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Research Paper

Digital transformation in HR Planning: Adaptation strategies and challenges in the industrial revolution 5.0 era

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Abstract

Digital transformation has become a global phenomenon that affects various aspects of business, including human resource (HR) planning. The Industrial Revolution 5.0 era requires organizations to integrate advanced technologies such as artificial intelligence (AI), Internet of Things (IoT), and big data into the HR planning process. This study aims to explore adaptation strategies and challenges faced by organizations in facing digital transformation in the field of HR planning. The research method used is qualitative with a literature study approach and secondary data analysis from indexed journals. The results of the study show that digital transformation offers opportunities to improve the efficiency and accuracy of HR planning, but also presents challenges such as employee resistance, skills gaps, and ethical issues. The conclusion of this study is that organizations need to develop a holistic strategy that includes training, organizational culture change, and collaboration with stakeholders to adapt to the Industrial Revolution 5.0 era.

Keywords: Adaptation Strategy, Challenges, Digital Transformation, HR Planning, Industrial Revolution 5.0.

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Abstrak
Transformasi digital telah menjadi fenomena global yang memengaruhi berbagai aspek bisnis, termasuk perencanaan sumber daya manusia (SDM). Era Revolusi Industri 5.0 menuntut organisasi untuk mengintegrasikan teknologi canggih seperti kecerdasan buatan (AI), Internet of Things (IoT), dan big data dalam proses perencanaan SDM. Penelitian ini bertujuan untuk mengeksplorasi strategi adaptasi dan tantangan yang dihadapi organisasi dalam menghadapi transformasi digital di bidang perencanaan SDM. Metode penelitian yang digunakan adalah kualitatif dengan pendekatan studi literatur dan analisis data sekunder dari jurnal-jurnal yang terindeks. Hasil penelitian menunjukkan bahwa transformasi digital menawarkan peluang untuk meningkatkan efisiensi dan akurasi perencanaan SDM, namun juga menghadirkan tantangan seperti resistensi karyawan, kesenjangan keterampilan, dan masalah etika. Kesimpulan dari penelitian ini adalah bahwa organisasi perlu mengembangkan strategi holistik yang mencakup pelatihan, perubahan budaya organisasi, dan kolaborasi dengan pemangku kepentingan untuk beradaptasi dengan era Revolusi Industri 5.0.

Kata Kunci: Strategi Adaptasi, Tantangan, Transformasi Digital, Perencanaan SDM, Revolusi Industri 5.0.

1. Introduction

Industry 5.0 emerges as a significant breakthrough in the development of modern industry, bringing innovations that go beyond the limitations found in the previous Industry 4.0 era (Borchardt et al., 2022). Unlike Industry 4.0, which primarily focuses on technological advancement, automation, and maximizing efficiency through data utilization, Industry 5.0 shifts its emphasis towards sustainability, placing greater attention on human values and social well-being (Ben Youssef & Mejri, 2023). Although Industry 5.0 is built upon the technological foundations introduced by Industry 4.0, both concepts have fundamental differences. Industry 4.0 concentrates on digitalizing and automating industrial processes to increase productivity and drive economic growth (Santhi & Muthuswamy, 2023). However, in its implementation, Industry 4.0 often overlooked environmental and social issues, sparking debates regarding the potential negative impacts of technological advancement, such as job displacement and the widening of social inequality (Grybauskas et al., 2022). In response to these challenges, Industry 5.0 emerges with a more society-oriented approach. It focuses on digital transformation and ensures that industrial development aligns with principles of environmental sustainability and social responsibility (Destouet et al., 2023). Furthermore, Industry 5.0 seeks to redefine the role of industries shifting from merely generating profit to becoming key actors in addressing social challenges and creating value for society (Sindhwani et al., 2022).

The Industrial Revolution 5.0 has brought significant changes in various aspects of life, including human resource management (HR). This revolution emphasizes automation, digitalization, and collaboration between humans and machines to create greater added value (Xu et al., 2018). Digital transformation is the key to facing this change, especially in HR planning, which must adapt to the dynamics of an increasingly complex business environment.

