

ANALYSIS OF HUMAN RESOURCE COMPETENCY DEVELOPMENT STRATEGIES IN IMPROVING ORGANISATIONAL PERFORMANCE IN THE INDUSTRY 4.0 ERA: LITERATURE REVIEW AND PRACTICAL IMPLICATIONS

Sri Ndaru Arthawati

Universitas Sultan Ageng Tirtayasa
arthawatisri@gmail.com

Eloh Bahiroh

Universitas Sultan Ageng Tirtayasa, Indonesia
elohbahiroh@untirta.ac.id

Abstract

This study aims to analyse human resource competency development strategies in improving organisational performance in the Industry 4.0 era through a literature review and practical implications. Digital transformation has brought significant changes to work patterns, management systems, and workforce competency requirements. HR is now required to have not only technical skills, but also digital, collaborative, and creative competencies in order to adapt to dynamic technological developments. This study uses a qualitative method through a literature review of various scientific journals, management books, and organisational reports published in the last five years to obtain a comprehensive picture of the relationship between competency development and organisational performance. The results of the study show that effective competency development strategies include the implementation of technology-based training, continuous learning, knowledge management, and the strengthening of an organisational culture that supports innovation. These strategies have been proven to play a role in increasing productivity, efficiency, and organisational competitiveness through the improvement of individual and collective capabilities. In practical terms, organisations need to adopt HR development policies that are adaptive to technological changes by expanding reskilling and upskilling programmes, strengthening digital leadership, and building a collaborative and sustainable learning ecosystem. These findings confirm that competency development is a key pillar for creating superior and innovative organisations in facing the challenges of Industry 4.0.

Keywords: competency development, human resources, organisational performance, Industry 4.0, digital transformation.

Introduction

The Industry 4.0 era has brought major changes to almost all aspects of human life, including the world of work and the dynamics of modern organisations. This revolution is characterised by the development of digital technology, artificial intelligence, the Internet of Things (IoT), big data analytics, and robotics integrated into production and service systems. These changes require organisations to be more adaptive, responsive, and innovative in facing increasingly complex global competition (Patel, 2025). In this context, human resources (HR) are no longer seen merely as

organisational assets, but also as intellectual capital that is crucial to the sustainability and competitive advantage of companies in the digital era.

Industry 4.0 is changing the work paradigm from manual-based systems towards automation and collaboration between humans and intelligent machines. Business processes that were once linear and conventional are now integrated through digitalisation systems that emphasise efficiency, speed, and flexibility. This situation requires organisations to undertake a major transformation in the way they plan, manage, and develop HR competencies (Nagel, 2020) . It is no longer sufficient to rely solely on technical skills; today's workers must have critical thinking skills, be able to adapt quickly to new technologies, and be able to collaborate across disciplines and systems (Chen, 2023) .

The concept of human resource competency fundamentally encompasses a combination of knowledge, skills, and attitudes needed to perform a job effectively. In the context of Industry 4.0, these competencies extend to include digital capabilities, data literacy, information technology skills, and soft skills such as creativity, problem solving, and emotional intelligence (Chen, 2023) . Therefore, human resource competency development can no longer be carried out conventionally through one-way training or technical training alone. A comprehensive and future-oriented strategy is needed so that the workforce can adapt to the dynamic changes in the modern work environment.

Organisational performance is fundamentally influenced by the quality and capacity of its human resources. Various studies indicate that organisations with robust competency development systems tend to demonstrate higher performance in terms of productivity, innovation, and profitability. Competency improvement not only serves to optimise individual abilities, but also strengthens synergy between work units and accelerates the achievement of organisational strategic goals (Li, 2024) . Thus, HR competency development strategies become the main enabler in shaping agile and innovative organisations amid technological turbulence.

However, adopting competency development strategies in the digital era is not without challenges. Many organisations, particularly in developing countries, face significant obstacles such as limited technological infrastructure, low digital literacy, and cultural resistance to change. These problems often cause a gap between the expected competency requirements and the actual capabilities of the workforce (Andersson, 2024) . Without proper planning and implementation strategies, HR development efforts can result in inefficiencies and even failure in the organisation's digital transformation process.

