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E-Learning Readiness Index and Analysis of E-Learning Application Readiness to Nahdlatul Ulama Higher Education

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ABSTRACT

Evaluating the implementation of e-learning is a crucial aspect of its successful application. To facilitate the systematic collection of essential data for developing e-learning initiatives, the E-Learning Readiness (ELR) model was developed. This study utilises the Aydin and Tasci ELR model to assess the e-learning readiness of Nahdlatul Ulama Higher Education institutions, focusing on four key dimensions: readiness, self, technology, human, and innovation. A cross-sectional quantitative descriptive research design was employed, collecting data from participants at 88 institutions. The findings indicate an average readiness index of 3.52, suggesting that the institutions are generally prepared to adopt e-learning with minor enhancements. Innovation scored the highest at 3.72, reflecting strong awareness of technological solutions, while human readiness scored the lowest at 3.40, indicating challenges in managing organisational change. The study highlights the importance of sustaining e-learning integration through targeted and systematic assessments to strengthen underdeveloped areas. These findings provide a strategic framework for institutional leaders to enhance teaching and learning through e-learning systems.

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Introduction

E-learning has emerged as one of the most prevalent educational approaches, transforming traditional learning into a high-technology-driven process (Al-Shehi, 2022). It extends beyond the mere digitisation of content—shifting from paper-based delivery to machine-readable formats—to encompass a broader transformation in educational practices. This transition prioritises collaborative, problem-solving-based learning models that are generally more open and less restrictive compared to conventional face-to-face lectures (Srinivasan et al., 2021). The impact of this shift is particularly pronounced in developing nations, where e-learning enhances educational accessibility and academic quality in contexts where traditional methods often fall short. However, this transformation also brings into focus critical questions about readiness and the effective implementation of e-learning systems (Madni et al., 2022).

In the process of scientific transfer, a paradigm shift in learning systems has begun to take shape (Wilbers & Brankovic, 2023). While numerous studies highlight the advantages of e-learning, not all institutions adopting such systems achieve the desired outcomes (Giannakos et al., 2022; Yunusa & Umar, 2021). Traditional approaches to education often prioritise the teaching process, characterised by a content-focused, abstract methodology that is confined to specific groups, thereby rendering the process predominantly passive (Marougkas et al., 2024). In contrast, contemporary learning models emphasise contextual, problem-based approaches that are inclusive and unrestricted by specific demographics (Shimizu et al., 2021). This transformation aligns closely with advancements in information and communication technology (ICT). In this evolving learning environment, learners are expected to enhance their engagement by leveraging available resources, particularly those accessible through the Internet.

Evaluation plays a pivotal role in e-learning, offering insights into the extent to which its implementation aligns with initial objectives (Naveed et al., 2020). The success of e-learning systems is gauged by their effectiveness in facilitating educational processes and human resource development. Key metrics include the delivery of learning materials, the quality of social interaction and communication among participants, and the achievement of learning objectives via e-learning platforms (Zhang et al., 2020). The primary factors contributing to the success of e-learning are the alignment of content with learners' needs and the effective use of technology for delivery (Aali et al., 2020). Consequently, the effectiveness of e-learning implementation can be assessed across three critical dimensions: content, technology, and management.

Among the various components involved in the implementation of e-learning, the readiness of students, lecturers, and institutions plays a pivotal role in evaluations. Several models have been developed to assess e-learning readiness specifically from the perspective of students. Ate, Joosten, Cusatis, and Zine have each proposed distinct frameworks for evaluating student readiness for e-learning (Firdaus et al., 2020). Assessing ELR is crucial for understanding an organisation's current capabilities relative to the desired ideal state. ELR refers to an organisation's mental and physical preparedness for adopting a learning experience (Majid & Lakshmi, 2022). Its significance lies in addressing common challenges encountered during e-learning implementation, such as resistance to change, insufficient computer literacy, limited human resources, inadequate infrastructure,

and entrenched organisational cultures (Zine et al., 2023). Evaluating these factors helps organisations identify gaps and strategies improvements to achieve successful e-learning adoption.

