

Digital Transformation in Pesantren Education to Enhance Work Readiness Among Students: A Comparative Case Study

Mohammad Syairozi Dimyathi¹, Putra Bagus Muchammad², Hannanah Mukhtar Thabrani³, Nurhan M. Syairozi⁴

¹Universitas Islam Negeri Syarif Hidayatullah Jakarta, Indonesia

²International Islamic University Malaysia (IIUM), Malaysia

³Universitas Islam Negeri Sultan Maulana Hasanuddin Banten, Indonesia

⁴University of Birmingham, Birmingham, United Kingdom

Email: syairozi.dimyathi@uinjkt.ac.id

Abstract

Digital transformation in Islamic boarding school education (pesantren) has become a strategic necessity in the era of the Industrial Revolution 4.0 and Society 5.0. This study aims to analyze the forms, strategies, and effectiveness of digital transformation in three modern Vocational High School Boarding School (VHS BS): ABC VHS BS (Bogor Regency), PQR VHS BS (West Bandung Regency), and XYZ VHS BS (Bandung Regency) as well as its impact on enhancing students' employability skills. The research employs a qualitative approach with a multi-case study design. Data were collected through semi-structured interviews, observations, and document analysis, including digital policy documents, e-learning modules, and alumni employment data from 2022-2025. Thematic analysis was conducted based on Change Management, TPACK, and Dynamic Capabilities theories. The findings reveal that digital transformation in VHS BS encompasses four main dimensions: (1) digital policy and infrastructure, (2) capacity building for teachers and students, (3) technology integration in vocational and Islamic curricula, and (4) strengthening students' digital employability skills. The implementation of digitalization has proven to enhance digital literacy, professional communication, collaboration, and Islamic work ethics. The success of digital transformation is determined by visionary leadership, human resource readiness, industry partnerships, and the internalization of spiritual values within the organizational culture of the pesantren. Theoretically, this study introduces a new concept of Digital Employability Skills Santri, which integrates technological competence, Islamic character, and industry relevance as the foundation for work readiness in the digital era. The findings contribute to the development of a conceptual model for digital transformation in Islamic education and provide strategic recommendations for implementing Indonesia's Digital Education Roadmap 2030.

Keywords: *Digital Transformation; Islamic Boarding Schools; Vocational Education; Employability Skills; Digital Literacy.*



A. INTRODUCTION

The rapid expansion of digital technology has revolutionized nearly every aspect of modern life, including the education sector. Digital transformation in education is not merely associated with the use of devices or digital learning media; it also reflects a paradigm shift in pedagogy, educational management, and technology-driven curriculum design. In the Indonesian context, a significant challenge lies in how pesantren Islamic boarding schools deeply rooted in religious tradition can adapt

to digital transformation while maintaining their distinctive religious and national values.

Pesantren that integrate vocational education (SMK) hold a strategic position in combining Islamic competencies with vocational skills that are relevant to the contemporary labor market. Digital transformation within vocational pesantren has become essential for enhancing the relevance, efficiency, and competitiveness of graduates amid the disruptions of Industry 4.0 and Society 5.0. Research by Nugroho & Astutik (2024) demonstrates that digitalization in Islamic educational institutions can improve managerial efficiency, information accessibility, and learning quality when implemented systematically and sustainably. Furthermore, a study by Samsul Bahri et al. (2024) highlights the crucial role of kyai and pesantren administrators in ensuring the continuity of inclusive digital education services.

The integration of technology within vocational pesantren does not always proceed smoothly. Common obstacles include limited infrastructure, low levels of digital literacy among educators, and cultural resistance to technological innovation. Akhmad (2024) notes that pesantren adaptation to the Society 5.0 ecosystem continues to face both technical constraints and strong institutional cultural barriers.

On the other hand, graduates of vocational pesantren are expected to possess not only hard skills but also soft skills such as digital literacy, professional communication, problem-solving, and collaboration. A quantitative study by Santosa et al. (2023) emphasizes that the development of Employability Skills Integrated with Digital Competencies (ESKD) is a key element in strengthening the competitiveness of vocational school graduates in the digital industrial era (jptm.ejournal.unsri.ac.id).

Although considerable research has been conducted on the digitalization of Islamic education and vocational schools, studies that specifically examine the strategies, implementation, and impact of digital transformation within the context of vocational pesantren remain limited. This study focuses on three institutions ABC VHS BS in Bogor Regency, PQR VS BS in West Bandung Regency, and XYZ VHS BS in Bandung Regency which represent modern VHS BS models attempting to simultaneously integrate religious education, vocational training, and digital competencies.

This study aims to: (1) identify the policies and forms of digital transformation implemented in the three institutions; (2) analyze the strategies for implementing technology in teaching, learning, and students' vocational training; (3) evaluate the impact of digital transformation on enhancing students' work readiness including digital literacy, professional communication, problem-solving, and collaboration; (4) assess the effectiveness of digitalization implementation and the factors influencing it; (5) formulate strategic recommendations for developing digitalization in vocational pesantren to ensure students' work readiness and adaptability in the digital era; and (6) analyze the employment absorption rate of graduates from ABC VHS BS, PQR VHS BS, and XYZ VHS BS during the period 2022–2025.