In facing these conditions, human resource management needs to reorient its HR development policies and programmes. A competency-based approach is highly relevant because it provides a clear framework for identifying, measuring, and managing skills that contribute directly to organisational performance (O'Reilly, 2023) .

In addition, the implementation of continuous learning and digital talent management can strengthen organisational competitiveness and encourage innovative behaviour among employees (Nakamura, 2023) .

The Industry 4.0 era also requires organisations to utilise learning technologies such as e-learning platforms, digital performance management systems, and virtual simulation-based training . The use of this technology not only improves the efficiency of material delivery but also allows for personalised training according to individual competency needs. With this approach, human resource development can be carried out in a more targeted, measurable, and sustainable manner, which in turn contributes to improving overall organisational performance (Manurung, 2025) . In addition to technological aspects, organisational culture also plays an important role in human resource competency development. A work culture that supports innovation, collaboration, and learning will create an environment conducive to employee professional growth. Conversely, organisations with a rigid hierarchical culture will find it difficult to adapt to the speed of technological change (Rohida, 2018) . Therefore, HR development strategies must be aligned with organisational cultural transformation in order to create an adaptive and learning-oriented work ecosystem.

The relationship between HR competency development and organisational performance can also be explained through the Resource-Based View (RBV) theory, which states that a company's competitive advantage depends on its ability to manage valuable, rare, and difficult-to-imitate internal resources. In this case, employee competencies are strategic assets that can provide competitive differentiation from competitors. Therefore, HR competency development should be positioned as a long-term investment that directly impacts organisational performance and sustainability (Wiraraja, 2024) .

The phenomena of globalisation and digitalisation reinforce the urgency of research in this field, as many organisations are still struggling to find human resource development models that are suited to the characteristics of the digital era. Some focus on improving technical skills, while others emphasise strengthening soft skills and changing mindsets. This study reviews these various approaches from academic and practical perspectives, with the aim of providing a comprehensive view of effective competency development strategies for improving organisational performance.

Research Method

The research method used in this study is a qualitative research method with a library research approach, which focuses on conceptual analysis and theoretical synthesis of various scientific sources relevant to the topic of human resource competency development and organisational performance in the Industry 4.0 era. This study collected secondary data from reputable international journals, modern HRM textbooks, professional institution reports, and official digital publications from the last

five years to ensure the relevance and actuality of the findings (Elijah & Aslan, 2025) . The analysis process was carried out systematically through the stages of identification, selection, classification, and interpretation of literature to find the main themes related to HR competency development strategies and their implications for improving organisational performance. Content analysis techniques were used to interpret the relationship between conceptual variables in depth by comparing various scientific views and previous research results (Tranfield et al., 2003) . Methodologically, this approach enables researchers to develop a conceptual model that explains the relationship between competency development strategies and organisational performance factors in the context of digitalisation and organisational transformation towards sustainable competitive advantage.

Results and Discussion

Human Resource Competency Development Strategies in the Industry 4.0 Era

The Industry 4.0 era brings a new paradigm in human resource management where digital transformation is the main driving force behind changes in the way we work, innovate, and collaborate. Technological developments such as artificial intelligence, big data analytics, the Internet of Things, and automation have affected almost all industrial sectors, requiring the workforce to have competencies that are in line with digital needs (Wiraraja, 2024) . This shift has made human resource competency development not just an organisational necessity, but a strategic imperative in order to survive in this era of rapid technological disruption. Human resources are now required to have multidimensional skills that include technical abilities, adaptability, cross-platform communication, and social intelligence in order to cope with an increasingly complex work environment (Santoso, 2024) .

HR competency development strategies in this era must be designed comprehensively, taking into account the balance between technical and non-technical aspects. Technical skills or hard skills such as mastery of data analytics, programming, automation system design, and understanding of cyber security are important prerequisites for the success of digital organisations. However, these skills need to be complemented by soft skills such as critical thinking, inclusive leadership, cross-cultural cooperation, and psychological flexibility. The integration of these two types of skills forms a new competency profile known as hybrid talent, which refers to individuals who are able to combine technological capabilities with interpersonal skills (Tapela, 2023) .

