

LEARNING AGILITY AS A KEY DRIVER OF HUMAN RESOURCE READINESS IN THE AGE OF AUTOMATION

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Abstract: The accelerating integration of automation and robotics in the workplace has prompted a growing need to assess the readiness of human resources (HR) in navigating this digital transformation. This study investigates the influence of digital competence, AI based training, learning agility, technology readiness, organizational support, and digital mindset on HR readiness for automation and robotics. Utilizing a quantitative approach, data were collected from 282 respondents across 94 manufacturing companies in Central Java, Indonesia. Structural Equation Modeling (SEM) with SmartPLS 4.0 was employed to test both direct and mediated relationships among constructs. The findings reveal that digital competence, AI-based training, organizational support, and technology readiness significantly contribute to HR readiness. Learning agility also plays a dual role as both a direct predictor and a mediator bridging the effects of training and digital competence on readiness outcomes. Conversely, digital mindset, while positively affecting learning agility, does not directly influence HR readiness. These results highlight the multidimensional nature of workforce preparedness and underscore the importance of integrating skill development, adaptive learning, and organizational support strategies in facing automation. The study offers theoretical and practical implications for HR development and policy design in the era of AI and robotics.

Keywords: *Human Resource Readiness, Digital Competence, AI-Based Training, Learning Agility, Technology Readiness*

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1. Introduction

Technological advances over the past few years have shown an unprecedented acceleration. Automation and artificial intelligence (AI) have systematically transformed the world of work by replacing traditional roles and demanding continuous renewal of human resource (HR) competencies (Bhore & Tapas, 2023). These changes have become an undeniable reality that compels all sectors to undergo transformation. Industrial robots now replace manual labor on production lines, automation software has taken over administrative functions, and AI-based systems play a significant role in decision-making processes that were previously performed entirely by humans. Such technological transformation not only affects the types of jobs available but also reshapes work processes, organizational structures, and the competency requirements of the workforce in the digital era (Almeida & Buzády, 2024; Frey & Osborne, 2017). The World Economic Forum's 2023 report projects that approximately 85 million jobs worldwide may be displaced by machines and automated

systems by 2025. At the same time, technological disruption is expected to create around 97 million new jobs that require digital capabilities, critical thinking skills, and adaptability to technology (Berhil et al., 2020; Turner & Winterton, 2021). This transformation indicates that digital change does not merely replace existing jobs but fundamentally redefines workforce quality and readiness to compete in the digital economy.

Technological development has significant implications for Indonesia, particularly Central Java Province, which has experienced increasing adoption of technology across various business sectors. Local companies have begun implementing digital systems and automation to enhance efficiency and competitiveness. However, the readiness of human resources across sectors still shows a considerable gap. Many organizations face a mismatch between technological implementation and the psychological readiness and skill levels of their workforce. Digital transformation practices in Central Java tend to focus on adopting hardware and information systems without being accompanied by sustainable internal human resource capacity development (Satispi et al., 2023). This condition is reflected in employees' low readiness to face automation and digitalization, both in terms of technical skills and mindset (Nascimento et al., 2023). Many employees continue to exhibit resistance to new technologies, limited ability to operate digital systems, and low participation in AI-based training and digital competency development programs. As a result, numerous digital transformation initiatives fail to deliver optimal performance and may even create new work pressures that negatively affect productivity (Adekanmbi & Ukpere, 2023).

Previous studies have emphasized the critical role of digital competence as a fundamental foundation for human resources to survive and thrive in digital work environments (Rusu et al., 2023; Warner & Wäger, 2019). Digital competence encompasses technical skills, information literacy, and technology-based critical and collaborative thinking abilities (Ng et al., 2021). AI-based training approaches have also gained attention as effective strategies for equipping the workforce with an understanding of intelligent systems, predictive algorithms, and data-driven decision-making processes (Abad-Segura et al., 2020). Rapid technological change requires broader adaptive capacity beyond technical mastery alone. Learning agility plays a crucial role in enabling individuals to learn quickly, adapt to change, and apply new knowledge in dynamic work situations (Yue et al., 2022). This capability encourages individuals to continuously transform their thinking and behavior in line with evolving technological and organizational demands. Psychological factors and the organizational environment also influence individual readiness to face the era of automation. Technology readiness determines the extent to which individuals possess confidence and willingness to embrace new technologies, while organizational support plays an important role in providing a supportive work climate, facilities, and policies that foster adaptation and continuous learning (Aydın & Baykal, 2023; Sudaryanto et al., 2023). The combination of individual readiness and organizational support enhances the likelihood of successful and comprehensive digital transformation.