This research focuses on analyzing the policies, implementation strategies, and effectiveness of digital transformation in these vocational pesantren. The study

encompasses the application of technology in project-based learning, vocational training, and the internalization of pesantren values through digital media. The analysis also measures the influence of digitalization on students' employability skills and identifies supporting and inhibiting factors in its implementation.

The findings of this study are expected to produce contextual and applicable strategic recommendations for strengthening the digitalization system in BS education. Academically, this study enriches the literature on digital transformation in Islamic educational institutions, particularly the integration of vocational education with Islamic values. Practically, the results are expected to serve as a guideline for VHS BS administrators and policymakers in designing effective technology-based educational policies. More broadly, this research contributes to enhancing the competitiveness of vocational pesantren graduates and reinforces the role of pesantren as adaptive, innovative, and productive educational institutions in the digital industrial era.

B. LITERATURE REVIEW

Digital transformation in education has become an inevitability in the era of the Fourth Industrial Revolution and Society 5.0. The education sector including vocational education and boarding school is required to adapt to technological advancements to produce graduates who meet the demands of modern industries and contemporary work environments. In the context of Vocational High Schools (VHS), the integration of digital technology is not merely a learning aid but an institutional strategy to prepare students for shifting work patterns and the competencies required in the twenty-first century.

Syarif & Janata (2023) emphasize the importance of technological mastery among vocational teachers and its integration into the curriculum as an essential component of digital transformation. The bibliometric mapping conducted by Fuadiy, Rozi, Arafah, Kamal, and Sunoko (2025) shows a significant increase in publications related to e-learning, digital literacy, and blended learning in the post-pandemic era, indicating an accelerated digitalization of education in Indonesia. In the pesantren context, Nugroho & Astutik (2023) found that digitalization positively influences memorization achievement, comprehension, and the application of Qur'anic learning, suggesting that digital transformation in boarding school must be understood holistically encompassing technological, pedagogical, cultural, and religious dimensions.

Vocational pesantren such as ABC VHS BS, PQR VHS BS, and XYZ VHS BS occupy a unique position as they face dual demands: preserving Islamic values and pesantren traditions while simultaneously modernizing the education system to equip students with competencies aligned with the needs of the digital industry. Digital transformation in this context includes the digitalization of learning facilities, restructuring of management systems, curriculum enhancement, and institutional cultural adaptation.

Theoretically, digital transformation in education is grounded in Change Management Theory (Kotter, 1996), which underscores the importance of establishing

a sense of urgency, building a leadership coalition, formulating a shared vision, and embedding innovation into organizational culture. In pesantren, the success of digital transformation is heavily influenced by the leadership of the kyai and school management in navigating change without compromising traditional values. The Dynamic Capabilities Theory (Teece, 2007) is also highly relevant, as it highlights an organization's ability to sense, seize, and reconfigure technological opportunities to remain adaptive in a rapidly evolving digital environment.

From the instructional perspective, the Technological Pedagogical Content Knowledge (TPACK) framework emphasizes that the success of digital transformation depends on teachers' ability to integrate technological, pedagogical, and content knowledge. In the context of vocational pesantren, teachers must understand technology and adapt it to vocational learning grounded in Islamic values. Hodijah et al. (2023) highlight the importance of technical training and self-directed learning in improving teachers' digital competencies. However, a study conducted at SMKN 8 Bandung by Masnah et al. (2024) shows that although 69% of teachers possess digital skills, only 32% have received formal training, indicating that digital transformation has not yet reached optimal implementation.

Furthermore, Digital Literacy Theory serves as a crucial foundation for developing twenty-first-century skills. Suriyani et al. (2023) found that integrating digital literacy with creative thinking skills can enhance vocational students' competencies in the era of Society 5.0. Digital literacy is also positively correlated with career adaptability (Swastika & Sudjani, 2023), suggesting that digital literacy plays a significant role in shaping employability skills—the ability to obtain, sustain, and develop a career in a digital work environment.

The concept of employability skills can be explained through Human Capital Theory (Becker, 1993), which asserts that investment in education and training increases workforce productivity. In the context of vocational pesantren, employability skills include digital literacy, professional communication, collaboration, problem-solving, and religious character qualities such as responsibility and integrity. Setiyawan, Suharno, and Pambudi (2024) demonstrate that digital literacy and vocational information literacy significantly influence the learning outcomes of vocational students. Muliawati et al. (2023) also emphasize the importance of developing students' career readiness through information technology, soft skill enhancement, and industry partnerships.

Leadership within pesantren plays a critical role in the success of digitalization efforts. Bahri et al. (2024) highlight the role of the kyai in advancing the digitalization of pesantren administration and services through online systems that enhance transparency and efficiency. Kusuma & Muharom (2025) add that digital innovation can strengthen institutional capabilities without diminishing traditional values. The Digital Organizational Culture Theory further explains that effective technology adoption requires cultural shifts—from hierarchical structures toward more collaborative, data-driven organizational practices.

Digital transformation also generates social and cultural implications. Yuwanda, Fadhlan, and Bundo (2023) emphasize the importance of human capital characterized by creativity, innovation, collaboration, and digital leadership. However, the success of digital transformation in boarding school is measured not only by the adoption of technology but also by the institution's ability to maintain a balance between Islamic values and modern innovation. The humanistic Islamic education perspective (Lubis, 2024) asserts that technology must strengthen humanity, ethics, and students' spiritual development.