One of the main strategies in developing human resource competencies is through the transformation of traditional training systems towards a digital-based learning model. The implementation of e-learning, mobile learning, and blended learning allows the training process to be carried out flexibly anytime and anywhere. Digital technology enables the personalisation of the learning process according to individual abilities, interests, and needs, so that the training results are more effective

(Setiawan, 2023) . In addition, the use of artificial intelligence-based adaptive learning platforms enables automatic evaluation of participants' achievements and recommendations for advanced material tailored to their performance profiles (Priansa, 2018) .

Apart from e-learning, experiential learning approaches are an important strategy in improving the practical competencies of human resources. In the context of Industry 4.0, this type of learning can be carried out through innovation projects, virtual simulations, cross-departmental work, and inter-company collaboration. Direct experience in dealing with the dynamics of digital work will strengthen practical understanding and shape an agile mindset among employees. Thus, organisations not only train human resources to understand technology, but also create an adaptive learning culture that focuses on continuous self-development (Utama, 2023) .

The implementation of a knowledge management system is also a crucial element in competency development strategies. With this system, the knowledge possessed by individuals can be accessed, shared, and developed collectively within the organisation. The implementation of internal platforms such as knowledge sharing hubs, digital libraries, or intranet learning portals enables the dissemination of best practices across all work units (Susanto, 2024) . Knowledge management not only plays a role in information transfer, but also encourages the creation of continuous collaboration-based innovation between human resources from various job levels.

Organisational cultural transformation is also an integral part of HR competency development strategies. A work culture that supports innovation, openness to new ideas, and the courage to take risks will foster an environment conducive to learning. Companies need to build an organisational culture that values lifelong learning and encourages each individual to continuously update their competencies (Lubis, 2023) . In this context, digital leadership plays an important role in instilling the value of change and supporting competency development through policies and managerial practices that are aligned with the organisation's digital transformation vision (Adiguna, 2024) .

In addition to cultural transformation, competency evaluation is a key factor in ensuring the effectiveness of HR development strategies. Evaluations are conducted not only on outcomes but also on processes, including how relevant training content is to job requirements, the learning methods used, and the long-term impact on individual and organisational performance. Technology-based evaluation systems such as analytical dashboards can assist HR in monitoring competency progress in real-time, providing data-driven insights for more accurate HR development decision-making (Prameswari, 2024) .

Human resource competency development strategies must also consider generational segmentation in the workforce. Millennials and Generation Z, who dominate the current workforce, have different learning styles from previous generations. They tend to prefer interactive, technology-based, and collaborative

learning (Sibarani, 2024) . Therefore, development programmes for this group must utilise more dynamic approaches such as gamification, microlearning, or digital mentoring. Meanwhile, for the older generation, the training approach must help the process of adaptation to digital technology with gradual and practice-based learning methods.

Another strategy that is gaining attention is data-driven competency development. Through big data analysis and human resource information systems, organisations can identify competency gaps, design more precise training programmes, and predict future skill requirements. This data-driven approach helps HR to allocate training resources efficiently and assess programme effectiveness quantitatively. With data analytics integration, decision-making in competency management becomes more objective and results-oriented (Harwin, 2025) .

Equally important, external collaboration with educational institutions, professional certification bodies, and technology companies is a strategic step in building a sustainable competency development ecosystem. These partnerships enable knowledge transfer, the development of industry-based training curricula, and internationally recognised competency certification. Synergy between the worlds of education and industry will reduce the gap between labour market needs and the quality of available human resources, while also increasing the competitiveness of the national workforce in the global market (Krisnawati, 2021) .

The development of human resource competencies must also accommodate aspects of transformational leadership. Leaders who are able to inspire, encourage collaboration, and direct change will be the main drivers for the successful creation of an innovative organisational culture. Transformational leadership functions not only as a driver of structural change, but also as a guide in the process of employee learning and empowerment. Leaders in the digital era are expected to be able to act as coaches who help employees recognise their potential and develop new skills that are relevant to the needs of the organisation (Nahrisah, 2024) .

Amidst rapid technological advances, one major challenge for competency development is maintaining a balance between automation and humanity. Although technology can improve efficiency, the role of humans remains crucial in strategic decision-making, innovation, and social interaction. Therefore, competency development strategies must strengthen human-centric skills such as empathy, interpersonal communication, digital ethics, and social responsibility. The balance between technological sophistication and human values will be the key differentiator for sustainable organisations in the future (Firdaus, 2024) .