HR planning in the digital era is no longer only focused on traditional workforce management but also requires the integration of advanced technologies such as artificial intelligence (AI), big data, and the Internet of Things (IoT) to increase efficiency and effectiveness (Brougham & Haar, 2018). However, this transformation also presents new challenges, such as the digital skills gap, resistance to change, and the need to manage an organizational culture that includes technology (Vial, 2019).

The digital skills gap in Indonesia remains a significant challenge amid the rapid growth of the digital economy. There is an imbalance between industry demands for digital talent and

the availability of a workforce equipped with such skills. According to data from the Ministry of Communication and Information Technology (Kominfo), Indonesia requires around 600,000 digital talents yearly. However, educational institutions in Indonesia can only produce approximately 100,000 graduates in information and communication technology (ICT) annually. Ironically, about 75% of these graduates are still considered to face a skills gap, making them not fully ready to compete in the digital workforce (LinkedIn, 2023).

Moreover, survey results indicate that 60% of the workforce in Indonesia consider digital skills as their primary focus for self-development. 88.3% of respondents acknowledge that basic digital skills such as internet usage, office applications, and social media have become essential foundations. However, with the continuous advancement of digitalization, the need for advanced digital skills such as data analysis, cybersecurity, application development, and digital marketing continues to rise and presents challenges for many workers (The Economist Impact, 2022).

Regional and gender factors also influence the digital skills gap in Indonesia. Data from Statistics Indonesia (BPS) recorded that internet penetration in Jakarta reached 84.7%, while in Papua, it was only 26.3%. Furthermore, a digital divide still exists between urban and rural areas, where 90.9% of urban households have internet access, significantly higher than the 80.5% of rural households (BPS, 2022). On the other hand, a gender gap is still visible, as women particularly those with low education levels or those who are elderly tend to have more limited access to and mastery of technology compared to men (Kompasiana, 2023).

To overcome this gap, the Indonesian government targets producing around 9 million digital talents by 2030, or approximately 600,000 people annually (UNDP Indonesia, 2023). In addition, support from the private sector continues to strengthen, such as Microsoft's commitment to invest USD 1.7 billion in Indonesia, including programs to provide digital skills training for around 840,000 Indonesians (Reuters, 2024).

In Indonesia, digital transformation in HR planning still faces various obstacles, such as a lack of technological infrastructure readiness, low digital literacy, and minimal understanding of the importance of adaptation in the Industrial Revolution 5.0 era. Digital transformation and Industry 5.0 are two interrelated concepts, but they have different focuses in the evolution of modern industry. Digital transformation focuses on integrating n of digital technology into all aspects of business, fundamentally changing how organizations operate and deliver value to customers (McKinsey & Company., 2024). On the other hand, Industry 5.0 emphasizes the collaboration between humans and machines, aiming to create more sustainable and human-centered production systems (Ghobakhloo et al., 2024). This distinction shows that while digital transformation focuses on technology adoption, Industry 5.0 highlights the synergy between human labor and advanced technology in production processes.

However, the implementation of digital technology in human resource management (HRM) often faces challenges in the form of employee resistance. The Technology Acceptance Model (TAM), developed by (Davis, 1989), provides a framework for understanding the factors influencing individuals' acceptance of new technology. According to TAM, perceived ease of use and usefulness are two key determinants that affect an individual's intention and behavior in using technology (Davis, 1989). In HRM, if employees feel that a new digital system is challenging or does not provide clear benefits, they will likely resist adopting the technology.

Therefore, a comprehensive adaptation strategy is needed to ensure that organizations can take advantage of the opportunities offered by digital transformation while addressing the challenges. Digital transformation in human resource management (HR), especially in planning, is an important aspect influenced by rapid advances in digital technologies such as artificial intelligence (AI), big data, and blockchain (Bragagnolo et al., 2023). The digital transformation occurring in various industrial sectors increasingly demands increased skills and knowledge of

human resources to optimize the potential of technology in supporting efficiency and sustainability.

This study explores the adaptation strategies and challenges in the digital transformation of HR planning in the Industrial Revolution 5.0 era. Using a qualitative approach, this study is expected to provide theoretical and practical contributions to the development of HR management in Indonesia and become a reference for academics and practitioners in this field.