This study introduces digital mindset as a novel dimension that serves as a psychological foundation for coping with technological change. Digital mindset reflects openness to digital innovation, belief in the strategic value of technology, and a proactive attitude toward organizational transformation. Individuals with a strong digital mindset tend to view technology as an opportunity, initiate digital solutions, and actively engage in innovation processes. This mindset aspect has often received less attention than technical training, despite its strategic role in the success of digital transformation initiatives. Accordingly, this study proposes a conceptual model that integrates six main variables digital competence, AI-

based training, learning agility, technology readiness, organizational support, and digital mindset as determinants of human resource readiness in facing automation and robotics. The research focuses on companies in Central Java that are currently undergoing or have implemented digital transformation in the manufacturing, service, and technology sectors.

The novelty of this research lies in the integration of technical, cognitive, and psychological dimensions into a single comprehensive model, with particular emphasis on digital mindset as a relatively underexplored variable in studies on automation readiness in Indonesia. This approach is expected to contribute both theoretically and practically by providing organizations with insights for designing adaptive and sustainable human resource development strategies in the era of the industrial revolution.

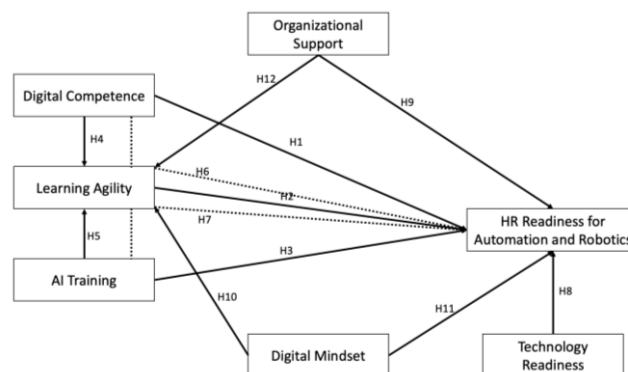


Figure 1: Conceptual Framework

The conceptual framework of this study illustrates the relationships among individual, learning, psychological, and organizational factors in shaping human resource readiness for automation and robotics. Digital competence and AI-based training are positioned as key individual capability drivers that enhance learning agility, defined as the ability to learn quickly, adapt, and apply new knowledge in dynamic work environments. Learning agility serves as an important mechanism through which competence and training influence human resource readiness.

In addition to individual factors, technology readiness and digital mindset directly affect employees' acceptance of and preparedness for automation and robotic systems. Organizational support functions as a contextual factor that strengthens the overall relationships within the model by providing a supportive work environment, policies, and resources that encourage learning and technological adaptation. Overall, this framework emphasizes that human resource readiness is the result of an integrated interaction among competence, continuous learning, digital mindset, technology readiness, and organizational support.

2. Research Method

This study employs a quantitative approach using Partial Least Squares–Structural Equation Modeling (PLS-SEM) with SmartPLS 4.0 to analyze the relationships among digital competence, AI-based training, learning agility, technology readiness, organizational support, digital mindset, and human resource readiness for automation and robotics. PLS-SEM was selected due to its ability to accommodate complex models involving both reflective and formative constructs. A purposive sampling technique was applied to target employees who

have direct exposure to digital transformation and automation in the workplace (Hair et al., 2019).

The study population consisted of 94 manufacturing companies in Central Java, with three respondents from each company at the supervisor and line manager levels, resulting in 282 valid respondents. This sample size meets the minimum requirements for SEM analysis and was further confirmed through statistical power testing using G*Power 3.1 (Kock & Hadaya, 2018). Data were collected through an online questionnaire distributed via company emails, HR WhatsApp groups, and professional networks, with informed consent obtained from all participants. The collected data were screened for completeness and consistency prior to analysis. All variables were measured using validated multi-item scales adapted from previous studies and contextualized to digital transformation in the manufacturing sector. All indicators were assessed using a five-point Likert scale ranging from strongly disagree to strongly agree to ensure reliable and consistent measurement.