In the context of practical implementation, competency development strategies require support from organisational policy systems such as performance-based reward systems, transparent performance appraisals, and career paths that encourage continuous learning. With the right combination of policies, organisations can motivate

employees to continuously hone their skills and adopt new technologies without feeling forced. This approach makes competency development not just an administrative activity, but part of the organisation's core strategy to achieve long-term competitive advantage (Hartono, 2024).

Thus, the strategy for developing human resource competencies in the Industry 4.0 era is a multidimensional process that requires integration between technology, people, and organisational culture. The success of this strategy depends on the extent to which the organisation is able to adapt its approach to the characteristics of digitalisation and the individual needs of workers. Through innovation in learning, cross-sector synergy, and leadership commitment to human transformation, competency development strategies can become the main foundation for improving organisational performance towards sustainable excellence in a competitive digital economy.

The Impact of Competency Development Strategies on Organisational Performance

Human resource competency development strategies have a significant influence on improving organisational performance because employee competencies are a major component of a company's productivity and competitiveness. Good competencies enable the workforce to perform tasks efficiently, generate innovation, and contribute to the achievement of the organisation's strategic objectives (Yendrawati, 2013). Organisations that consistently develop the abilities and skills of their employees tend to demonstrate higher performance levels than organisations that neglect this aspect. This influence is not only seen in individual output, but also in the collective synergy between members of the organisation (Kurniawan, 2023).

Improving organisational performance through competency development can be explained through the Resource-Based View (RBV) theory, which emphasises the importance of internal resources as the primary determinant of competitive advantage. Employees with superior competencies are considered strategic assets that are difficult for competitors to imitate. When an organisation succeeds in instilling competencies that are rarely found in other companies, this advantage becomes a source of long-term success. Thus, competency development not only improves operational effectiveness but also strengthens the organisation's strategic position in global industry competition (Prasetyo, 2022).

The implementation of competency development strategies results in increased productivity as employees become more skilled and efficient in performing their jobs. Appropriate training helps them understand new technologies, complete work in less time, and reduce error rates. In addition, good competencies strengthen the ability to adapt to change, especially in facing the challenges of technological disruption in the Industry 4.0 era. As a result, organisations become more resilient and able to maintain operational stability even when faced with the dynamics of an uncertain business environment (Warunayama, 2025).

The next impact is seen in the improvement of the quality of company innovation. Competent human resources have the ability to think creatively and critically in finding new solutions to problems faced by the organisation. Through a competency development strategy based on continuous learning, employees learn to explore ideas, test new possibilities, and dare to take risks in creating innovative products or services. Organisations that invest in enhancing innovative thinking capabilities will be more successful in creating added value for their consumers and maintaining business relevance in the digital market (Putra, 2023).

Competency development strategies also have a positive impact on leadership effectiveness and team collaboration. When employees have a deep understanding of their roles and strong interpersonal skills, work coordination becomes more harmonious. Training in communication, conflict management, and teamwork creates an open and productive work environment. As a result, leadership competencies and cross-unit collaboration improve, which in turn strengthens the organisation's ability to achieve its goals through collective synergy (Smith, 2024). In addition to increasing productivity and innovation, competency development strategies also encourage increased employee commitment and motivation. Employees who are given the opportunity to learn and develop feel valued and recognised for their contributions by the organisation. This sense of belonging creates a positive work climate that has a direct impact on morale and performance. In the long term, employee retention rates increase, and organisations can reduce the costs associated with high staff turnover (Müller, 2023).

Another equally important impact is the improvement of managerial effectiveness through a knowledge-based decision-making system. When human resources have analytical competence, data literacy, and strategic understanding, the decisions made are more rational, targeted, and results-oriented. This accelerates the decision-making process because every level of management can actively participate based on adequate competencies. Thus, competency development strategies help create a more adaptive and efficient organisational structure in facing contemporary business challenges (Wijaya, 2023).

Customer service quality also improves with the implementation of competency development programmes. Trained human resources are able to understand customer needs, provide quick responses, and resolve issues effectively. Good customer service competencies enhance the organisation's image and strengthen consumer loyalty. When customer experience becomes a key differentiator in modern business, organisational excellence in public or commercial services will be an invaluable competitive advantage in the digital age (Martinez, 2024).