2. Theoretical background and and hypothesis

Industrial Revolution 5.0

The development of industrial revolutions throughout history reflects how technological advancement has continuously reshaped how humans work and produce goods. One of the most significant transformations emerged in the era of Industry 4.0, which is characterized by integrating digital technologies, automation, and intelligent systems within industrial processes (Cannavacciuolo et al., 2023). Industry 4.0 relies heavily on technologies such as the Internet of Things (IoT), Artificial Intelligence (AI), Big Data, Cloud Computing, and Cyber-Physical Systems to create highly efficient, accurate, and automated production environments (Nahavandi, 2019). In this phase, the role of human labor tends to be reduced as automated systems and machines increasingly handle many tasks.

However, Industry 4.0 faced new challenges over time, particularly the need for a more human-centered and sustainable approach. This challenge became the foundation for the emergence of Industry 5.0. Unlike Industry 4.0, which mainly focuses on efficiency and productivity through automation, Industry 5.0 repositions humans at the core of industrial processes (Alves et al., 2023). Industry 5.0 emphasizes the collaboration between humans and machines, where technology is designed not to replace human roles but to enhance human creativity, innovation, and the ability to deliver personalized products (Briken et al., 2023).

The most fundamental distinction between Industry 4.0 and Industry 5.0 lies in their primary objectives. While Industry 4.0 is predominantly driven by technology for operational efficiency, Industry 5.0 focuses on achieving harmony between humans and technology by prioritizing sustainability, social well-being, and ethical values (Aveni, 2023). One of the key characteristics of Industry 5.0 is the use of collaborative robots (cobots) designed to work alongside humans rather than replacing them. Moreover, Industry 5.0 promotes the creation of more inclusive, resilient, and adaptable industrial environments capable of addressing global challenges (Zizic et al., 2022).

The emergence of Industry 5.0 marks a significant phenomenon in the industrial world. This era came in 2019 in Japan. This era prioritizes sustainability and technological innovation (Battaglia et al., 2023). Although the term Industry 5.0 is relatively new, the concept is attracting attention because it seeks to align the often conflicting goals of a growing economy with environmental protection (Ghobakhloo et al., 2023). Industry 5.0 integrates human creativity and skills with intelligent system capabilities and automation to increase efficiency, productivity, and environmental sustainability (Cronin & Doyle-Kent, 2022).

Industry 5.0 is defined as an evolution that aims to utilize the creativity of human experts working together with efficient, intelligent, and precise machines (Pizoń & Gola, 2023). Industry 5.0 brings human labor back to the factory floor, where humans and machines are paired to make processes more efficient. It harnesses the power of human brainpower and creativity by integrating workflows with intelligent systems (Maskhulin & Azizah, 2025).

Industry 5.0 emerged as an industrial vision that aims to focus on efficiency and productivity while respecting human values and contributing to society's vital needs. It argues that modern industry requires a transition from the efficient use of industrial automation (Industry 4.0) to the creation of new value through a critical rethinking of human resources (Industry 5.0) (Golovianko et al., 2022).

Industry 5.0 focuses on humans as the center of technological innovation. By combining the power of cutting-edge technology and human capabilities, organizations can achieve unprecedented levels of efficiency while respecting human values in the workplace (Nazarudin & Kuswinarno, 2024). This concept is a progressive response to the need for more sustainable and human-focused processes. In this era, humans will live alongside advanced technology (Brauner & Ziefle, 2022). The core of Industry 5.0 lies in technological progress, and the principle of sustainability is not two contradictory things; instead, it supports and strengthens each other (Rame et al., 2024).

Industry 5.0 places humans back at the center of technological innovation. Unlike Industry 4.0, which focuses primarily on automation and production efficiency, Industry 5.0 encourages harmonious collaboration between humans and technology (Nazarudin & Kuswinarno, 2024). The term "advanced technology" in Industry 5.0 does not only refer to automation based on Artificial Intelligence (AI), the Internet of Things (IoT), and Big Data but also includes the application of digital twin technology for industrial process simulation, bioprocess technology for developing environmentally friendly products, and collaborative robots (cobots) designed to work alongside humans rather than replacing them (Maskhulin & Azizah, 2025).

