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**EXPLORING THE INTERSECTION OF STRATEGIC HUMAN RESOURCE MANAGEMENT AND INDUSTRY 5.0: A SYSTEMATIC LITERATURE REVIEW\***
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**Abstract.** The concept of Industry 5.0 (I5.0) represents a new form of industrial transformation that emphasizes the synergy of human resources (HR) with advanced technology. This concept has been appearing in the literature since 2020. It is only associated with certain areas of HR issues. The relationship with Strategic Human Resource Management (SHRM) provides a space for identifying new insights in this area. In the context of I5.0, SHRM is a key tool that contributes to sustainability through building a flexible and resilient workforce. This study aims to identify critical areas where the link between SHRM and I5.0 can be explored, with further discussion and an outlook on future research opportunities. A bibliometric analysis was undertaken, and a PRISMA diagram was developed. The areas where we find a link between SHRM and Industry 5.0 based on a systematic literature review are big data analytics in human resource management, IT cost and technology change management, digital transformation and its impact on innovation or organizational resilience.

**Keywords:** Industry 5.0; strategic human resource management; transformation; technology; human resource

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**JEL Classifications:** O14, O15, O33, Q56

## 1. Introduction

The proliferation of digital technologies is driving dramatic changes in industry and society. For the industry to become a real driver of prosperity, it must embrace social, environmental, and societal aspects (Chen et al., 2022; Androniceanu & Georgescu, 2022). The symbiosis of the three segments - technological, social, and environmental - forms the essence of I5.0 (Grabowska et al., 2022). Ghobakhloo et al. (2022) define I5.0 as a paradigm shift in managing digital industrial transformation to achieve sustainable economic and socio-environmental development. Industry 5.0 is a new concept in the Industrial Revolution that emphasizes the synergistic relationship between people, machines, and technology, increasing enterprises' competitiveness and enhancing their ability to contribute to sustainable development and environmental goals. In the era of digital innovation, HR departments around the world are using digital applications, artificial intelligence, and robots to create "employee experience platforms" to support the ever-changing needs of employees (Zhang & Chen, 2023). The information systems create an inevitable condition for effective work with human resources (Vlasekova & Mura, 2017). One of the most important barriers to its development is the availability of skilled human resources (Leon, 2023).

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This concept brings with it new challenges and opportunities for strategic human resource management (HRSM). Therefore, HRSM must address the issues of how to ensure that employees have the necessary skills and abilities for new jobs. Also, the challenges that Industry 5.0 will bring within the HR field are social changes or ethical issues. Industry 5.0 also brings opportunities for HR, such as new opportunities for employee development, improved productivity, or new business opportunities. The main responsibilities of HR departments include conducting job analyses, creating job descriptions or identifying business processes. HRM departments will need to restructure much of their work before incorporating robots into their businesses (Demir et al., 2019). With the huge amount of data (Big data) that will help in an even better selection of candidates, the tasks of the human resource manager will become more difficult. HR managers, HR executives, and HR practitioners will need to acquire a new set of competencies that match their evolving duties and responsibilities if they want to sustain the transformation of the HR management function (Tataru, 2019). It is, therefore, necessary to address these challenges and opportunities to ensure that employees and organizations are prepared for the new era of the industrial revolution, and to emphasize human capital and its development, which is key to the ability of companies to adapt to a dynamic environment while supporting the creation of innovative and sustainable business models.

The main aim of the study is to identify critical areas where the link between SHRM and I5.0 can be explored, with further discussion and outlook on future research opportunities. This paper provides a systematic review of studies that address strategic human resource management in the context of Industry 5.0. In line with the stated aim of the study, the wording of the research question is as follows: RQ: What is the current knowledge on the relationship between strategic human resource management and Industry 5.0, and in which areas are there research gaps that could provide the impetus for further research?

This paper is structured as follows. The next section describes the theoretical background of this study. The methodology used in this study is then explained, followed by a description of the findings and a discussion of studies that have focused on the research topic. Finally, the conclusions and implications for future research are presented.

## **2. Theoretical background**

Industry 5.0 and Society 5.0 are key to supporting efforts to achieve the Sustainable Development Goals (Kasinathan, et al. 2022). Maddikunta et al. (2022) argue that Industry 5.0 represents the next step in industrial development, which focuses on harnessing the creativity of human experts combined with intelligent machines to achieve resource-efficient manufacturing solutions that are both resource-friendly and meet user preferences. It represents a new revolution that follows Industry 4.0 and is characterised by the mass personalisation of existing technologies such as data analytics, cyber-physical systems, artificial intelligence, machine learning, and the Internet of Things. Related to this transition is the adaptation of the human resource management of organizations (Ganer, et al. 2022).