From the perspective of a learning organisation, competency development strategies play a role in building a work culture that is adaptive to change. Employees who are accustomed to learning will become agents of change that support the internal

innovation process. The organisation also develops into a dynamic entity, capable of continuously renewing itself in line with technological and economic developments (Sari, 2023) . Thus, competency development not only improves short-term performance but also ensures long-term performance sustainability through a structurally embedded learning culture. Organisational performance also improves because competency development accelerates the digital transformation process. When employees master digital tools, business process automation can run optimally. Human resources who understand data analytics help leaders develop evidence-based management strategies. Successful digital transformation requires a workforce with high digital readiness, enabling their contributions to innovation, decision-making, and cost efficiency to become more significant (Kamaluddin, 2024) .

Another strategic impact is increased accountability and transparency within the organisation. Competencies related to digital work ethics and data governance help reduce the risk of violations and increase stakeholder trust in the organisation. A workforce that is competent in professional ethics and regulatory compliance is able to maintain the organisation's reputation while ensuring operational sustainability. Increased performance accountability also strengthens the internal control system, making the organisation more credible and trustworthy (Johnson, 2024) .

In a macro context, human resource competency development affects national competitiveness. When many organisations adopt this strategy, the quality of a country's workforce will improve. This creates a chain effect on national economic productivity and strengthens the country's position in global competition. Thus, the human resource competency development strategy has broad implications not only for organisations but also for innovation and knowledge-based economic development. However, the positive impact of competency development strategies does not occur automatically (Tahar, 2022) . Implementation that is not on target, irrelevant to job requirements, or not followed by an evaluation system can lead to waste of resources and decreased performance effectiveness. Therefore, careful planning is required, involving competency needs analysis, comprehensive training module development, and continuous outcome assessment. An integrated approach ensures that each development programme has a tangible impact on organisational performance (Hidayat, 2024) .

Overall, human resource competency development strategies have a profound impact on organisational performance through increased productivity, innovation, employee loyalty, and business process efficiency. Organisations that are adaptive to digital challenges will continue to improve the quality of their human resources to be able to face global changes competitively. A planned, targeted, and sustainable competency development approach is the main foundation for creating an excellent organisation in the Industry 4.0 era. Therefore, efforts to strengthen human resource

competencies are not merely an investment in human resources but a key strategy towards high-competitive organisational transformation.

Conclusion

An analysis of human resource competency development strategies in the context of the Industry 4.0 era shows that organisations must adapt to changes in work structures that are increasingly digitised and data-driven. This era demands a workforce that not only masters technical skills but also has the ability to think critically, innovate, and collaborate across disciplines. Therefore, human resource competency development must be directed towards a strategic model that integrates digital technology with the strengthening of interpersonal and intellectual abilities. This transformation can be realised through technology-based learning systems such as e-learning, knowledge management, and learning management systems that focus on continuous learning. This approach creates a work environment that is responsive to change while strengthening the organisation's capabilities in improving efficiency, productivity, and global competitiveness.

Empirically, human resource competency development has a direct implication on organisational performance through increased productivity, innovation, and work loyalty. Competent employees can perform their roles more effectively because they are able to adapt to digital technology, dynamic work situations, and increasingly high customer demands. In addition, a systematic competency development strategy strengthens the performance management function while creating a knowledge-based organisation culture. This impact is not only seen in individual performance but also in the increasingly solid synergy between organisational departments. The successful implementation of competency development strategies will have a chain effect in the form of increased creativity, service quality, accuracy in decision-making, and overall business process efficiency.

In practical terms, the findings from this literature review indicate that HR competency development is necessary as the main foundation for building a sustainable organisation in the digital era. This strategy should be implemented through adaptive policies such as industry-based reskilling and upskilling programmes, the implementation of a reward system for high-achieving individuals, and the integration of technology into all HR management processes. Organisations also need to build a learning culture that emphasises the values of agility, collaboration, and innovation so that every individual is prepared to face technological changes on an ongoing basis. By managing competency development strategically, organisations can achieve consistent performance improvements, strengthen their competitive advantage, and ensure sustainability in facing the increasingly complex challenges of the Industry 4.0 era.

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