The primary objective of the ELR model is to facilitate the collection of essential information necessary for the development of e-learning systems. Numerous scholars, both individually and collaboratively, have proposed various ELR models. For example, the Kirkpatrick model posits that e-learning evaluation encompasses four levels: reaction, knowledge, behaviour, and results (Julia, 2023; Puertas-Bartolomé et al., 2024). These four levels provide a comprehensive framework for assessing the outcomes achieved by an institution following the implementation of e-learning, offering a detailed understanding of the effectiveness and impact of e-learning initiatives.

Alternatively, the ELR model proposed by Kaur and Abas, which measures e-learning readiness in Malaysia, encompasses several key assessment components (Goh & Blake, 2021). These components include learner readiness, management, personnel, content, technical infrastructure, environment, culture, and financial resources. Similarly, Bacolod (2023) developed an ELR model that categorises e-learning readiness into eight preparation groups. These include mental preparedness, social readiness, environmental preparedness, financial readiness, technological competence, and content readiness, among others. This comprehensive approach highlights the multifaceted nature of e-learning readiness, focusing on various aspects that contribute to the successful implementation and utilisation of e-learning systems.

An e-learning readiness assessment is crucial for identifying both barriers and enablers in adapting technology for learning, as it helps to recognise strengths, weaknesses, and other factors that influence the effectiveness of technology use in education (Zine et al., 2023). Several frameworks have been established, with key measures for determining readiness including technology investment, personnel, institutional support, and innovation. Among these, the Aydin & Tasci (2005) model is particularly favoured and is especially suitable for assessing e-learning preparedness in developing countries. This model evaluates aspects such as technology, innovation, human readiness, and self-development, offering a comprehensive perspective on the potential for successful e-learning implementation in institutions (Majid & Lakshmi, 2024).

The Aydin and Tasci (2005) ELR model identifies four key criteria to assess a country's readiness for e-learning. These include: (1) technology factors, which focus on knowledge of technological innovations, particularly for education and business; (2) business-orientation factors, which evaluate the capabilities of educators and business professionals; (3) human factors, which consider the characteristics of human resources in schools and organisations; and (4) self-development, which measures the confidence of institutions in their capacity for self-improvement. These elements collectively help determine e-learning readiness. Rosida et al. (2021) adopted the Aydin and Tasci model to assess e-learning readiness (Firmansyah et al., 2021). The study examined various factors such as human resources, organisational culture, technology, policies, financial circumstances, and infrastructure to determine a business's preparedness for e-learning implementation. Focusing on lecturers and students, the study evaluated ABC University's readiness to successfully adopt e-learning. The results indicated that ABC University had an e-learning

readiness index ranging from 3.41 to 3.60. While most factors were deemed ready for e-learning adoption, the personal growth factor required further attention before it could be considered fully prepared. Students, in particular, appeared "unprepared" in terms of technology and innovation, although they were "ready" in terms of human factors and self-development. Despite these gaps, the study concluded that ABC University is "ready" to implement e-learning in teaching and learning, with opportunities for improvement.

According to Zine et al. (2023) in their study "E-Learning Readiness Assessment Using Machine Learning Methods," researchers employed the ADKAR model in conjunction with machine learning-based feature detection techniques to assess learners' preparedness for online education. The study used Random Forest (RF) and Decision Tree (DT) algorithms to evaluate capacity and knowledge scores, which were found to be 0.565 and 0.514 for capacity, and 0.170 and 0.251 for knowledge, respectively. The results indicated that the most significant factors influencing e-learning readiness were related to students' skills and knowledge. Based on these findings, it is recommended that institutions focus on enhancing students' skills and providing them with the necessary knowledge to better prepare them for e-learning.

Ate et al. (2021) examined five factors—social support, technology readiness, attitudes towards e-learning, e-learning acceptance, and students—to assess e-learning readiness at universities in developing countries. The study found that student readiness was the highest, driven by their openness to collaboration, time management, and motivation with technology. However, attitudes towards e-learning were the least prepared, highlighting the need for improvement in this area. The research also identified significant barriers to the successful integration of e-learning in underdeveloped countries. Effective implementation of e-learning requires strategic planning and evaluation to ensure the system delivers optimal outcomes and addresses areas needing improvement.