From the existing literature, it can be concluded that digital transformation in VHS BS encompasses four main dimensions: (1) policies and infrastructure, which include institutional preparedness and system readiness; (2) human resources, referring to the digital competencies of teachers and students; (3) the implementation of learning technologies, which involves digital integration in both vocational and Islamic learning; and (4) learning outcomes, reflected in improved employability skills such as digital literacy, communication, collaboration, and career adaptability. These four dimensions operate within the pesantren system, which is inherently boarding-based, religious, and rooted in Islamic moral values.

Thus, digital transformation in boarding school education is not merely a process of adopting technology but a strategic effort to enhance human resource quality and develop students' work-readiness skills so that they remain adaptive to the challenges of the digital era while preserving the Islamic identity that forms the core of Indonesian Islamic Boarding School (pesantren) education.

C. METHOD

This study employs a qualitative approach using a multisite case study design to explore the digital transformation of education in three vocational pesantren: ABC VHS BS in Bogor Regency, PQR VHS BS in West Bandung Regency, and XYZ VHS BS in Bandung Regency. This design was selected to enable an in-depth analysis of policy patterns, implementation strategies, and the supporting and inhibiting factors that emerge across different institutional contexts (Yin, 2023).

The informants consisted of school/pesantren leaders, digitalization management teams, vocational teachers, and final-year students who had participated in digital learning processes. Data were collected through semi-structured interviews with the Principal, Vice Principal for Curriculum Affairs, Dormitory Coordinator, IT Team, teachers, and students; observations of digital and face-to-face learning activities; and documentation analysis, including internal policies, digitalization roadmaps, e-learning modules, alumni reports, and technology infrastructure records.

The data analysis process followed Thematic Analysis as outlined by Braun & Clarke (2023), which includes the stages of data familiarization, initial coding, theme identification and review, theme definition, and reporting. The analysis was conducted both deductively (based on theoretical frameworks such as digitalization policies and employability skills) and inductively (based on emerging empirical themes). Data validity was ensured through source and method triangulation,

member checking with key informants, and researcher reflexivity to minimize interpretive bias.

Through this approach, the study aims to develop a comprehensive understanding of how VHS boarding school implement digital transformation in vocational learning, cultivate students' digital work-readiness skills, and balance these efforts with the values and cultural traditions of VHS BS.

D. RESULT AND DISCUSSION

1. Identification of Digital Transformation Forms and Policies Implemented at ABC VHS BS in Bogor Regency, PQR VHS BS in Bandung Regency

The digital transformation initiatives across the three VHS boarding school reveal distinct patterns and characteristics, yet they share a common objective: to enhance managerial efficiency, improve the quality of learning, and strengthen students' work readiness in the digital industrial era.

The digital transformation at ABC VHS BS has been implemented systematically to strengthen administrative management, teaching processes, and students' competency development. Prior to digitalization, all administrative tasks such as learning journals, activity reports, and records of students' religious practices were conducted manually. As the school's network expanded, the conventional system became increasingly inefficient, prompting the institution to transition to digital platforms using Google Workspace and Google Forms. This system enables centralized and real-time reporting of teacher and staff performance without relying on external vendors.

In the area of teaching and learning, the productive curriculum particularly in IT, programming, and design is aligned with industry needs through annual surveys. Learning materials are delivered through a project-based and case-based learning management system (LMS), with students' work outputs integrated into digital report cards and professional portfolios. Teachers receive competency development support through internal video tutorials, external training programs, and digital certification. Institutional policy mandates that all administrative and reporting processes be conducted digitally to ensure efficiency, transparency, and to prepare students for the demands of the modern workforce.

PQR VHS BS has implemented digital transformation comprehensively through strategic policies, curriculum development, instructional systems, and character formation programs. Since 2020, digitalization has been formally incorporated into the school's Strategic Plan with the aim of cultivating students who are excellent, independent, and technologically adaptive. Teaching and learning are conducted using a blended learning model supported by Google Classroom, Moodle, and an internal project-based learning LMS.

Digitalization is also applied in the boarding school's character-building and administrative systems, including attendance recording, moral assessment, memorization tracking (tahfidz tracker), and students' daily activity monitoring. Digital infrastructure such as computer laboratories and creative studios further

enhances students' digital literacy and entrepreneurial skills. The institution's policy framework is built upon three pillars Digital Learning, Digital Management, and Digital Character which ensure that the integration of technology remains aligned with Islamic values and boarding school ethics.

The digital transformation at XYZ VHS BS has developed gradually since the COVID-19 pandemic, beginning with the implementation of online learning and hybrid learning models. Following the pandemic, the school evaluated the effectiveness of its digital implementation and assessed the readiness of its infrastructure, teachers' competencies, and students' digital literacy. The focus of development was then directed toward improving the quality of learning and enhancing the efficiency of academic management.

The school optimizes its LMS, interactive media, digital worksheets, and game-based learning to increase student engagement. Its digitalization policies are aligned with the national Merdeka Belajar (Independent Learning) program and are supported by the leadership of the pesantren and dormitory administrators. Internal policies emphasize the use of LMS and blended learning, accompanied by continuous teacher competency development through ongoing training. Regular evaluations are conducted to ensure that the policies remain adaptive, relevant, and impactful in strengthening students' employability skills.

