stressed that creating educational and training lifelong learning programs for SME employees is crucial for developing employees' competencies, such as innovativeness and creativity, which foster an innovative environment and firm performance. Scholars such as Cummings and O'Connell [142], Sultana and Rahman [143], and Holtzhausen and Botha (2019) consider innovative leadership to be a crucial driver of organizational success and innovation. They define creative leadership as combining diverse leadership styles to motivate people to develop innovative ideas, products, and services, cultivating a culture of innovation and trust within enterprises.

Open innovation is a collaborative approach involving relationships with external groups to enhance research, development, and innovation. Matsuzaki et al. [144] emphasize the importance of collaboration with universities, public research institutions, and other enterprises as critical components of open innovation. What's more, Liu et al. (2022a) and Zhang et al. [145] define knowledge management as an organizational strategy aimed at acquiring, developing, and utilizing knowledge to support employee performance and improve organizational learning capacities. All these components describe the relationship between knowledge-oriented leadership, organizational learning capabilities,

absorptive capacity, and employee performance. They emphasize the roles of organizational learning capabilities and absorptive capacity as mediators and moderators, respectively.

Networking and social processes play a crucial role in innovation domain. West et al. [146] suggest that organizations with a diverse human capital pool have an advantage in open innovation, as they can leverage existing diversity rather than create it by hiring fresh staff. Open innovation is commonly understood as the inflow or outflow of knowledge across organizational borders, emphasizing the inflow component—using external knowledge sources to expedite the innovation process. Social networking and social processes collectively underline the importance of well-structured networks, positive team dynamics, and strong leadership in enhancing organizations' innovative capabilities. By optimizing these elements, firms can improve their internal processes and strengthen their competitive market position through better knowledge management and innovation outcomes.

4.3.3. Output

Various literature sources illustrate the complex nature of innovation and its connection to internal dynamics. Our analysis identified several outcomes of altering internal dynamics and empowering human resource practices, enabling us to recognize organizational changes linked to the enhancement of different types of innovation—open, organizational, process, product, technological, and radical—as well as absorptive capacity. Understanding these connections is essential for organizations aiming to enhance their innovative capabilities.

Developing innovative and useful ideas for services, products, procedures, and processes [147] relies on assessing, integrating, and applying new knowledge [11]. In this context, adopting human resource practices that link organizational culture behavior with outcomes is imperative, particularly in achieving innovation. Innovation requires "without a box" thinking and merging often unrelated knowledge into new concepts. Zhang et al. [148] suggest that creativity and innovation arise from team interactions; thus, fostering effective team dynamics is critical for the success of innovation. Wright and Snell [149] emphasize the necessity of empowering human resources with flexibility regarding resource and coordination capabilities, including the extent to which an organization possesses various skills and how quickly they can be activated, underscoring the importance of adaptability in human resources and organizational processes.

Park et al. [92] portray human resource practices as necessary for technology innovation, encompassing component and combinative skills within human resource management systems. Moderating human resource practices—such as training programs, recruitment strategies, and fostering a high-performance work culture—addresses the relationship between human resource flexibility and absorptive ability. These practices highlight how businesses can leverage internal and external information to gain competitive advantage and enhance innovativeness. By investing in these areas, organizations can build a skilled and adaptable workforce capable of driving innovation forward.

Chesbrough [150] portrays open innovation as accelerating innovation through blurring organizational borders and embracing external sources. Several scholars, including Lavie and Rosenkopf [51], Cheng and Chen [52], and Beck and Schenker-Wicki [53], acknowledge the role of external sources and emphasize the significance of dynamic innovation capabilities and absorptive capacity in fostering breakthrough innovations and enhancing innovation performance. Similarly, Bogers et al. [16] examine how diversity within firms can facilitate openness to external knowledge sources, contributing to open innovation efforts. Papa et al. [151] underscore the role of HRM in shaping the relationship between the firm and its employees and developing technology through open innovation techniques. These studies collectively highlight the critical role that external knowledge and partnerships play in the innovation process.

As depicted in Fig. 5, the networking view is often associated with technological and open innovation research, particularly regarding how

it affects a firm's ties and overall degree of openness and performance. Lopez and Estevez [46] explore external and internal networks as the main resources for gaining new knowledge and supporting technological and open innovations. Their study includes research on new Web 2.0 applications and a new management paradigm of knowledge storage to accelerate the processing of large datasets, enabling organizations to scale their hiring processes swiftly to meet dynamic market demands. Organizations must adopt new technologies and networking to remain innovative.