Table 1. Variables and Indicators in the Study

Variable / Dimension	Indicator	Source
Digital Competence	DC1. Ability to use digital tools relevant to work tasks DC2. Ability to search, evaluate, and manage digital information DC3. Ability to communicate and collaborate using digital technologies DC4. Ability to solve problems using digital technologies DC5. Ability to adapt to new digital systems and applications	van Laar et al. (2020); Ilomäki & Lakkala (2022)
AI-Based Training	AIT1. Frequency of AI-related training provided by the organization AIT2. Relevance of AI training to job requirements AIT3. Coverage of AI and data analytics concepts in training programs AIT4. Practical applicability of AI training in daily work	Liu et al. (2022); Chui et al. (2020)
Learning Agility	LA1. Ability to quickly learn new skills and knowledge LA2. Ability to adapt learning to new and unfamiliar situations LA3. Willingness to learn from experience and feedback LA4. Ability to apply new learning in dynamic work environments	De Meuse (2022); Lombardo & Eichinger (2021)
Technology Readiness	TR1. Optimism toward the benefits of new technologies TR2. Innovativeness in trying new technologies TR3. Discomfort when using complex digital technologies TR4. Insecurity regarding technology reliability and data safety	Parasuraman (2020)

Organizational Support	OS1. Availability of training and development related to digital technology OS2. Managerial encouragement to adopt new technologies OS3. Availability of digital infrastructure and resources OS4. Organizational policies supporting continuous learning	Dwivedi et al. (2021); Babic-Hodovic et al. (2022)
Digital Mindset	DM1. Openness to digital innovation and change DM2. Curiosity toward emerging digital technologies DM3. Proactive attitude in using technology to improve work processes DM4. Comfort with uncertainty caused by digital transformation	Westerman et al. (2021); Beier & Oswald (2020)
HR Readiness for Automation and Robotics	HRR1. Technical preparedness to work with AI and robotic systems HRR2. Psychological readiness to accept automation and robotics HRR3. Ability to adapt to changes in job roles due to automation HRR4. Willingness to collaborate with AI-based and robotic systems	Makridakis (2020); McKinsey & Company (2021); Ransbotham et al. (2020)

3. Results and Discussion

3.1. Results

A total of 282 respondents participated in this study, all of whom were employees working in manufacturing companies in Central Java that are currently undergoing or have implemented digital transformation and automation initiatives. Respondents were selected using a purposive sampling technique, focusing on individuals at the supervisor and line manager levels, as these positions are directly involved in managing operational processes and technological changes related to automation and robotics. This selection ensured that respondents possessed adequate experience and understanding of digital systems, AI-based technologies, and organizational transformation practices. In terms of organizational context, all respondents were drawn from 94 manufacturing firms, with each company contributing three respondents to represent different functional perspectives. The respondents were considered relevant informants due to their direct exposure to digital tools, automated production systems, and organizational policies related to technological adoption. Their involvement in daily operational decision-making and workforce coordination provided reliable insights into learning agility, digital competence, technology readiness, and overall human resource readiness for automation and robotics.

Table 2. Hypothesis Test Results, R Square

Hypothesis	Structural Path	Beta	t-value	p-value	R Square	Adjusted R Square
H1	Digital Competence → HR Readiness	0.298	4.689	0.000	0.789	0.785
H2	AI-Based Training → HR Readiness	0.271	4.672	0.000		

H3	Learning Agility → HR Readiness	0.186	3.153	0.002		
H4	Digital Competence → Learning Agility	0.412	7.357	0.000	0.655	0.652
H5	AI-Based Training → Learning Agility	0.395	4.672	0.000		
H6	Learning Agility → HR Readiness (Mediation of Digital Competence)	0.126	2.625	0.009	0.789	0.785
H7	Learning Agility → HR Readiness (Mediation of AI-Based Training)	0.114	2.533	0.012	0.789	0.785
H8	Technology Readiness → HR Readiness	0.211	3.702	0.000	0.789	0.785
H9	Organizational Support → HR Readiness	0.239	4.845	0.000	0.789	0.785
H10	Digital Mindset → Learning Agility	0.322	8.601	0.000	0.655	0.652
H11	Digital Mindset → HR Readiness	0.098	1.556	0.121	0.789	0.785
H12	Organizational Support → Learning Agility	0.276	4.689	0.000	0.655	0.652