In Indonesia, several Nahdlatul Ulama higher education institutions have made significant contributions to the education sector. However, their readiness to implement e-learning has not been comprehensively assessed, leading to gaps in understanding their challenges and opportunities. This study aims to evaluate the e-learning readiness index of Nahdlatul Ulama Higher Education institutions using the Aydin & Tasci model and identify areas requiring development. In addition to addressing the gap in literature on e-learning readiness, this research offers practical guidelines for institutional leaders to target areas for improvement. By addressing these challenges, these institutions can foster effective and inclusive technology-enhanced learning, supporting the success of e-learning platforms. The study's findings are expected to inform future research and contribute to the development of a sustainable e-learning model for similar educational settings.

This study aims to determine the e-learning readiness index and conduct a readiness analysis of e-learning implementation at Nahdlatul Ulama Higher Education institutions. By assessing the degree of preparedness for e-learning, the study seeks to identify the strengths and weaknesses within these institutions regarding the adoption of e-learning systems. Utilising the e-learning readiness model, the findings will provide valuable insights for institutional leaders, enabling them to develop strategic policies that enhance the effective implementation of e-learning systems.

Research Method

This research employs a descriptive research design to assess the readiness of Nahdlatul Ulama Higher Education institutions for e-learning. The Aydin & Tasci (2005) ELR model was selected for the analysis, as it was specifically developed to evaluate the technological and organisational infrastructure readiness of developing countries. The model focuses on four key factors: technology, innovation, human readiness, and self-development. Data collection was primarily conducted through a questionnaire, which was designed using items derived from the ELR model. The Aydin & Tasci ELR model incorporates four key readiness variables to assess an institution's preparedness for e-learning implementation. Designed specifically for institutions in developing nations, this model is well-suited for application in Indonesia. The survey included 37 questions covering four readiness categories: (a) institution, (b) people, (c) technology and innovation, and (d) personal development. The instrument underwent pilot testing with 32 respondents to ensure validity, achieving a high reliability measure with a Cronbach's alpha coefficient of 0.85. 88 participants, including programme chairs, e-learning coordinators, completed the final questionnaire and lecturers, who were purposively sampled to ensure the credibility of those involved in the implementation of e-learning in the institutions.

Respondents were selected using a criterion-based sampling method, focusing on factors relevant to the implementation of e-learning readiness. The criteria for selecting respondents were: (a) the ability to provide a clear understanding and conclusions about the data held by the institution, (b) possessing extensive knowledge about the data available at the university, and (c) being competent in handling institutional data. Data collection targeted institutions that met three critical criteria: (1) accreditation as a higher education institution under Nahdlatul Ulama, (2) access to information and communication technology, and (3) network/internet connectivity. These institutions were chosen to reflect geographical diversity and variations in organisational positioning within the Nahdlatul Ulama Higher Education system.

The purposive sampling method employed to select Nahdlatul Ulama Higher Education institutions for this research sample was guided by specific characteristics or features relevant to the implementation of e-learning. According to these criteria, 88 institutions were chosen from an initial pool of 258 Nahdlatul Ulama Higher Education institutions. Quantitative data analysis was conducted to determine readiness indices for each institution, with scores ranging from 1 to 5. A readiness level of 3.00 or higher indicated readiness, with higher scores reflecting greater preparedness. This approach provided insights into the level of institutional readiness and identified areas of strength necessary for the effective implementation of e-learning. The findings were subsequently used to offer targeted recommendations for improving the e-learning process within the participating institutions.

Results and Discussion

The readiness analysis of Nahdlatul Ulama Higher Education institutions for e-learning reveals an overall readiness index of 3.52, indicating that these institutions are nearly ready for e-learning implementation, with only minor improvements needed. Among the four

measured factors, innovation achieved the highest mean score of 3.72, followed by technology (3.60), self-development (3.41), and human readiness (3.40). This suggests that while there has been significant progress in technological infrastructure and openness to change, areas related to human capital and development still require focused attention. Overall, the results place Nahdlatul Ulama Higher Education institutions in the "ready" category, with slight enhancements needed to fully integrate e-learning into the teaching and learning process.

Table 1 illustrates that Nahdlatul Ulama Higher Education institutions must focus on enhancing their human resource preparation for e-learning implementation. The institutions have demonstrated a high level of preparedness to integrate e-learning into the instructional and educational processes, as depicted in Figure 1. The innovation component ranks the highest with a score of 3.72, followed by the technology factor (3.60), personal development (3.41), and human readiness (3.40), in decreasing order of importance. Notably, the human readiness factor remains the key area requiring improvement. Figure 1 displays the e-learning readiness index for Nahdlatul Ulama Higher Education institutions.