At the same time, Industry 5.0 emphasizes human-centric values as the foundation for technological development. These values include respect for human dignity at work, worker autonomy in decision-making, safety and comfort in the workplace, the balance between work and personal life (work-life balance), and protection of employees' emotional and social well-being (Golovianko et al., 2022). Therefore, Industry 5.0 is seen not only as a technological evolution from Industry 4.0 but also as a response to the future industrial need for a more inclusive, ethical, and sustainable approach (Rame et al., 2024).

Digital Transformation in HR Planning

Although the origins of digital technology can be traced back to the mid-20th century with the emergence of early computerization, the concept of digital transformation, in its contemporary sense, only gained momentum in the late 1990s and early 2000s. This evolution was marked by key milestones, including the adoption of Enterprise Resource Planning (ERP) systems in the 1990s, the development of cloud computing in the 2010s, and the widespread integration of Artificial Intelligence (AI), Big Data, and the Internet of Things (IoT) in the 2020s (Gonzalez et al., 2024). These technological advances have become an integral part of both professional and personal life globally, making digital literacy a crucial skill for individuals and organizations in the 21st century (Tulowitzki et al., 2022).

In line with these developments, Human Resource (HR) management has undergone a fundamental transformation. Traditionally, HR functions were primarily administrative, focusing on personnel management, attendance, and payroll systems. However, with the emergence of digital transformation, HR has evolved into a more strategic function aligned with organizational goals and competitive advantage (Trzcieliński, 2020)

The integration of digital technology in HR processes aims to enhance the efficiency, accuracy, and agility of various HR activities, including recruitment, employee development, performance management, and workforce planning (Zhang et al., 2023). Technologies such as

AI, Big Data, and IoT have been increasingly utilized to support real-time data analysis, forecast future workforce needs, and identify critical skill gaps (Nocker & Sena, 2019).

For instance, the application of AI in recruitment and training can accelerate decision-making processes, improve the accuracy of candidate selection, and enable personalized learning paths for employees (Brougham & Haar, 2018). Similarly, IoT facilitates real-time monitoring of employee productivity, while Big Data analytics allows HR teams to predict trends and anticipate talent shortages.

However, it is important to note that the successful implementation of digital transformation in HR is not guaranteed by technology adoption alone. Research shows that approximately 70% of HR technology projects fail to deliver their expected outcomes due to challenges such as poor change management, lack of employee engagement, and organizational culture resistance (Gartner, 2023). Therefore, digital transformation requires not only technological readiness but also cultural adaptation, leadership commitment, and continuous employee involvement (Vial, 2019).

In the context of Industry 5.0, digital transformation plays a crucial role in shaping human-centered HR practices. The combination of advanced technologies enables organizations to develop more personalized, efficient, and sustainable human resource strategies. With tools such as AI, Big Data, and IoT, companies are better equipped to identify future skill requirements, evaluate employee performance in real-time, and design more targeted HR development programs (Mukrodi, 2020).

Adaptation Strategy in the Industrial Revolution 5.0 Era

In responding to the dynamics of the Industrial Revolution 5.0, organizations must adopt strategic measures, particularly in human resource (HR) planning. Digital transformation in HR is not solely about technological implementation but also demands a structured and systematic adaptation strategy to ensure its success. These strategies are essential for effective implementation, broad acceptance across organizational levels, and enhancement of overall competitiveness.

Based on the literature analysis, several key adaptation strategies can be applied. First, digital skills enhancement is a fundamental component, as continuous training and development in digital technology are necessary to ensure HR readiness (Bughin et al., 2018). Second, technology integration through the use of Human Resource Information Systems (HRIS) combined with artificial intelligence (AI) and big data can significantly improve the efficiency and accuracy of HR planning (Marler & Boudreau, 2017). Third, cultivating an adaptive organizational culture that encourages innovation and responsiveness to change is critical (Putri et al., 2024). Lastly, the role of leadership is indispensable, as effective leaders empower employees through trust, encouragement, support for innovation, and constructive problem-solving (Schiuma et al., 2021).