The research results indicate that the developed model has strong explanatory power in explaining human resource readiness to face automation and robotics. An R-square value of 0.789 (Adjusted R-square = 0.785) suggests that most of the variance in HR readiness can be explained by digital competence, AI-based training, learning agility, technological readiness, organizational support, and digital mindset. Meanwhile, learning agility also shows substantial explanatory power with an R-square value of 0.655, indicating that employees' adaptive capabilities are significantly influenced by digital competence, AI-based training, digital mindset, and organizational support. These findings confirm that HR readiness is a multidimensional construct shaped by the interaction of technical, learning, psychological, and organizational factors.

Path analysis reveals that digital competence, AI-based training, learning agility, technological readiness, and organizational support have positive and significant effects on HR readiness. Digital competence and AI-based training not only exert direct effects but also indirect effects through the mediating role of learning agility. This indicates that improvements in technical skills and technology-based training are more effective when accompanied by individuals' ability to learn and adapt rapidly. In addition, digital mindset and organizational support are proven to have significant effects on learning agility; however, digital mindset does not show a significant direct effect on HR readiness. This suggests that the role of digital mindset is primarily indirect, operating through the enhancement of adaptive learning capacity. Overall, the findings emphasize the importance of integrated HR development strategies that focus not only on technical aspects but also on continuous learning, psychological readiness, and organizational support in responding to the era of automation and robotics.

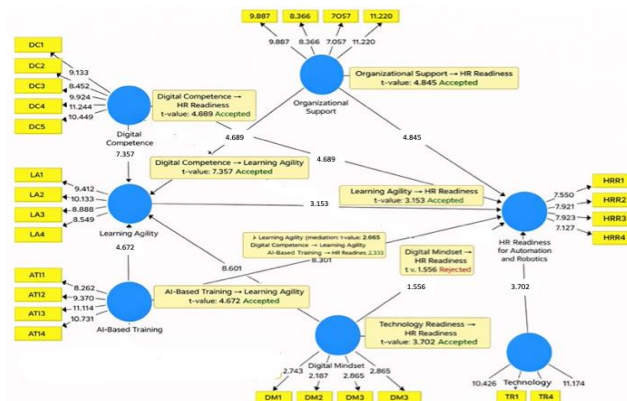


Figure 2. Path Analysis

3.2. Discussion

Based on the results of this study, several key findings highlight the complexity of human resource (HR) readiness in facing the era of automation and robotics. This research emphasizes the importance of digital competence, AI-based training, learning agility, technology readiness, organizational support, and digital mindset as critical determinants in shaping HR readiness for technology-driven transformation.

The first finding indicates that digital competence has a significant direct effect on HR readiness ($\beta = 0.298$, $p < 0.001$). This supports competency theory (Spencer & Spencer), which posits that relevant skills and knowledge form the foundation for performance in specific work contexts (Spencer & Spencer, 2008). Individuals with high digital competence are better equipped to understand technology-based systems, adapt to changes, and perform tasks efficiently in digitalized work environments (Ghobakhloo & Iranmanesh, 2021). This finding also reinforces van Laar et al, who argue that digital competence plays a vital role in successful workplace adaptation to digital transformation (Van Laar et al., 2019).

In addition, AI-based training is shown to significantly enhance HR readiness ($\beta = 0.271$, $p < 0.001$), aligning with organizational learning theory (Argyris & Schön, 1978), which emphasizes the role of learning processes in fostering organizational adaptability. Training focused on artificial intelligence equips employees to understand and use new technologies effectively, enhancing their capacity to work alongside automated systems. Supporting this, Zheng et al. (2024) found that technology-based training improves work efficiency and AI adoption readiness in the industrial sector (Zheng, 2024).