The literature review and MCA analysis indicate that the resource-based view is often combined with the absorptive capacity and behavioral and cognitive views to understand human resource practices and their impact on innovation. Our review demonstrates that organizational innovation is closely associated with a knowledge-based view, suggesting that the knowledge-based view, intellectual capital view, and absorptive capacity are essential for understanding the relationship between internal dynamics and innovation. This association can be explained by the significant influence of knowledge-based dynamic capabilities, indicating that employees must develop norms and routines to support external knowledge absorption. Consequently, building these capabilities within the workforce becomes a strategic priority for organizations seeking to innovate.

These insights stress the importance of deliberate investments in human resource practices as a cornerstone for fostering innovation. Organizations can create a solid foundation that supports continuous innovation and long-term success by focusing on developing their human resources.

5. Future research and implications

Innovation is necessary for organizational competitiveness and performance in a rapidly evolving technological landscape. Recognizing the relevance of organizational capabilities, the critical role of the environment within an organization, and the pivotal contribution of human resources in value creation, our review reveals the current state of research and what gaps or future research opportunities exist in this domain.

In light of the MCA analysis results, we have developed Fig. 7 to serve as a guideline for formulating future research agenda. It identifies key topics and theoretical foundations that form the basis of the domain's intersections and those that are emerging or currently under-explored. Specifically, Fig. 7 illustrates the frequency of each topic and theoretical foundation, depicting their relative distance from the central interplay of the domain [44]. This approach categorizes topics into distinct quadrants: well-researched topics in the top-left quadrant, emerging topics in the bottom-left quadrant, and under-researched topics in the bottom-right quadrant. Coordinates derived for Fig. 5 were used to calculate distances between each theoretical perspective and major research topic relative to the center of the map. Fig. 7 visualizes these outcomes, dividing the map into quadrants. The top-left quadrant represents well-researched topics characterized by high frequency and proximity to the center, indicating they are fundamental to the field of research. Although these topics are foundational, future studies should assess their continued relevance critically. The bottom-left quadrant highlights emerging topics, reflecting areas of increasing scholarly interest and identifying potential gaps in literature that require further investigation. The bottom-right quadrant identifies pertinent gaps, emphasizing under-researched topics that offer significant opportunities for future study. This approach is acknowledged for its efficacy in identifying and visualizing areas with varying degrees of research attention (see examples in Ref. [45,152]), thus providing a compelling framework for future research development.

Traditional human resource management approaches aim to align firm internal dynamics with business strategy, leveraging knowledge, connections, and organizational resources to transform and innovate existing norms and approaches. The results of our analysis show the