Table 1

Nahdlatul Ulama Higher Education E-Learning Readiness Index

Factor	ERL Index
Human	3.40
Self-Development	3.41
Technology	3.60
Innovation	3.72
Average	**3.52**

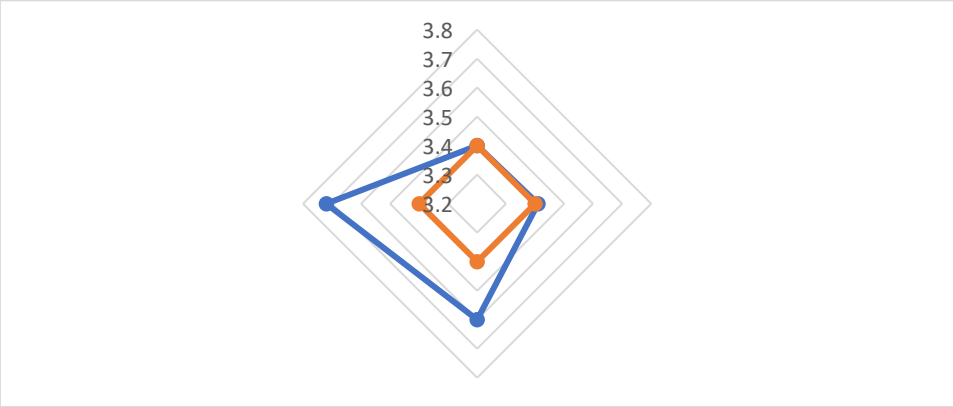

Figure 1: Nahdlatul Ulama Higher Education E-Learning Readiness Index

E-Learning Readiness Index and Human Factors Readiness Analysis

The readiness index indicates that Nahdlatul Ulama Higher Education institutions are 'ready' for e-learning implementation, though there is room for improvement to optimise

results. The higher scores for innovation and technology suggest that these institutions are prepared to adopt new tools and have made investments in them. However, the lower scores for human readiness highlight challenges such as insufficient digital literacy among staff and students, as well as inadequate preparation for effective e-learning practices. These areas require focused attention to fully harness the potential of e-learning. The ELR model proposed by Aydin and Tasci identifies human resources, including experienced individuals, early adopters of e-learning, e-learning service providers, and the capacity for technological learning, as critical components for e-learning implementation. Human resources, as a unique form of energy, are essential inputs in the execution of educational activities (Faeni, 2024). This underscores the crucial role of human resources in the successful integration of e-learning. Human resources contribute in two key ways: 1) through the ability to make decisions, which relates to skills, capacity, and efficiency, and 2) through collaboration, driven by motivation and a willingness to learn (Putra & Ali, 2022).

The human readiness index, scoring 3.40, is the lowest, indicating that human capacity remains the weakest link in e-learning readiness. This highlights the challenges faced by faculty and administrative staff in higher education, particularly due to limited access to standardised training and support. Similar trends in e-learning readiness have been observed in other developing countries (Abuhassna et al., 2022). To address this, institutions must prioritise formal training programmes that enhance digital competency and awareness while fostering a positive learning environment on a daily basis. Individuals with a higher level of education are more likely to adopt e-learning innovations than those with less advanced qualifications (Pinho et al., 2021). Aydin and Tasci further highlighted that the questionnaire instrument they proposed includes factors such as the level of education, the skills of existing resources, e-learning pioneers, and external e-learning service providers (Ubachs et al., 2024). In light of these perspectives, human factors play a critical role in determining an institution's readiness to implement e-learning. Figure 2 presents the e-learning readiness index along with an analysis of human factors readiness.