2. Strategies for Implementing Digital Technology in Teaching, Learning, and Skills Training at ABC VS BS, PQR VHS BS, and XYZ VHS BS

The strategies for implementing digital technology in vocational-based pesantren such as ABC VS BS, PQR VHS BS, and XYZ VHS BS are carried out in an integrated, systematic, and contextual manner to support academic learning, vocational training, and the character-building process of santri.

Digital transformation at ABC VHS BS focuses on project-based learning aligned with evolving industry needs. Productive curricula such as Software Engineering, Visual Communication Design, and Information Technology are reviewed annually based on feedback from industry partners and internship (PKL) institutions. Digital implementation is realized through the integration of Google Workspace, Forms, and Classroom, which support administrative tasks, project management, and students' daily reporting.

The use of digital technology enables fast, accurate, and transparent monitoring of teachers' and students' performance. Teachers utilize digital platforms to provide rubric-based feedback and assessments, while musyrif supervise spiritual development and character formation through online systems. For students, digitalization enhances flexibility, interactivity, and employability, as their projects and portfolios are automatically documented online as evidence of professional competence.

PQR VHS BS implements a digital strategy structured around three pillars: Digital Learning, Digital Management, and Digital Character. Teaching and learning processes are delivered through a blended-learning model using an internal Learning

Management System (LMS) that integrates theoretical instruction, practical training, and project-based learning. Students are trained in digital and entrepreneurial skills, including graphic design, video production, and digital marketing.

The E-Asrama system is used to record attendance, daily activities, and the development of students' moral character, ensuring that spiritual coaching and character formation remain continuously monitored through digital platforms. Teachers and the IT team regularly participate in professional training, improve and update the LMS, and collaborate with alumni and technology institutions to enrich students' digital competencies. This approach ensures a balance between the effectiveness of modern learning innovations and the preservation of pesantren values, ethics, and Islamic character.

The digital strategy at XYZ VHS BS is developed through a reflective and collaborative approach. Implementation begins with observing teaching practices, reviewing lesson plans and instructional modules, and analyzing data from digital platforms to evaluate learning effectiveness. Teachers establish a learning community to share best practices, including instructional videos and interactive applications. Industry-based skills training (teaching factory) is integrated with digital technology to ensure that students gain hands-on experience aligned with digital industry standards.

Student feedback is utilized to adjust learning strategies and strengthen curriculum relevance. Collaboration with industry partners expands internship opportunities and enriches students' contextual learning experiences. Periodic evaluations are conducted to refine strategies, address challenges, and ensure continuous improvement of students' digital competencies.

3. The Impact of Digital Transformation on Enhancing Students' Work Readiness, Including Digital Literacy, Professional Communication, Problem-Solving, and Collaboration at ABC VS BS, PQR VS BS, and XYZ VHS BS

Digital transformation in ABC VHS BS, PQR VHS BS, and XYZ VHS BS have demonstrated a significant impact on strengthening students' employability skills, particularly in the areas of digital literacy, professional communication, problem-solving, and collaboration.

At ABC VHS BS, digitalization is implemented comprehensively through the integration of learning platforms, digital assessment systems, and continuous teacher training. Monitoring is conducted through weekly subject-teacher meetings and school-wide weekly evaluations, with student project progress tracked using Semester Program, material checklists, and internal platforms such as Spaceship.

The use of Google Classroom supports professional communication by providing rubric-based feedback and automated reporting. Students become accustomed to using technology for discussions, consultations, and collaborative assignments, which enhances their critical thinking and problem-solving abilities. Adaptation challenges among senior teachers are addressed through targeted training

and mentoring. Activities such as Leadership Camp and digitally supported Amazing Race programs strengthen students' project management, team collaboration, and cross-group communication skills. The integration of digital systems also increases parental engagement in monitoring student progress and supports a coding-based curriculum that strengthens career readiness in the technology sector.

Digital transformation at PQR VHS BS enhances students' digital literacy and independence through online learning, digital content creation, and technology-based projects. Students become more creative, critical, and responsible for their learning process. The use of presentation media, email communication, and digital collaboration platforms cultivates professional communication aligned with modern workplace ethics.

Through the E-Asrama system, students develop discipline, self-reflection, and digital responsibility. Programs such as entrepreneurship boot camps, digital workshops, and creative content training strengthen both technical and entrepreneurial skills. Collaboration is fostered through technology-driven group projects that build communication, leadership, and cross-functional coordination. Beyond technical competencies, digital transformation reinforces students' digital character, including media ethics and data security awareness, preparing PQR VHS BS graduates to navigate ethically grounded and productive digital work environments.

Digital transformation at XYZ VS BS has a positive impact on improving students' digital literacy and critical thinking abilities. Evaluation is conducted through digital portfolios, project-based assessments, and vocational skills training. Students become accustomed to using the LMS, producing multimedia content, and operating professional software for creative production.

Professional communication is developed through presentations, project pitching, and media-based activities that require strong argumentative and collaborative competencies. Problem-solving skills are enhanced through film production and digital content projects, where students learn troubleshooting and technical innovation. Collaboration is evident in group projects and technology-based pesantren activities that emphasize shared responsibility and effective teamwork.

4. The Effectiveness of Digitalization Implementation at ABC VHS BS, PQR VS BS, and XYZ VHS BS, and the Key Factors Influencing Its Effectiveness

The study indicates that the implementation of educational digitalization at ABC VHS BS, PQR VHS BS, and XYZ VHS BS are generally effective, although the strategies and areas of emphasis differ according to the unique characteristics of each institution.