The authors Cabrilo and Dahms (2018) found that structural and relational capital have a direct impact on innovation performance, with human capital influencing innovation in conjunction with strategic knowledge management (SKM). The study also identified different combinations of conditions that can lead to higher innovation and market performance. SKM strategies, as discussed in the study, can play a key role in the development and management of human resources in Industry 5.0. Acquiring, sharing, and effectively leveraging the knowledge and experience of employees is essential to ensure the successful implementation of digital technologies and innovation processes. SKM strategies can also support agile learning and contribute to workforce agility in the context of the rapid changes brought about by Industry 5.0. Ultimately, strategic human resource management and SKM strategies are crucial in preparing organisations for the challenges and opportunities of Industry 5.0. The integration of these approaches can help organisations achieve more effective use of human resources in an environment of rapid digitisation and automation.

Authors Hamilton and Sodeman (2020) examined the impact of big data analytics on human resource management with an emphasis on strategic human capital. They discuss how big data analytics can address

strategic human capital issues and contribute to overall firm performance. The authors also analyze new data sources that enable real-time assessment of workforce performance and identification of key players in the company. They also address regulatory and ethical challenges, including privacy and GDPR. In the article, they discuss how big data analytics can facilitate strategic change in HR and across the organization. The article is also relevant in the context of Industry 5.0, highlighting the integration of modern technology with the human factor. It highlights the importance of considering big data analytics in the effective use of human capital in new technological environments and highlights the ethical challenges, which is crucial in the era of rapid technological innovation in Industry 5.0. Cheng et al. (2023) used a synthesis of the information technology (IT) cost management literature and a resource-based view to develop a research model. This model seeks to examine whether IT compensation affects the strategic alignment of IT and business and, consequently, organizational performance. At the same time, the authors analyse how human IT resources enhance the effects of IT compensation. The findings of the study show that IT compensation promotes strategic alignment and organizational performance, but only for firms with business-competent CIOs and not for business managers with IT competencies. In this case, significant linkages with strategic human resource management can be observed in the context of Industry 5.0. In the new industrial era, this concept emphasizes the integration of advanced technologies such as the Internet of Things (IoT), artificial intelligence, and automation with human factors in industrial processes. It is important for organisations to have skilled human resources that are capable of managing and implementing these new technologies. In this context, strategic human resource management can be closely linked to IT cost management issues such as IT compensation analysis.

A study by Visvizi et al. (2022) looks at the drivers of innovation management in contemporary organizations, with a focus on data-driven companies. The authors argue that organizations that integrate a strategic orientation based on data, human capabilities, and proactive management are more effective in fostering innovation. The findings of the study identified key factors that support the development of innovation in data-driven organisations. They also reveal that these companies can develop different innovation patterns depending on the capabilities activated. The study provides evidence of how a combination of data-driven culture, skills enhancement, and human resource support can positively influence the emergence of innovation. How organisations manage innovation processes in a data-driven environment is important in strategic human resource management. In Industry 5.0, where technological innovation is combined with human labour, data-driven innovation management can contribute to the achievement of HR objectives.

Minbaeva (2021) discusses future research directions to bridge the gaps in human resource (HR) management and focuses on three global megatrends - flexible workforce, digitization of business models, and artificial intelligence and machine learning. It examines the impact of these megatrends on human resource management (HRM) in general and in the context of the Covid-19 pandemic. In the context of Industry 5.0, where the integration of advanced digital technologies and human capital is emphasized, HRM research is crucial to the success of organizations. Research in HRM can help organizations better understand the impact of Industry 5.0 on human resource management and develop strategies that will merge digital technologies with human capital for competitive advantage. Flechsig et al. (2022) showed that the adoption of robotic process automation depends on the readiness and digital maturity of organizations in the area of purchasing and supply management. The authors identify technical, organizational, and environmental barriers as well as differences between the private and public sectors in implementing robotic process automation. Although its adoption in human resource management is not directly mentioned, some parallels can be observed with the development and adaptation of new technologies in the corporate environment. In the context of Industry 5.0, which emphasises the integration of people and technology in the industrial environment, the implementation of technologies such as robotic process automation could also influence strategic human resource management. This is about how organisations integrate new technologies with human resources and how these technologies affect the work process and employee performance in the context of the industrial revolution. The findings of Krakowski et al. (2023) highlight that AI-based technological change can transform sources of competitive advantage and require managers to develop new capabilities to remain relevant in an AI-based competitive environment. In the context of Industry 5.0, which is characterised by the integration of advanced technologies, automation, and collaboration between humans and machines, the findings highlight the need for HR managers and organisations to adapt their strategic human resource management. The new capabilities that are emerging due to technological change could require the development and improvement of employee competencies that are key

to competitiveness in this new industrial era. This could include the development of digital skills, the ability to work effectively with automated systems, and adaptability to change concerning new technologies.