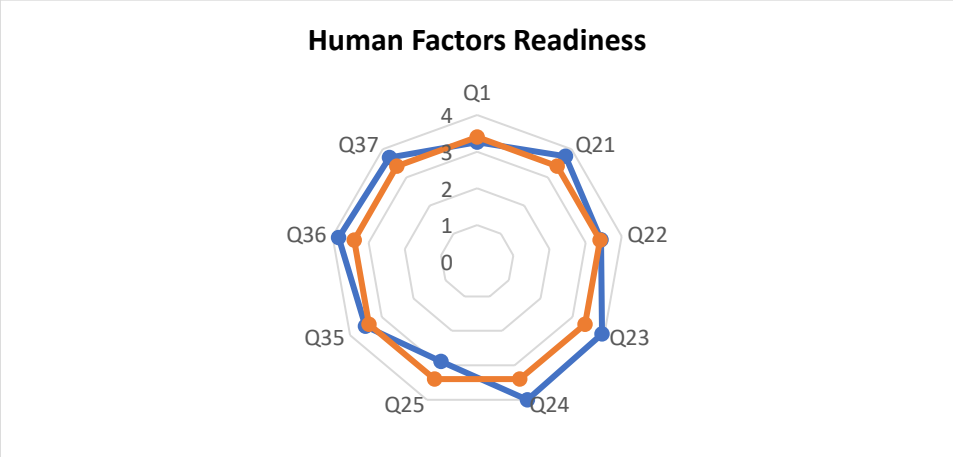

Figure 2: E-Learning Readiness Index and Human Factors Readiness Analysis

E-Learning Readiness Index and Readiness Analysis of Personal Development Factors

When comparing the actual scores of participants to the self-development readiness index, respondents achieved a score of 3.41 out of 5, indicating moderate readiness. However, several barriers to self-development were identified, particularly concerning budgeting and time management. The current e-learning models require substantial capital investment, posing a challenge for many organisations with limited budgets. Additionally, time management issues impact both students and lecturers, as e-learning involves flexible learning schedules rather than fixed timetables. To address these challenges, it is crucial to promote confidence in self-directed learning and allocate dedicated funds for the sustainability of e-learning initiatives.

Aydin and Tasci's self-development factors highlight the importance of e-learning budgeting, time management, and confidence in self-directed learning (Rosida et al., 2021). These factors play a critical role in determining an organisation's readiness to implement e-learning. In terms of budget, e-learning is often more costly than traditional classroom settings due to the substantial investment required to establish and maintain the necessary infrastructure for seamless operation. Effective budgeting is essential for the successful implementation of e-learning in universities, ensuring that investments are utilised efficiently and effectively (Sultani et al., 2023).

Time management is a critical element of e-learning, as it was designed to eliminate physical and temporal barriers between educators and students (Basir et al., 2021). Efficient time management is pivotal for determining successful performance in e-learning environments (Alqahtani & Rajkhan, 2020). E-learning extends beyond campus-based activities, incorporating flexible learning outside traditional classroom settings. Confidence in self-development ensures that both students and faculty are empowered to enhance their skills during the e-learning process. Philosophically, e-learning implementation entails two significant consequences. The first requires an independent learning system, where students have autonomy in deciding: (1) what they learn, (2) when, where, and how they learn it, and (3) when and how they demonstrate their learning achievements. The second consequence involves optimising communication tools, especially telecommunications technologies, to meet specific needs effectively. Thus, the self-development factor is crucial as an indicator of e-learning readiness (Krismanto et al., 2020). Figure 3 presents the e-learning readiness index and personal development factor readiness analysis. Moreover, based on Figure 3, which outlines the readiness of self-development factors, the following areas require attention: (1) Encouraging students to engage actively and enjoy participating in e-learning (Q11), (2) Improving the management of funding sources to ensure the sustainability of e-learning implementation (Q18), and (3) Allocating dedicated time for discussions on the e-learning budget (Q19). These aspects are essential for enhancing the overall effectiveness and longevity of e-learning initiatives.