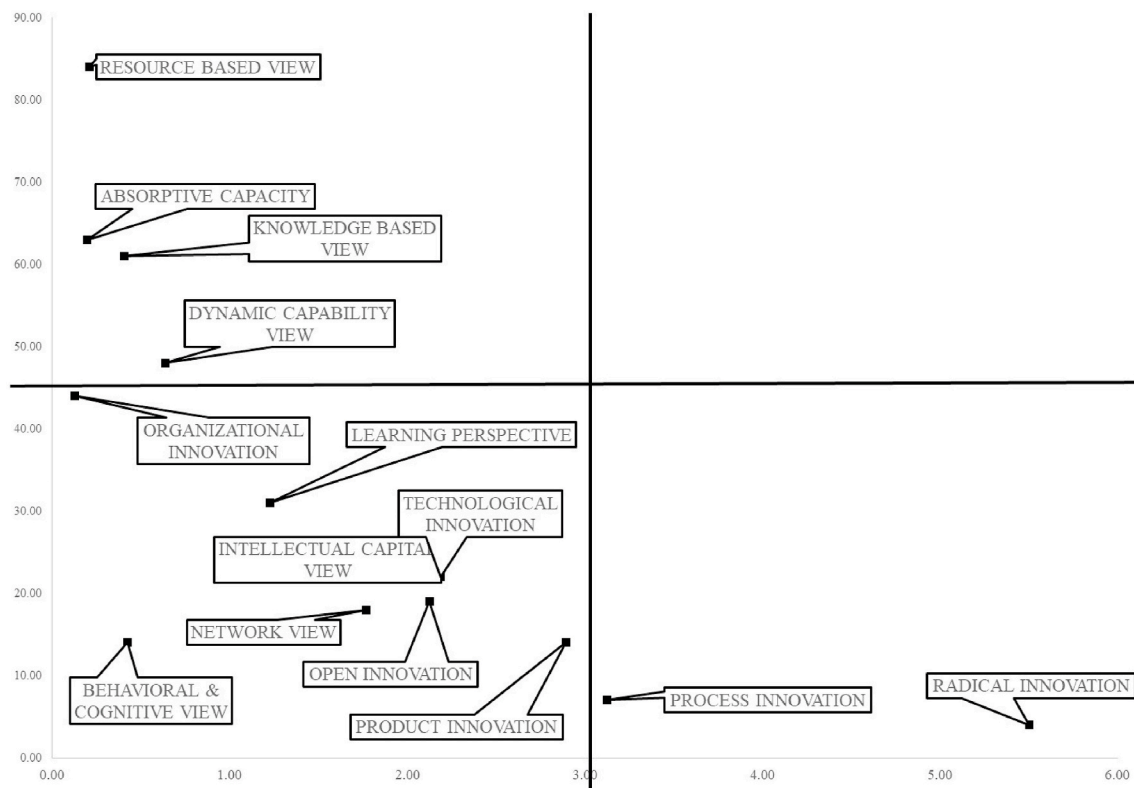


Fig. 7. Domain intersection theoretical underpinnings and topics distance and frequency.

Note: Horizontal axis represent distance from the center of the intellectual domain while vertical axis represents frequency of descriptor within the domain.

continuous scholarly emphasis on conducting research built upon the tenets of theoretical views such as resource-based, knowledge-based, and dynamic view perspectives, while there is a lack of study around topics of process and radical innovation (see Fig. 7).

Consequently, our review concurs with Aliasghar et al. [153] notion that process innovation is relatively underexplored, which is surprising considering that complementary to product innovation, process innovation is one of the methods organizations use to create value through internal and external integration. Recognizing that knowledge sharing and social cohesion are crucial for innovation, our review identifies that studying the relevance of the working atmosphere or organizational culture and its influence on knowledge transfer and potential information asymmetry caused by knowledge hiding represents promising research avenues.

Acknowledging behavioral and cognitive perspectives as emerging theoretical foundations for understanding the interaction between human resource practices, absorptive capacity, and innovation raises questions about the influence of traits such as a strong need for power or a high propensity for risk-taking. To what extent do these traits genuinely drive innovation? When considering cognition, it asks which aspects are most pertinent. Should the emphasis be on decision-making processes, such as those identified by Kahneman's (2011) System 1 and System 2, in relation to innovation? It could be argued that human resource practices that balance intuitive and analytical decision-making modes might give firms a dual advantage in fostering a responsive yet informed approach to innovation. Some perspectives suggest that intuitive decision-making, which relies on simplified heuristics and fast responses, might support rapid adaptation and absorptive capacity in dynamic markets. Conversely, analytical decision-making could enable a deeper, more deliberate integration of complex information, potentially enhancing the quality of innovative outcomes.

Another important aspect is the relationship between a firm's internal dynamics, specifically its diversity, equality, and inclusion

practices, and its absorptive capacity, which is critical in promoting innovation. Research suggests that diverse teams bring varied experiences and viewpoints, which can lead to more creative problem-solving and innovation. The interactions among individuals from different backgrounds can generate new ideas, facilitate effective feedback, and improve the integration of mechanisms within organizations. Understanding how diversity, equity, and inclusion influence the relationship between human resource practices, absorptive capacity, and innovation is essential for developing more inclusive organizational strategies that promote creativity and performance.

In particular, our literature review aligns with Wang and Chen's [29] systems approach, linking a high-performance work system of HR practices (e.g., staffing, training, skill-based rewards, and team development) with intellectual capital, emphasizing development and innovation. In this context, future research can significantly contribute by illustrating promotion focus and prevention focus practices. Researchers could explore how various formal incentives, motivations, and feedback related to the regulatory focus can encourage competitiveness and innovativeness. Above all, an important research gap concerns employee voice empowerment, employee motivation, and its effects on transitioning from potential to realized innovation, which may be negative when long-term benefits and incentives are diminished. Conversely, hiring temporary workers or embracing a hybrid modus operandi can introduce fresh ideas to companies and inspire full-time employees, fostering the development of new process solutions (e.g., reducing development times and improving quality and reliability). To capture these effects and recognize noticeable improvements in production processes, future research may benefit from digging deeper into the role of prior research and development experience and the investment in workers' skills, particularly across various levels and sizes of departments or organizations.