The findings of He et al. (2023) suggest that investment in technology contributes to the systematic control of organisations and sustaining operations in crisis situations. The authors found various impacts of organisational resilience dimensions on the organisation and employees, providing insights into the complex relationship between digital transformation and an organisation's ability to cope with uncertain conditions. Here, we can observe the interconnection in various aspects such as digital transformation and human resources, employee adaptability, culture and transformation management, and organizational resilience in the context of Industry 5.0 in the context of strategic human resource management. When implementing Industry 5.0, where technological innovations happen quickly, employees need to be able to adapt quickly to new technologies and workflows. There is also a need for leaders to be able to effectively manage the transformations associated with digitalization and automation, as well as build a culture that supports adaptability. In the context of Industry 5.0, where organisations are exposed to rapid change and challenges, it is important that they have strong crisis response capabilities. This includes not only technological but also human and organisational aspects.

Nafizah et al. (2023) found that micro-enterprises should be encouraged to adopt artificial learning and machine learning to compensate for their limited resources and capabilities in the innovation process. They emphasize that digital technologies have the potential to transform the way firms operate and that the right strategic approach to adopting these technologies is key to achieving innovation benefits. In the context of Industry 5.0, it is important to understand that the development of technologies such as artificial intelligence and machine learning is not only about technological transformation but also about the transformation of the working environment and the collaboration between people and technology. Strategic human resource management must adapt to the new dynamics of the work environment, where micro-enterprises can use advanced technologies to improve innovation capabilities and collaborate effectively with technology. Belitski et al. (2023) find that the relationship between the breadth of knowledge collaboration and innovation depends on several factors, including the geographic location of the collaborating partner, the type of partner, and the absorptive capacity of the firm. Investing in digital technologies and increasing the share of graduates in science, technology, engineering, and mathematics have been found to be factors that affect the absorptive capacity and transaction costs associated with R&D collaborations. The authors' study indirectly touches on strategic human resource management in the context of Industry 5.0 by analysing the impact of digital collaboration on product and process innovation in firms. In the context of Industry 5.0, which is the integration of digital technologies and human labour, it is crucial to understand how collaborative research and development (R&D) influences firm innovation processes. Recognising the importance of digital collaboration and its relationship to innovation outcomes may have implications for human resource management strategies in the Industry 5.0 era. As the study has shown that the relationship between R&D collaboration and innovation is influenced by absorptive capacity and partner type, HR managers may be challenged to develop human capital that can absorb new knowledge quickly and collaborate effectively with different types of partners, be they regional, national or international entities.

The authors Li et al. (2018) find that HIWS with employee experience is positively related to innovation, and this positive effect is amplified by all three activators of emergence (i.e., experience homogeneity in HIWS, strategic importance of innovation, and turnover in human resources). Here, we can observe several connections between Industry 5.0 and HRSM. In Industry 5.0, where it is important to achieve synergy between people and technology, HIWS can be a key tool to foster innovation. High employee engagement, thus, can lead to better performance and a willingness to collaborate on the implementation of new technologies. Kot and Leszczynski (2022) point out significant differences in the informational, strategic, transactional, and transformational dimensions of value when using conversational agents compared to other technologies. The value created by AI is shown to be dynamic, context-dependent, and, in many ways, ambiguous. In addition, the authors highlight the role of the interaction of resources and non-technological factors that enable conversational agents to reflect and replace human actions. The integration of conversational agents may imply the need to rethink work processes and employee skills. Strategic human resource management may need to take into account the new relationship between artificial intelligence and human work. It is important to assess how conversational agents

can improve the efficiency and performance of human resources, but also to identify areas where human interaction is needed and where other technological and human resources could be leveraged.