The effectiveness of digitalization at Pesantren ABC VHS BS is supported by strategic planning that integrates technical competence, digital proficiency, and pesantren (boarding school) values. A stakeholder-based digital feedback system, LMS integration, and periodic evaluations serve as the core strategies ensuring transparent and relevant follow-up actions. The hybrid learning model which

combines religious education with technology-based projects further enhances students' work readiness.

Supporting factors include teacher capacity-building through digital training, the Teacher Digital Innovation Hub, and formal certifications; adequate infrastructure such as stable internet connectivity, digital devices, and platforms aligned with pesantren (boarding school) values; as well as partnerships with industry and community organizations through internships and mentorship programs. The integration of character education ensures the development of ethical behavior, digital ethics, and adaptability to technological advancements.

At Pesantren PQR VHS BS, digitalization is effective due to visionary leadership, clear strategic direction, and a pesantren culture that embraces innovation. Enhanced digital competencies among teachers and students, the efficiency of learning processes, and an adaptive learning culture are key indicators of success. Adequate infrastructure, a competent IT team, regular training programs, and integrated digital systems for administration, learning, and dormitory management serve as critical supporting factors.

Students experience direct benefits through easier access to learning materials, the development of digital skills, and participation in technology-driven creative projects. The effectiveness of digitalization remains balanced with pesantren values through technology discipline and digital ethics supervision.

Digitalization at XYZVHS BS is effective due to visionary leadership, a collaborative culture, and an integrated learning system. The implementation of the Merdeka Curriculum using the TPACK framework, blended learning approaches, and the use of digital devices and interactive media enhances students' motivation and engagement.

Continuous professional development, the internal media team, and the curation of local content enable teachers to produce contextual digital materials aligned with pesantren values. Collaboration with industry strengthens real-world practice experiences, improves employability, and fosters a digital learning ecosystem that is adaptive, collaborative, and oriented toward workforce-relevant skills.

5. Strategic Recommendations for Advancing Digitalization in Vocational Pesantren Education at ABC VS BS, PQR VS BS, and XYZ VS BS to Prepare Work-Ready and Adaptive Students for the Digital Industry Era

Based on the findings from ABC VHS BS, PQR VS BS, and XYZ VHS BS, the development of digitalization in vocational pesantren education should be directed toward producing students who are digitally and technically competent, work-ready, adaptable to Industry 4.0 demands, and firmly grounded in Islamic values.

Pesantren ABC VHS BS demonstrates a high level of digital readiness through its industry-based curriculum and dual-track programs (studying while working). To maintain curriculum relevance amid the rapidly evolving demands of the technology sector, it is recommended that the institution establish an integrated Digital Feedback Management System (DFMS) linked to the Learning Management System (LMS). This

system would function as a centralized data hub for real-time reporting, evaluation, and follow-up actions, ensuring alignment between the curriculum and contemporary digital industry competencies.

Moreover, the existing Hybrid Pesantren Model which combines religious training and project-based learning should be strengthened through broader industry internships that provide students with real-world work experience while enabling them to apply spiritual values within professional contexts. Teacher development programs through the Teacher Digital Innovation Hub (TDIH) are also recommended to maintain consistent quality in digital learning, foster innovation, and ensure adaptability to emerging technologies.

Pesantren PQR VHS BS excels in developing digital entrepreneurship grounded in pesantren values. The findings reveal that more than 40% of its alumni work in fields such as digital marketing, creative content production, and halal e-commerce. To strengthen this ecosystem, strategic partnerships should be established with digital industry actors, certification bodies, and local technology communities through the formation of a Boarding School Industry Advisory Council.

Replicating the successful Santri Digitalpreneur model may serve as a strategic pathway for fostering digital economic self-reliance among students. In addition, implementing a Digital Ethics Education program is essential for cultivating media ethics, social responsibility, and integrity in technology use. Digital infrastructure including internet bandwidth, cloud storage, and e-learning platforms should be enhanced to maximize the effectiveness of digital learning activities. Continuous evaluation should be conducted using indicators such as alumni employability rates, teachers' digital competence, and industry partner satisfaction.

XYZ VHS BS demonstrates significant progress in students' digital literacy and creativity. To further strengthen this role, establishing a Digital Innovation Center (DIC) is recommended to serve as a central hub for technology development, digital training, and the incubation of student-led projects in both social and creative economic domains. Vocational curricula particularly in Software Engineering, Computer Networking, and Visual Communication Design should be enriched with modules on digital literacy, data analysis, and Islamic digital storytelling. Student assessment should encompass both technical abilities and digital ethics through digital portfolios and value-based collaborative projects.

To strengthen the pesantren's digital culture, a periodic Digital Discipline and Reflection Week may be implemented to promote balance between spirituality, productivity, and responsible media use. Across the three institutions, the findings indicate that the success of digitalization in vocational pesantren education is shaped by the synergy of five key factors:

- a. Integrated digital curriculum and Islamic values,
- b. Teacher competence and innovation through the TDIH,
- c. Robust digital infrastructure and supportive pesantren (boarding school) ecosystem,
- d. Industry and alumni partnerships for internships and certification, and
- e. An ethical and spiritually grounded digital culture within the dormitory environment.