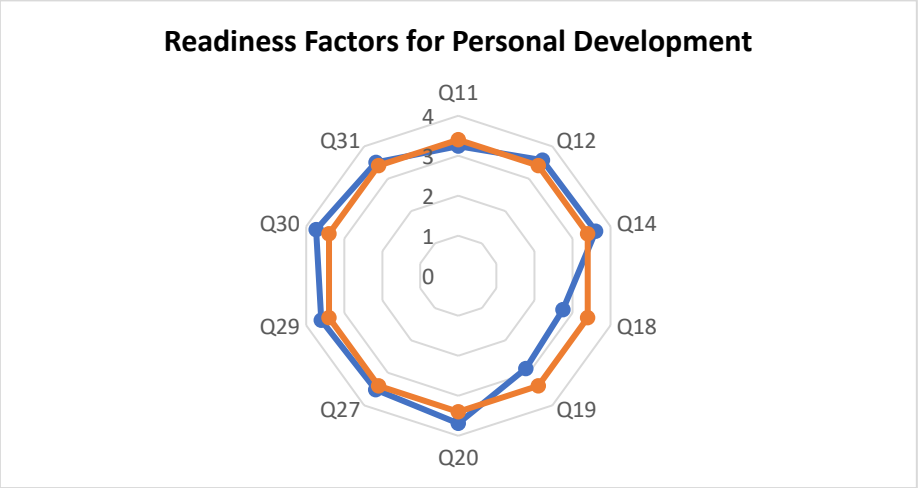

Figure 3: E-Learning Readiness Index and Analysis of Personal Development Factor Readiness

E-Learning Readiness Index and Technology Factor Readiness Analysis

The index related to the use of technology among the institutional population (3.60) reflects the institution's capacity in terms of infrastructure and technological utilisation. The availability of internet connections and functional computer labs demonstrates preparedness for e-learning. However, there are areas for improvement, particularly in the equitable distribution of technology, especially in remote learning for students residing in distant areas. Institutions should focus on enhancing internet connectivity and enabling students to use their own devices, thereby bridging the digital divide identified earlier. Technology is a critical factor influencing the adoption of e-learning innovations. Hardware and software constitute the two primary components of any technological system (Englander et al., 2021).

Hardware refers to the tangible elements of technology, while software represents the intangible information that supports the execution of specific tasks. The effectiveness of e-learning is highly dependent on the availability of reliable infrastructure and tools. Given the high dependency on technological resources, the infrastructure's availability is also a crucial factor (Pashchenko et al., 2020). E-learning does not require extensive infrastructure; a reliable internet connection and sufficient computers can ensure its effective operation (Ylirisku et al., 2021). Therefore, the ability to utilise computers and internet access must be considered as key elements in the implementation of e-learning (George et al., 2021). Based on these perspectives, technological factors play an essential role in e-learning implementation. Figure 4 illustrates the e-learning readiness index and the readiness analysis of technology factors. Moreover, figure 4 presents the e-learning Readiness Index and Technology Factor Readiness Analysis. Key areas that require attention include: (1) Enhancing computer laboratory facilities and infrastructure to enable individual access to computers by students (Q2), and (2) Ensuring the provision of reliable internet access throughout the university environment (Q3).