Concentrating on fundamental changes through radical innovation within significant contexts like multinational corporations offers

promising research directions. This line of research might examine how human resource practices impact the ability of these companies to capitalize on opportunities through collaboration with various external organizations, including suppliers, customers, universities, public research institutes, and commercial R&D laboratories from different regions. Accordingly, the breadth of human capital, encompassing both cognitive and non-cognitive dimensions, directly influences the development of sustainable competitive advantages and organizational innovation. As such, this research line could encompass specific skills acquired through professional international experience and the role of personal traits such as motivation, personality, and values in enhancing radical innovation. Next, given that radical innovations entail higher risks and call for strategic reward incentives like career advancements (e.g., moving from junior to senior positions), analyzing human resource practices individually or as part of cohesive bundles is essential. Considering that human resource practices affect performance-related outcomes [154], the strategic integration of performance measurement systems represents crucial mechanisms that influence organizations' innovative capabilities and absorptive capacity. For example, authors von Briel et al. [10] explored the role of social integration mechanisms on radical innovation focusing on knowledge distance. Knowledge distance is the distance between external knowledge and internal knowledge within firms. This study explored the importance of absorption of knowledge distance on radical innovation – the intersection of the absorptive capacity and innovation. Despite its significance, research on radical innovation remains scarce. Our review recognizes this gap and proposes the following questions: How do specific human resource practices influence and support radical innovation? In what ways do team social networks shape radical innovation outcomes? How can team creativity drive and sustain radical innovation? How do knowledge transfer processes between teams and their partners enhance radical innovation, particularly when mediated by organizational strategies and culture?

Embracing research on network density, two-way interactions that help the interpretation and understanding of new external knowledge, alongside the role of supportive cross-departmental relationships, represents a promising research avenue. Especially considering that Gebauer et al. [50] highlighted how information socialization affects all four learning processes (exploratory, assimilative, transformative, and exploitative). Therefore, future research can significantly contribute by illustrating the practices and impacts of companies that urgently need to manage the accumulation of external knowledge. It is essential for these companies to enhance their combinative capabilities—such as systematization, coordination, and socialization of knowledge—and to ease information overload in order to succeed in innovation. Further exploration of the capabilities essential for radical and process innovation should include a comprehensive analysis of individual, team, organizational, and inter-organizational dimensions, with particular attention to the characteristics of knowledge distance.

Next, exploring how the learning perspective enhances process, and radical innovation would be useful, seeing as firms' capability to absorb, assimilate, and transform new external knowledge. This involves continuous perception of the environment (e.g., market changes, technology trends) and appropriate reaction to changes (e.g., new strategies or improved business processes). Furthermore, exploring the relationship between learning processes and innovation outcomes would be useful, including network and intellectual capital views as the evolution of learning processes and combinative capabilities. Future research could examine the convergence of absorptive capacity and network perspectives because the concept of absorptive infrastructure is vital for effectively assimilating and utilizing new knowledge. The importance of internal and external networks in knowledge acquisition significantly influences learning process evolution and combinative capabilities, which drive innovation.

In an era of ever-expanding sources of information, further to research gaps identified in Fig. 7., several topics linked to artificial

intelligence (AI) emerge, focusing on how AI affects work practices, creates new interaction paradigms, and transforms organizational processes. In recent years, AI-driven tools have emerged as viable solutions to address challenges in employment and recruitment, offering scalability, efficiency, and the potential to reduce biases [155]. For instance, companies such as Sapia and Pymetrics have pioneered the use of AI in recruitment by implementing Natural Language Processing (NLP) models to infer personality traits from text and interviews (Dai et al., 2022). However, despite the promise shown by AI systems, their psychometric properties—such as reliability, validity, resistance to social desirability, and their impact on firm innovativeness—remain under-explored in academic literature and warrant further research. The rapid adoption of AI in recruitment processes has significantly transformed how organizations identify, assess, and select candidates. For example, traditional psychometric tests, long considered the gold standard in predicting job performance, have demonstrated robust validity and reliability over decades (Schmidt & Hunter, 1998). We recommend that researchers investigate how integrating artificial intelligence enhances organizational capabilities, particularly in maintaining a competitive edge through effective and adaptable recruitment processes. Accordingly, research into AI and its effects on human resources will provide insights into necessary workforce adjustments, re-institutionalization practices, and training programs so that employees can work effectively alongside AI technologies and continue to enhance organizational innovativeness.

Furthermore, it is essential to thoroughly examine how AI will influence various aspects of employee roles, including redundancy, replacement, displacement, and the creation of new opportunities. This includes evaluating the evolving skills requirements, the impact on job meaningfulness, workforce relationships and dynamics, job satisfaction, and innovativeness. Additionally, as companies harness AI's innovative potential, future research should investigate the associated risks and uncertainties due to its rapid development, as well as the potential for misuse.