Implementing these strategies will enhance the competitiveness of pesantren graduates in the digital industry era while maintaining their Islamic character. Digital transformation at ABC VHS BS, PQR VHS BS, and XYZ VHS BS is therefore technological, cultural, and spiritual creating an educational ecosystem that is adaptive, innovative, and ethically grounded.

6. Employment Absorption Rates of Graduates from Pesantren ABC VHS BS, PQR VHS BS, and XYZ VHS BS for the Years 2022, 2023, 2024, and 2025

From 2022 to 2025, the digital transformation of education at ABC VHS BS, PQR VHS BS, and XYZ VHS BS has made a significant contribution to alumni employability and workforce absorption across professional sectors, entrepreneurship pathways, and higher education.

At Pesantren ABC VHS BS, the digitalization of learning and vocational training equips students with both technical competencies and strong work ethics. Alumni have successfully established technology-based enterprises through programs such as ABC Mengajar and entrepreneurship bootcamps. A number of graduates are employed in local and international technology companies, while others continue their studies at ABC Polytechnic or partner universities abroad (Malaysia, China, and Türkiye).

The dual-track program enables graduates to work while pursuing higher education, supporting long-term career development aligned with their interests and competencies. Trends in alumni employment from 2022 to 2025 show a consistent increase, corresponding with the integration of industry-oriented digital curricula and project-based learning.

Between 2022 and 2025, PQR VHS BS achieved employment absorption rates ranging from 75% to 87%. Approximately 40% of graduates pursue entrepreneurship in digital marketing, creative content, halal culinary businesses, and e-commerce; 35% work in private companies or digital industry sectors; and the remainder continue their studies at public and private universities, including scholarship programs in Malaysia and Brunei.

This success is supported by an industry-aligned curriculum, a minimum six-month internship requirement, and strong boarding school-based character development. Alumni demonstrate high levels of digital autonomy, including managing online business platforms and serving as mentors in technology training programs. The boarding school's digital and entrepreneurial culture has proven effective in cultivating strong entrepreneurial mindsets.

At XYZ VHS BS, graduates are absorbed into the creative industries, digital media, and IT services, while some continue their studies at Islamic universities and state polytechnics. In 2022–2023, alumni found employment in media companies, printing and publishing, IT services, and digital entrepreneurship (graphic design, digital content creation, and broadcasting).

The year 2024 shows increased independence and work readiness among graduates, supported by an industry-integrated curriculum, internships, and competency certifications. Data for 2025 is still being collected, but early indicators suggest that the positive trend will continue due to the implementation of a digital alumni tracking system.

Overall, alumni employment outcomes have improved through the synergy of digitalized learning, vocational training, and character development. The pesantren's digital culture nurtures graduates who are adaptive, creative, and ethically grounded well-prepared for the modern workforce and the challenges of Industry 4.0.

Digital transformation in vocational pesantren during the era of the Industrial Revolution 4.0 and Society 5.0 is not merely technological in nature; it also encompasses institutional policies, organizational culture, and the character development of students. Findings from ABC VHS BS, Pesantren PQR VHS BS, and XYZ VHS BS reveal varied implementation strategies, yet all share the overarching goals of enhancing educational effectiveness, managerial efficiency, and students' employability.

At ABC VHS BS, the digitalization of administrative processes through Google Workspace and Google Forms reflects the early-to-intermediate stages of Kotter's (1996) Change Management Theory, while simultaneously aligning with the principles of Dynamic Capabilities (Teece, 2007) through sensing emerging opportunities and reconfiguring institutional systems. The internal digital system fosters a data-driven culture, a critical component of modern pesantren governance.

ABC VHS BS demonstrates a higher level of digital transformation maturity, with comprehensive policies established since 2020 that have shaped a complete digital educational ecosystem. The concepts of Digital Learning, Digital Management, and Digital Character position technology as an integral part of students' moral and spiritual development. This approach aligns with Lubis (2024), who emphasizes the integration of technological innovation with religious values, as well as Bahri, Wahid, and Najiburrahman (2024), who highlight the role of the kyai as an agent of digital transformation.

XYZ VHS BS adopts a gradual and reflective approach. Since the pandemic, the school initiated digital learning through online and hybrid modalities, followed by systematic assessments of infrastructure readiness, teacher competencies, and instructional effectiveness. The principles of learning organization and adaptive capability (Teece, 2007) are reflected in the internalization of technological innovations tailored to pesantren values. The use of LMS platforms, interactive media, and game-based learning enhances student motivation while strengthening digital literacy.

In the domain of teaching and learning, all three institutions apply the Technological Pedagogical Content Knowledge (TPACK) framework as the foundation for integrating technology into classroom practices. ABC VHS BS implements industry-oriented project-based and challenge-based learning (Syarif & Janata, 2023); PQR VHS BS integrates its internal LMS with Google Classroom and Moodle; while XYZ VHS BS emphasizes improving teachers' digital competencies through training and mentoring (Hodijah et al., 2023). Digital transformation contributes directly to improved employability skills, consistent with Human Capital Theory (Becker, 1993). ABC VHS BS develops digital projects and professional portfolios; PQR VHS BS embeds work ethics rooted in Islamic moral and spiritual principles; and XYZ VS BS leverages interactive media to cultivate motivation, independence, and 21st-century creativity. Digital literacy has been shown to correlate positively with career adaptability (Swastika & Sudjani, 2023) and SMK students' work readiness (Setiyawan et al., 2024).