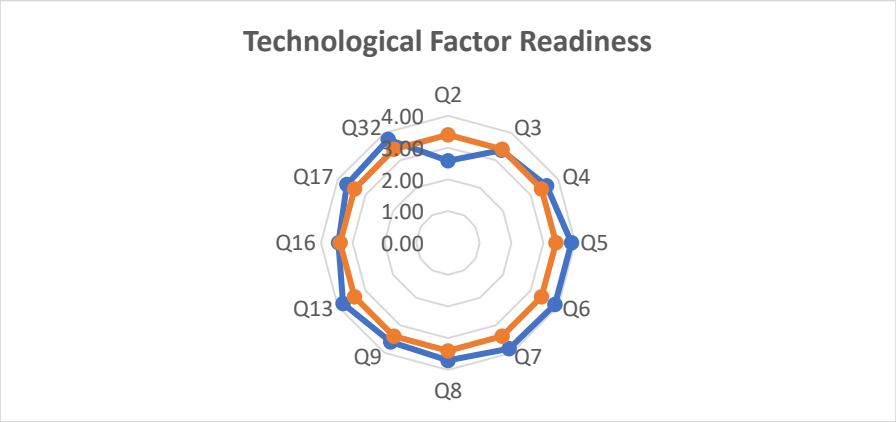

Figure 4: E-Learning Readiness Index and Technology Factor Readiness Analysis

E-Learning Readiness Index and Innovation Factor Readiness Analysis

Innovation, with a score of 3.72, ranks highest, reflecting the institutions' readiness to adopt new strategies and approaches to teaching and learning. The faculty and administrators demonstrate a strong willingness to experiment with new pedagogies, such as hybrid learning models and the integration of digital media. However, for such innovation to be effectively incorporated into the curriculum, it must be accompanied by ongoing staff development to ensure its successful implementation. Innovation factors involve assessing previous e-learning experiences, which can influence the adoption of e-learning practices (Şahin et al., 2022). The acceptance or rejection of innovation can serve as an indicator of readiness for e-learning implementation (Alhammadi et al., 2023). Barriers to e-learning can stem from both internal and external factors, and the innovation factor encompasses these barriers, the capacity to adopt e-learning, and openness to new e-learning approaches. Based on these perspectives, the innovation factor is crucial in determining the readiness level for e-learning implementation (Naveed et al., 2020). Figure 5 illustrates the e-learning readiness index and innovation factor readiness analysis.

Figure 5 illustrates the e-learning readiness index and innovation factor readiness analysis. One key issue that must be addressed is the alignment of internal and external interests or factors that may impede the adoption of e-learning (Q28). This finding is consistent with prior research on e-learning readiness in higher education, which highlights that human resources and technology are critical for the successful implementation of e-learning (Wagiran et al., 2022; Yalley, 2022). These results underscore the importance of centralising efforts to evaluate the readiness of Nahdlatul Ulama Higher Education institutions for e-learning adoption in Indonesia, with the crucial caveat that the theoretical aspects of human and self-development elements must be systematically addressed. Based on this analysis, periodic assessments are necessary to monitor the progress and alignment of e-learning integration efforts, ensuring they evolve in line with institutional goals and student expectations. The findings suggest several actionable recommendations:

- Enhancing Human Capacity: The administration should organise awareness campaigns for faculty and administrative staff to improve their proficiency in using information communication technologies, particularly e-learning tools.
- -Supporting Self-Development: Establish dedicated resources for e-learning initiatives, and carefully structure training and self-paced learning schedules for both students and staff.
- Improving Technological Access: Expand internet coverage across the institution and ensure that all students have access to the necessary technology for e-learning.
- Sustaining Innovation: Encourage continuous self-development and foster partnerships with external e-learning service providers to ensure ongoing innovation and adaptation in e-learning practices.

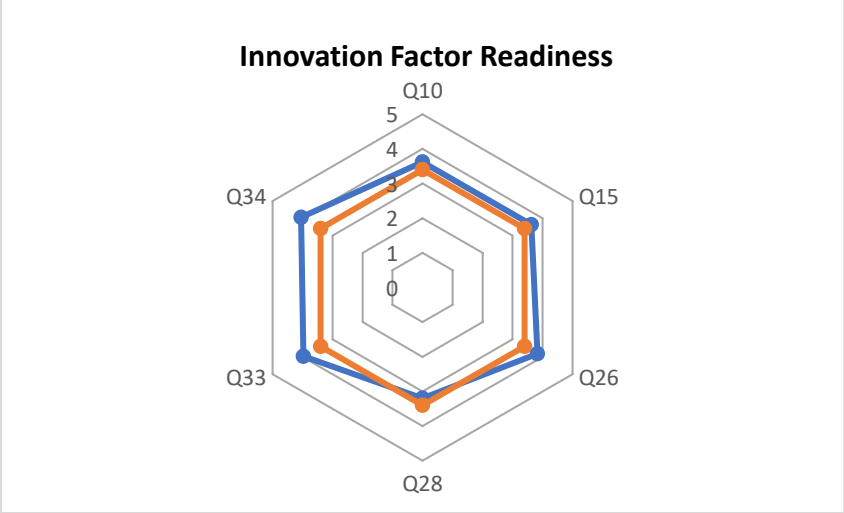

Figure 5: E-Learning Readiness Index and Innovation Factor Readiness Analysis

Conclusion

Based on the analysis, this research finds that NUHE is moderately ready for e-learning with an ELR index of 3.52. Key readiness scores include human readiness (3.40) and self-development (3.41), with the highest score for innovation (3.72), indicating openness to new teaching methods. To enhance e-learning readiness, institutions should invest in infrastructure, professional development for staff, and improve access to information technologies. Regular evaluations are essential to track progress, address weaknesses, and ensure continuous high-quality e-learning integration. These findings provide practical recommendations for institutional leaders to drive sustained progress.

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