Lang et al. (2023) examined the impact of human capital (HC) and structural social capital (SSC) on the performance growth of small and medium-sized enterprises (SMEs) in the context of digital transformation (DT). They found that these resources and capabilities, especially in a DT environment, have a key impact on the growth of SMEs. The integration of digital technologies and human capital can be a key factor in the success of SMEs in Industry 5.0. AI enables organizations to process data quickly, leading to improvements in their marketing and sales strategies. Research by Masih and Josih (2023) and Quyet (2024) highlights the transformational impact of AI on all areas of an organization, including human resource management, marketing, and sales, contributing to their efficiency and financial performance.

### 3. Research objective and methodology

The main aim of this paper is to identify critical areas where the link between SHRM and I5.0 can be explored, with further discussion and an outlook on future research opportunities. We used bibliometric analysis and the PRISMA four-phase flow diagram to conduct a systematic literature review. In line with the stated aim of the paper, the wording of the research question is as follows:

RQ: What is the current knowledge on the relationship between strategic human resource management and Industry 5.0, and in which areas are there research gaps that could provide impetus for further research? When conducting a Prisma analysis, it is important to select the right keywords that will be relevant to the topic. Initially, it was planned to use the keywords 'strategic management', 'human resources', and 'Industry 5.0'. However, in the initial analysis, there were only 3 articles in the database that contained all three keywords. This may be because the topic of Industry 5.0 is relatively new and research in this area is still in its early stages. Considering that enough articles is needed for the analysis, only two keywords were used, namely "strategic management" and "human resources". In the last step of the analysis, the abstracts of the articles were then selected based on which addressed the relationship between strategic management and human resources in the context of Industry 5.0 (e.g., digital transformation, artificial intelligence, big data, sustainability, etc.). This approach thus allowed us to obtain enough articles for analysis.

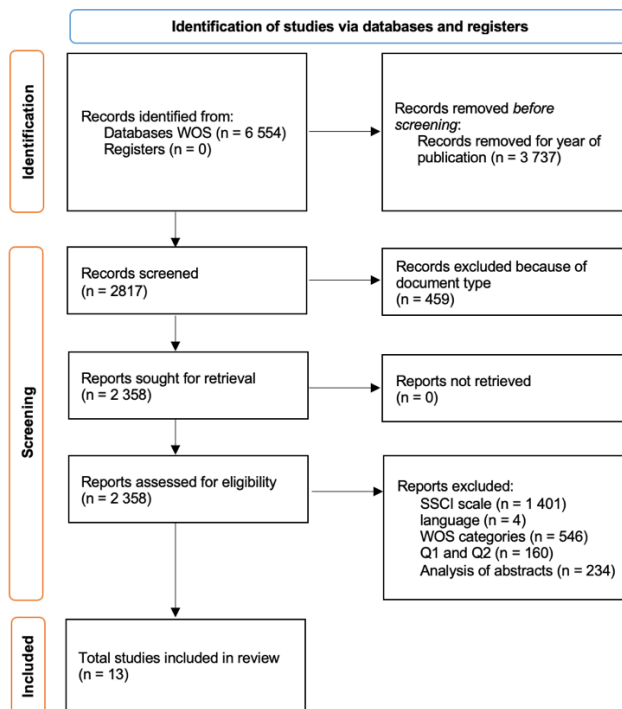


Figure 1. Results of a systematic literature review - PRISMA diagram

Source: own processing

The keywords "strategic management" and "human resources" were used in the search, which resulted in an initial set of scholarly research (n=6,554). One of the criteria was to only display research that was published between 2018 and 2023 (n=3,737). The next step was to select according to document type, where only articles were selected (n=459). Next, selection based on the SSCI ranking of the journals (n=1401). The next step was selection based on language, where 4 articles were excluded (n=4). Based on Journal Citation Report (JCR), those in Q1 or Q2 were selected resulting in the identification of a total of 247 articles, with 160 articles published in Q3 and Q4. After this step, the research that were analysed in more detail were identified (n=247). The final selection was focused on the analysis of the abstracts of each research, and it can be stated that 234 articles were excluded that were not related to the issue at hand. Figure 1 shows the sequence of steps involved in the analysis in the form of a PRISMA diagram. From the 6554 scientific research initially included, 13 of the most relevant ones in relation to strategic human resource management in the context of Industry 5.0 were identified in this way.