Challenges in Digital Transformation of HR Planning

Despite its potential, the digital transformation of HR planning faces several challenges. One key issue is organizational culture readiness; resistance to change and a limited understanding of the benefits of digital technologies can hinder the transformation process (Rogers, 2016). Another significant barrier is employees' lack of digital skills, which affects their ability to adapt and operate new technologies effectively (World Economic Forum, 2022).

Moreover, data security concerns are increasing as digital technology integration in HR requires strong measures to protect sensitive information and maintain privacy (Putri et al., 2024). Resistance to change is also frequently encountered, particularly when management

does not adequately inform or support employees. Poor communication and weak leadership may exacerbate this resistance (Rafferty et al., 2013). Additionally, ethical concerns arise with using AI in HR planning, particularly regarding data privacy, surveillance, and algorithmic bias, which must be addressed to ensure fairness and transparency in decision-making (Zuboff, 2020).

3. Methodolody

Sample and Procedures

This research adopts a qualitative approach to gain a deep and comprehensive understanding of the studied phenomena (Herlissha et al., 2024). The study utilizes library research or literature review methods, collecting data from credible sources such as books, encyclopedias, scientific journals, newspapers, magazines, and institutional documents (Creswell, 2019). The literature selection process involved systematic searches using academic databases, including Google Scholar, Semantic Scholar, ScienceDirect, and Taylor & Francis, employing identical keyword strings across platforms. The keywords used during the search phase included: “digital transformation of HR,” “Industry 5.0,” “challenges of HR digitalization,” and “adaptive strategies in digital transformation of HR planning.” Literature inclusion was based on several eligibility criteria: (1) the use of either Indonesian or English language, (2) articles available for free access and download, (3) research-based journal articles, and (4) thematic alignment with the research keywords. The selected articles were compiled into a single database, from which only relevant and high-quality sources were retained for further analysis.

Measurement

The unit of analysis in this study is academic literature related to human resource planning in the context of digital transformation and the Industrial Revolution 5.0. The sources were measured based on their relevance to the research theme, the novelty of the perspective presented, and the publication's credibility. Each document was examined to extract information about strategies, challenges, and ethical implications related to the digitalization of HR planning. Furthermore, emphasis was placed on identifying core themes and recurring patterns to ensure consistency and depth in the findings.

Data Analysis Technique

This research employs content analysis as its primary analytical method. Content analysis is commonly used in qualitative studies to systematically reduce and interpret textual data to identify meaningful patterns or themes (Nicmanis, 2024). Through this technique, the selected literature was categorized, coded, and analyzed to determine recurring themes and insights relevant to adaptation strategies and challenges in digital HR planning. The process involved careful reading, thematic categorization, and cross-referencing of concepts to construct a comprehensive understanding of the topic. In addition, the literature review enriched the study's theoretical foundation and guided the formulation of a structured framework for analyzing the research problem (Martaningtyas, 2023).

4. Results and discussion

Adaptation Strategy in Digital Transformation of HR Planning

Digital transformation in human resource (HR) planning requires technological changes and demands strategic adaptation to ensure the success of HR processes. Various studies emphasize that the adaptation strategies applied by organizations strongly influence the success of digital transformation implementation. Based on literature analysis, organizations can implement

several key adaptation strategies when facing digital transformation in HR planning. These strategies are summarized in Table 1 below:

Table 1. Adaptation Strategy in Digital Transformation of HR Planning

No	Adaptation Strategy	Description	Source
a	Digital Skills Enhancement (Upskilling and Reskilling)	Investing in improving employees' digital skills through training programs on technologies such as AI, IoT, and data analytics, as well as reskilling to prepare for new roles emerging from automation.	Li (2022); Wijaya (2023); Ramadian & Safuan (2024)
b	Technology Integration in HR Planning Process	Utilizing technology such as Human Resource Information Systems (HRIS) integrated with AI and big data to support accurate HR planning processes.	Susanto et al. (2024)
c	Human Value Enhancement	Strengthening human values in HR planning to foster empathy, effective communication, and adaptability to change in the digital era.	Putri et al.,(2023)
d	Inter-Departmental Collaboration	Establishing strong collaboration between HR and IT departments to ensure that technological solutions align with business needs and are effectively integrated.	Dima et al., (2024)
e	Flexible Policy Implementation	Implementing flexible policies, such as remote working supported by cloud computing technology, to improve employee productivity and satisfaction.	Ferrara et al. (2022)