The findings also confirm the mediating role of learning agility. Learning agility is significantly influenced by both digital competence ($\beta = 0.412$, $p < 0.001$) and AI-based training ($\beta = 0.395$, $p < 0.001$), and it directly impacts HR readiness ($\beta = 0.186$, $p = 0.002$). These results support work adaptability theory (Pulakos et al., 2000), which states that the ability to quickly learn and adapt to new situations is crucial in unpredictable work environments. The mediating effect of learning agility indicates that learning and cognitive flexibility are essential pathways through which skills and training translate into tangible readiness. This is in line with De Meuse (2022), who identified learning agility as a strong predictor of individual success in adapting to technological change (De Meuse, 2022).

Organizational support exerts a direct influence on both HR readiness ($\beta = 0.239$, $p < 0.001$) and learning agility ($\beta = 0.276$, $p < 0.001$). These findings align with perceived organizational support theory (Eisenberger et al., 1986), which asserts that employees' perceptions of organizational support influence their motivation, engagement, and workplace

behavior. Support mechanisms such as access to digital training, encouragement from supervisors, and availability of technological resources play a critical role in the success of digital transformation initiatives. This is supported by studies from Dwivedi et al. (2021) and Babic-Hodovic et al. (2022), which demonstrate a positive relationship between organizational support and readiness for technology-based change (Dwivedi et al., 2021).

Furthermore, technology readiness has a direct impact on HR readiness ($\beta = 0.211$, $p < 0.001$), suggesting that attitudes toward technology including optimism, innovativeness, discomfort, and insecurity are significant factors in determining automation readiness. The Technology Readiness Index (TRI 2.0) proposed by Parasuraman (2020) explains that individuals with high technology readiness are more open to and confident in adopting new technologies.

Meanwhile, the results show that digital mindset, although significantly influencing learning agility ($\beta = 0.322$, $p < 0.001$), does not have a direct effect on HR readiness ($\beta = 0.098$, $p = 0.121$). This suggests that a positive attitude toward technology alone, without adequate competence and systemic support, is insufficient to generate actual readiness. This extends the findings of Westerman et al. (2021), who argue that a digital mindset must be integrated with skill development strategies to have a concrete impact on organizational readiness for digital transformation.

Overall, this study demonstrates that HR readiness for automation and robotics is the result of an interaction between individual capabilities, organizational support, and technological and mental preparedness. The combination of these factors forms a solid foundation for embracing technological change. Learning agility serves as a critical mediating mechanism that bridges initial competencies and training with final readiness outcomes. Cognitively agile employees can translate their learning and skills into tangible actions to face automation challenges.

4. Conclusion

This study demonstrates that human resource (HR) readiness for automation and robotics is shaped by the interaction of individual capabilities and organizational–technological factors. Digital competence, AI-based training, learning agility, organizational support, and technology readiness significantly contribute to HR readiness, while digital mindset influences readiness indirectly through learning agility. The findings confirm the central role of learning agility as a mediating mechanism that strengthens the impact of digital competence and AI-based training on HR readiness, emphasizing the importance of adaptive learning in responding to rapid technological change. Overall, HR readiness is a multidimensional construct that requires the alignment of digital skills, continuous learning, and organizational commitment. Organizations seeking to remain competitive in the era of automation and robotics must adopt holistic HR development strategies to build a workforce that is both technologically capable and adaptable.

From a practical perspective the results indicate that organizations need to invest in digital upskilling and AI-based training while simultaneously fostering learning agility through structured learning environments, mentoring, and strong organizational support. Relying solely on a positive digital mindset is insufficient without the presence of adequate skills development and technological infrastructure, as learning agility plays a critical role in enabling employees to adapt effectively to technological change. From a theoretical perspective, this study contributes to the literature on human resource development and digital transformation by integrating multiple constructs into a comprehensive model of HR

readiness. The confirmation of learning agility as a key mediating variable reinforces its theoretical importance in facilitating adaptation within dynamic work environments. Furthermore, the findings support and extend existing theories, including Competency Theory, Organizational Learning Theory, Work Adaptability Theory, and the Technology Readiness Index, by highlighting the combined influence of individual and contextual factors on workforce readiness in the digital era.

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