5.1. Managerial implications

Human capital represents a multifaceted asset integral to innovation. Empowerment of human capital and pursuit of innovation and innovativeness depends upon elements of an 'innovation supportive' workplace, such as encouragement of risk-taking, freedom and autonomy, facilitation of collaboration, and provision of resources and support. Our review has shown that in organizations where team members' knowledge, suggestions, and opinions are vital for operations, managers need to focus on encouraging knowledge sharing positively. This approach can boost team members' ability to absorb new information and foster knowledge integration to generate innovative ideas. Additionally, organizations should offer training programs to educate managers on effectively encouraging knowledge sharing. We outline antecedents and drivers of innovation and absorptive capacity through the ADO framework. One particular notion that stands out from our review is the recognition of human resource professionals and the necessity for their proactive approach in creating, diffusing, and stabilizing changes, as employees are often convulsed due to organizational policy changes and practices that diminish trust, support, and respect. Therefore, we concur with Chowdhury et al. (2023) recognition of decision-makers' relevance in deploying resources to inspiring innovation-oriented organizations and making a difference, as this is likely to depend on internal organizational dynamics.

Equally important in today's era of technological advancements is the significance of performance measurement systems (PMS) as essential precursors to innovation. Our review highlights several scholars, including Lill et al. (2020) and Bedford et al. [55], who have demonstrated the crucial role that PMSs play in enhancing an organization's absorptive capacity - the capability to comprehend, assimilate, and utilize external knowledge. For example, Bedford et al. [55] suggest that

a broad-scope PMS correlates with a higher potential absorptive capacity in dynamic environments, enhancing the organization's ability to effectively acquire and assimilate external knowledge. Conversely, higher integration within PMSs may dampen this potential in such environments, though both broad scope and integration positively influence the realized absorptive capacity. This realized capacity pertains to the transformation and exploitation of acquired knowledge, which is crucial for sustaining competitive advantage and fostering innovation. These insights illuminate the nuanced impact of performance management and system design on a firm's innovative processes and outcomes. Companies can better harness their innovative potential and adapt more effectively to changing market conditions by strategically aligning internal dynamics with organizational goals and environmental demands. This strategic alignment is critical in a context characterized by rapid technological changes and intense competition, where practical knowledge and innovation management are critical to success.

6. Conclusion

Given the significant relevance of internal dynamics on innovation and their impact on organizational competitiveness, the topic of human resource management practices combined with absorptive capacity has attracted considerable interest among academics and practitioners. The increase in scholarly research since 2018 highlights the continuous efforts of scholars, managers, administrators, and policymakers to empower HRM and enhance absorptive capacity and innovation. By recognizing the key intersections within this domain and emerging or under-explored topics, our review adds value by highlighting existing connections and identifying gaps at these intersections. Specifically, the review provides a blueprint for further development in this field through recommendations and proposed avenues for future research that link unexplored topics—such as the network perspective, learning approach, intellectual capital, and various innovation types and methods.

As with many other reviews, this manuscript has certain limitations. First, our analysis excluded proceedings, conference papers, books, and grey literature. While most reviews primarily focus on peer-reviewed manuscripts, we acknowledge that relevant practices and novel approaches may exist in sources beyond our scope, which could have influenced the ADO framework and the outcomes of the MCA analysis. Additionally, recognizing that collecting and synthesizing manuscripts from various sources may introduce some author biases due to inherent subjectivity, we believe future reviews can build upon our work by extending beyond the intersection of the three domains and examining internal dynamics, such as innovative organizations or tangentially related areas like organizational resilience, digital transformation, or technological readiness. Similarly, we acknowledge a limitation related to the content analysis and execution of the hybrid approach, which, like search query development and data selection, may reflect some author biases. Despite these limitations, our study proposes several directions that we hope will inspire future research and draw further attention to this timely topic from both scientific and societal perspectives.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used ChatGPT 4o in order to improve readability and language of the manuscript (e.g., spelling and grammar check). After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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CRediT authorship contribution statement

Bojana Malisić: Writing – review & editing, Writing – original draft, Methodology, Data curation, Conceptualization. **Sandra Tinaj:** Writing – review & editing, Writing – original draft, Validation, Formal analysis, Conceptualization. **Jovana Popović:** Visualization, Methodology, Data curation. **Lidija Lukovac:** Visualization, Methodology, Data curation. **Božidar Vlačić:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.techsoc.2024.102773>.

Data availability

Data will be made available on request.

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