Source: Adapted from various relevant literature from 2022–2024

Challenges in Digital Transformation of HR Planning

Conversely, the digital transformation process in HR planning is not without challenges. These challenges arise from various aspects, including technology, organizational culture, and human resources. Table 2 presents a detailed overview of the challenges organizations face:

Table 2. Challenges in Digital Transformation of HR Planning

No	Challenges	Description	Source
a	Employee Resistance to Change	Employees often fear losing their jobs due to automation. Effective communication and employee engagement in the change process are essential to overcoming resistance.	Urbancová et al. (2024); Xu et al. (2018)
b	Skills Gap	The gap between employees' current skills and the skills required in the digital era remains a serious challenge. Organizations must identify these gaps and design relevant training programs.	Feijao & Stolk, (2021)

No	Challenges	Description	Source
c	Ethical and Privacy Issues	The use of AI and big data in HR planning raises ethical and privacy concerns, requiring compliance with data protection regulations such as GDPR.	Nazarudin & Kuswinarno, (2024); Yamin et al., (2024).
d	High Implementation Costs	Implementing advanced technologies requires significant investment, including technology acquisition, training, and maintenance costs. Organizations need to carefully conduct cost-benefit analyses before adopting new technologies.	Ananda et al. (2025).

Source: Adapted from various relevant literature from 2022–2024

Implications for Organizations

Based on research findings on adaptation strategies and challenges in the digital transformation of human resource (HR) planning, several essential implications emerge for organizations.

First, enhancing employees' digital skills through upskilling and reskilling programs is essential to enable them to adapt to technological changes and fulfill new roles emerging from automation. This requires organizational investment in structured and continuous learning and development programs aligned with future skill needs.

Second, integrating technologies such as Human Resource Information Systems (HRIS), artificial intelligence (AI), and big data into HR planning demands that organizations build sufficient technological infrastructure and ensure effective collaboration between HR and IT departments. Clear strategic goals must guide this integration to ensure digital solutions deliver optimal impact.

Third, strengthening human values in HR planning encourages organizations to uphold empathy, effective communication, and employee well-being amidst digitalization processes. A human-centered approach becomes a critical differentiator for maintaining employee engagement and motivation in an increasingly digital and automated work environment.

Fourth, inter-departmental collaboration is vital to align technology implementation with business and operational needs. Synergistic collaboration helps minimize the gap between technology development and its execution in daily workflows.

Fifth, implementing flexible working policies such as remote work arrangements supported by cloud computing technologies is an adaptive strategy to improve productivity, job satisfaction, and work-life balance. These policies also reflect the organization’s responsiveness to evolving employee expectations in the digital era.

Moreover, the identified challenges, such as resistance to change, skills gaps, ethical and privacy concerns, and high implementation costs, require organizations to develop effective risk mitigation strategies. Transparent communication, leadership engagement, and active employee participation are essential in reducing resistance and fostering ownership in the transformation process. Organizations must also build a culture of innovation that supports experimentation and learning from failure. On the other hand, ethical data governance, including compliance with regulations like GDPR and the responsible use of AI, should be prioritized to build trust and sustainability in the digital transformation of HR planning.

5. Conclusion

Based on the discussion, it can be concluded that digital transformation in HR planning in the Industry 5.0 era provides significant opportunities for organizations to enhance efficiency, accuracy, and flexibility in human resource management. However, the success of this transformation highly depends on the organization's readiness to implement appropriate adaptation strategies. These strategies include digital skills development (upskilling and reskilling), technology integration into HR processes, strengthening human values, inter-departmental collaboration, and implementing flexible working policies. On the other hand, organizations must also anticipate challenges such as resistance to change, skills gaps, ethical and privacy issues, and high implementation costs. Organizations must develop a holistic strategy focusing on technology and considering human aspects, organizational culture, and cross-functional collaboration to adapt and compete effectively in an increasingly complex digital era.

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