#### 4. Results and discussion

Bibliometric analysis allows researchers to highlight the theoretical underpinnings of a particular research area, identify the main findings of previous studies, and identify future research ideas (Ellili, 2022). This analysis was based on the analysis of the keywords "strategic management" and "human resources". In the first step, the keywords: strategic management and human resources were identified. 6554 results were extracted. Subsequently, criteria for further selection were defined:

- Publication period: 2018-2023
- Document type - article
- Web of Science Index: Social Sciences Citation Index (SSCI)
- Language - English

From the above keywords- 4 clusters were identified. Cluster 1 contains 12 items, cluster 2 contains 11 items, cluster 3 contains 10 items and cluster 4 contains 2 items. In academic papers focusing on strategic management and human resources, the most common key items are for example: performance, strategy, innovation, knowledge, competitive advantage, influence, and firm performance.

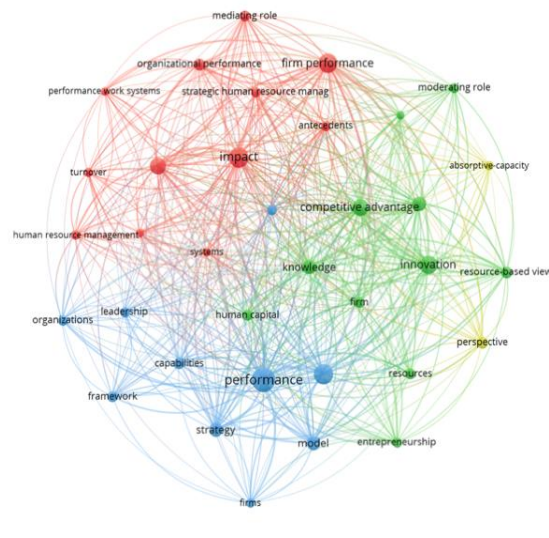


Figure 2. VOSviewer - high occurrence keyword map  
Source: own processing

The keywords that have been shown to be most frequently associated with strategic management and human resources are, for example, knowledge, influence, performance, innovation, competitive advantage, firm performance, capabilities, productivity, efficient work systems, etc. The keywords that are most frequently associated with strategic management and human resources are also relevant to Industry 5.0. For example, knowledge is key to the successful implementation of Industry 5.0 technologies and employee capabilities are key to success in the new industrial era.

**Table 1.** Studies included in review – author’s results

Authors	Results
Belitski et al. (2023)	The relationship between the breadth of knowledge collaboration and innovation depends on several factors. Investment in digital technologies and increasing the share of graduates in science, technology, engineering and mathematics have been shown to be factors that affect the absorptive capacity and transaction costs associated with R&D collaboration.
Cabrilo and Dahms (2018)	Structural and relational capital have a direct impact on innovation performance, while human capital influences innovation in conjunction with strategic knowledge management.
Flechsigg et al. (2022)	Identification of technical, organisational and environmental barriers as well as differences between the private and public sectors in the implementation of robotic process automation.
Hamilton and Sodeman (2020)	The impact of big data analytics on HRM with an emphasis on strategic human capital.
He et al. (2023)	Identify the different impacts of organisational resilience dimensions on the organisation and employees, providing insights into the complex relationship between digital transformation and an organisation's ability to cope with uncertain conditions.
Cheng et al. (2023)	IT compensation supports strategic alignment and organizational performance.
Kot and Leszczyński, (2022)	Significant differences in the informational, strategic, transactional, and transformational dimensions of value when using conversational agents compared to other technologies.
Krakowski et al. (2023)	AI-driven technological change can transform sources of competitive advantage and require managers to develop new capabilities to stay relevant in an AI-driven competitive environment.
Lang et al. (2023)	HC and SSC, especially in the DT environment, have a key impact on the growth of SMEs.
Li et al. (2018)	HIWS with employee experience is positively related to innovation, and this positive effect is amplified by all three activators of emergence (i.e., experience homogeneity in HIWS, the strategic importance of innovation, and turnover in human resources).
Minbaeva (2021)	The impact of three megatrends (flexible workforce, digitalisation of business models, artificial intelligence and machine learning) on human resource management.
Nafizah et al. (2023)	Digital technologies have the potential to transform the way businesses operate, and the right strategic approach to deploying these technologies is key to achieving innovation benefits.
Visvizi et al. (2022)	Identifying the key factors that support the development of innovation in data-driven organisations.