Leadership and organizational culture also play decisive roles in successful digital transformation. Pesantren PQR VHS BS has established a digital organizational culture without compromising Islamic values through Digital Character Education; ABC VHS BS emphasizes collaborative, data-driven work processes; while XYZ VHS BS focuses on continuous training and teacher empowerment. These findings are consistent with Kusuma & Muharom (2025) and Yuwanda et al. (2023).

The findings indicate that the strategies for implementing digital technology in vocational pesantren such as ABC VS BS, PQR VHS BS, and XYZ VHS BS are carried out systematically to enhance the quality of learning, educational management, and students' employability. Technology functions not merely as a supporting tool but as an enabler of educational transformation, encompassing curriculum design, pedagogy, and Islamic character development.

Drawing on organizational change theory (Kotter, 1996), digital transformation involves creating a sense of urgency, establishing a digital transformation team, and internalizing innovations into the institutional culture. At PQR VHS BS, the strategies of Digital Learning, Digital Management, and Digital Character demonstrate the integration of technological innovation with moral and spiritual values. The implementation of E-Asrama and the tahfidz tracker reinforces dynamic capabilities (Teece, 2007) through sensing opportunities, seizing technologies, and reconfiguring management systems. The pesantren functions as a learning organization, internalizing and adapting technological innovations to its institutional context.

In teaching and learning, the strategies align with the TPACK (Technological Pedagogical Content Knowledge) framework. Teachers at ABC VHS BS and XYZ VHS BS integrate technology with project-based learning and industry-driven vocational content (Syarif & Janata, 2023). Teacher collaboration through peer learning and continuous reflection supports professionalization based on a community of practice (Hodijah et al., 2023). In the vocational domain, the implementation of project-based learning and Teaching Factory reflects Human Capital Theory (Becker, 1993). Students acquire workplace competencies such as problem-solving, collaboration, and

professional communication, consistent with research showing that digital literacy enhances work readiness (Setiyawan et al., 2024; Muliawati et al., 2023).

Digital transformation also influences organizational culture. The success of implementation depends on cultural shifts toward collaboration, openness, and data-driven decision-making (Digital Organizational Culture, Kusuma & Muharom, 2025). At Pesantren PQR VHS BS, the integration of digitalization with Islamic values cultivates an ethical, disciplined, and responsible environment through Digital Character Education.

The integration of technology with pesantren values aligns with the principles of humanistic Islamic education (Lubis, 2024), wherein technology strengthens spiritual and humanitarian dimensions rather than replacing religious values. This strategy supports industry-oriented learning and 21st-century skills, with digital literacy contributing to students' career adaptability (Swastika & Sudjani, 2023; Suriyani et al., 2023).

Li et al. (2024) demonstrate that project-based and reflective integration enhances digital employability competence, while Aristovnik et al. (2023, Education and Information Technologies) emphasize that collaborative digital ecosystems improve learning performance and work readiness. Visionary leadership and collaborative teacher culture also serve as critical determinants of successful digital transformation (Tondeur et al., 2024).

Digital transformation in vocational pesantren such as ABC VHS BS, PQR VHS BS, and XYZ VS BS has significantly improved students' employability skills. This advancement is not limited to technological proficiency; it also encompasses changes in learning culture, assessment systems, and collaborative practices that strengthen digital literacy, professional communication, problem-solving abilities, and teamwork.

Digital literacy serves as the fundamental pillar. The use of platforms such as Google Classroom, internal LMS, Spaceship, and E-Asrama establishes structured digital learning habits. Students become not only consumers but also producers of digital content through multimedia projects, film making, and coding assignments. This aligns with Setiyawan et al. (2023), who found that digital literacy contributes significantly (48.2%) to vocational students' work readiness.

Professional communication and digital collaboration develop through activities such as Leadership Camp, Amazing Race challenges, and technology-based group projects. Presentations, idea pitching, and digital media use cultivate interaction skills, leadership, and teamwork consistent with Rahmawati et al. (2022), who emphasize the combination of digital and social competencies as key determinants of employability.

Problem-solving abilities are strengthened through technology-driven project-based learning. Students address real-world issues, manage collaborative projects, and cultivate creativity and responsibility. These findings align with Impact of Digital Skills on Employability (2023, MDPI), which highlights the significant influence of digital communication, collaboration, and content creation on employability outcomes.

Digital transformation also involves teachers and school leadership. At ABC VHS BS, regular training and digital mentoring enable teachers to adapt to technological innovations, in line with Human Capital Theory and the Diffusion of Innovation framework. Zulbilal et al. (2024) similarly underscore the importance of teacher capacity in the success of digital transformation.

Beyond technical skills, digital transformation shapes students' digital ethics and character. The E-Asrama system at PQR VHS BS fosters discipline, self-reflection, and digital responsibility, supporting the principles of digital citizenship highly relevant in the Society 5.0 era, where technology and humanity coexist.

The learning strategies adopted by VS Boarding Schools are consistent with Kolb's Experiential Learning Theory, where students learn through experience (digital projects), reflection, conceptualization, and reapplication in new contexts. Digital transformation thus reshapes students' ways of thinking, collaborating, and addressing workplace challenges.

Certain challenges remain, such as differences in adaptability between senior and younger teachers and limitations in infrastructure. These are mitigated through training, mentoring, and digital monitoring systems, supporting the sustainability of innovation (Zulbilal et al., 2024).