Source: own processing

Hamilton and Sodeman (2020) highlight how big data analytics can address strategic issues relating to human capital and how it can contribute to the overall performance of the firm, however, privacy and ethical challenges such as GDPR must be considered. Other studies (Cheng et al., 2023; Krakowski et al., 2023) address specific aspects of IT cost management and technological change, highlighting the importance of competencies in this area. Research related to innovation and digital transformation (Visvizi et al., 2022; He et al., 2023) provides evidence of how the combination of data-driven culture and human capabilities can positively impact innovation and organizational resilience. At the same time, Li et al. (2018) find that HIWS positively impacts innovation

by shaping the alignment, directionality, and adaptability of collective interactions. In the area of digital transformation, authors Lang et al. (2023) find that human capital and structural social capital have a significant impact on the performance growth of SMEs. In the context of robotic process automation, Flechsig et al. (2022) argue that successful adoption of this technology depends on the digital maturity of organizations and identifies technical, organizational, and environmental barriers as well as differences in its implementation between the private and public sectors. The development of technologies such as artificial intelligence and machine learning brings new challenges and opportunities for human resource management. It is essential to assess how these technologies affect the work of employees and identify the necessary skills and competencies (Nafizah et al., 2023). The necessary skills for implementing new technologies are also discussed by Kot and Leszczynski (2022), who found that the integration of conversational agents may require a restructuring of work processes and employee skills, while strategic human resource management must consider the new relationship between artificial intelligence and human work.

A research gap that emerged from the literature search conducted is the focus on how, for example, artificial intelligence, machine learning, etc. are changing the nature of work, and what are the requirements for new skills, abilities, and competencies in specific job roles, as also highlighted by Nafizah et al. (2023) who emphasise the need to assess the impact of technology on the work of employees and identify the necessary skills. Thus, there is a need to examine what specific skills and competencies will be needed in the digital environment for employees, and how organisations should adapt to develop and support these skills. We also consider it important to explore the impact of digital technologies on interpersonal relationships and collaboration in organisations, and how these technologies can be used to support more effective communication and teamwork. Based on the systematic literature review conducted and the research gap identified, we propose the following implications (I) for further research:

- I1: Optimizing employee training and development in the digital era - Identifying effective models for employee training and development that are best suited for adaptation in the context of digital transformation.
- I2: Skills and competencies for digital transformation - Analysing the necessary skills and competencies for employees in the context of digital transformation and then implementing strategies for their development.
- I3: Impact of digital technologies on working relationships - Exploring the impact of digital technologies on workplace dynamics and interpersonal relationships, including communication, collaboration and team building.
- I4: Artificial Intelligence in Human Resource Management - Exploring the impact of AI on strategic HR decision-making and identifying the best approaches to integrate AI into recruitment, assessment and talent management processes.

Based on a systematic literature review we can answer RQ. We found out, that the areas where we find a link between SHRM and Industry 5.0 are:

- big data analytics in human resource management,
- IT cost and technology change management,
- digital transformation and its impact on innovation
- or organizational resilience.

Based on the conducted systematic literature review several research gaps have emerged, which consist of:

- focusing on such as artificial intelligence, machine learning, etc. can change the nature of work and what are the requirements for new skills, abilities, and competencies in specific job positions,
- the need to examine what specific skills and competencies will be needed in the digital environment for employees and how organizations should adapt to develop and support these skills,
- exploring the impact of digital technologies on interpersonal relationships and cooperation in organizations and how these technologies can be used to support more effective communication and teamwork.



## Conclusions

In this study, we focused on identifying critical areas where the link between Strategic Human Resource Management (SHRM) and Industry 5.0 (I5.0) can be explored, and proposed future research directions. Based on a systematic literature review, several areas were found where SHRM and I5.0 intersect. These areas include big data analysis in HR management, managing IT costs and technological changes, digital transformation, and its impact on innovation and organizational resilience.

We identified a research gap concerning how artificial intelligence, machine learning, and other technologies influence the nature of work and the new skills and abilities required for specific job positions. It is important to investigate the skills necessary in a digital environment and how organizations can support their development. Another crucial area for exploration is the impact of digital technologies on interpersonal relationships and collaboration in organizations, examining how these technologies can enhance communication and teamwork.

Based on the literature review, we proposed several implications for further research. These include identifying effective models for employee training and development in the context of digital transformation, analyzing the necessary skills and competencies, implementing strategies for their development, and examining the impact of artificial intelligence on strategic decision-making in HR and identifying best practices for integrating AI into recruitment, assessment, and talent management processes. These suggestions provide direction for future research in the SHRM and I5.0 domains.

Future research should delve deeper into these relationships and identify the specific strategies and approaches to help organizations thrive in a fast-paced technological environment. Such efforts can lead to better utilization of the potential of digital technologies, while also contributing to sustainability and enhancing the competitiveness of organizations in the world of Industry 5.0.

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