Overall, digital transformation at ABC VHS BS, PQR VHS BS, and XYZ VHS BS cultivates students across four core dimensions of employability skills:

- a. Digital literacy – mastering, understanding, and creating technology for learning and work.
- b. Professional communication – engaging effectively in individual and team-based interactions.
- c. Problem-solving – applying critical, creative, and innovative thinking to real-world, technology-based challenges.
- d. Collaboration – working across disciplines and digital platforms to achieve shared objectives.

The implementation of digitalization in vocational pesantren such as ABC VHS BS, PQR VHS BS, and XYZ VHS BS has been effective and strategically oriented. Although each school has distinct characteristics, all three demonstrate significant progress in the adoption of educational technology, the enhancement of teachers' and students' digital competencies, and the integration of pesantren values. The effectiveness of digitalization can be analyzed through the readiness of human resources, infrastructure, curriculum design, and industry partnerships.

At ABC VHS BS, digitalization is implemented strategically through an integrated LMS, digital feedback mechanisms, and monitoring systems based on the Spaceship platform. Regular evaluations are conducted via weekly meetings, project assessments grounded in project-based learning (PBL), and active involvement of teachers, students, and parents, all of which contribute to implementation effectiveness. This success is consistent with Rogers' Diffusion of Innovation theory, which highlights communication, social support, and readiness to adopt technology as key determinants. Teacher capacity-building through training and the Teacher

Digital Innovation Hub ensures that digital transformation translates into improved instructional quality (Widaningsih et al., 2024).

At PQR VHS BS, digitalization strengthens the digital capabilities of both teachers and students, increases instructional efficiency, and fosters an adaptive learning culture. Visionary leadership, a pesantren culture that is open to innovation, and strong support from infrastructure and a competent IT team are critical success factors. The integration of administrative, academic, and dormitory systems into a unified digital ecosystem creates transparent and accountable learning processes. This model aligns with the Digital Maturity Model, in which cultural, systemic, and human resource readiness are as important as technological readiness. Rajamanickam et al. (2024) similarly emphasize the importance of visionary leadership, technological preparedness, and industry partnerships for effective digital transformation.

At XYZ VHS BS, digitalization is supported by progressive leadership, a collaborative culture, and a TPACK-based curriculum. The implementation of blended learning and interactive media enhances students' motivation and engagement. An internal media team produces contextual digital learning materials aligned with Islamic values and local needs. The Merdeka Curriculum and PBL approaches create flexible learning experiences that are relevant to the world of work, while collaboration with industry partners strengthens the link-and-match of students' employability skills (Rahmawati et al., 2022).

Several key factors influence the effectiveness of digitalization:

- a. Visionary leadership and management commitment to driving innovation.
- b. Teachers' and educators' digital competencies, enhanced through training and mentoring.
- c. Technological infrastructure readiness, including stable internet connectivity, adequate devices, and integrated platforms.
- d. Adaptive, technology-based curriculum design (TPACK, PBL, blended learning).
- e. Industry and community partnerships to ensure the relevance of students' skills.
- f. Pesantren culture and character education, which balance technology use with digital ethics.
- g. Continuous digital monitoring and evaluation systems that support quality assurance and accountability.

Digitalization at ABC VHS BS, PQR VHS BS, and XYZ VS BS are effective because it integrates technological, pedagogical, and boarding school value dimensions. The three schools successfully balance hard skills and soft skills, producing graduates who are prepared to face the demands of the world of work in the Industrial Revolution 4.0 and Society 5.0 eras without losing their spiritual identity.

This approach is consistent with Kolb's Experiential Learning Theory: students learn through digital projects, reflect via digital evaluation systems, and re-apply their understanding in real-life situations. Such processes strengthen intrinsic

motivation, critical thinking, and problem-solving skills, while embedding ethical and value-based considerations within a digitally mediated learning ecosystem.

Based on research conducted at ABC VHS BS, PQR VHS BS, and XYZ VHS BS, the digitalization of pesantren education has the potential to produce students who are technically competent, adaptive to the digital industry, and grounded in religious values. To ensure that this transformation is effective and sustainable, several strategies informed by theory and empirical evidence are recommended.

It is recommended that pesantren develop an integrated Digital Feedback Management System (DFMS) connected to the LMS for real-time data collection, follow-up actions, and reporting. This system enhances transparency, accelerates decision-making, and ensures continuous alignment of the curriculum with industry needs. This approach aligns with the Digital Quality Management System framework (Rajamanickam et al., 2024).

Vocational curricula should combine digital competencies such as coding, data analytics, and cyber ethics with Islamic values. The Hybrid Pesantren model, grounded in project-based learning, has proven effective in enhancing critical thinking and digital ethics (Rahmawati et al., 2022). Character development remains a central pillar in ensuring the success of digitalized education in pesantren settings.

Teachers must be trained as digital learning designers through structured training, certification programs, mentoring, and the establishment of a Teacher Digital Innovation Hub (TDIH) and digital teacher learning communities. Digital leadership across all layers of school management ensures coherence between policy direction and implementation (Widaningsih et al., 2024). Mentorship practices at ABC VHS BS demonstrate effective acceleration of teachers' technological adaptation.

Stable internet connectivity, adequate digital devices, and cloud-based platforms should be complemented by digital moral education, such as Etika Bermedia Santri or a Digital Akhlak Charter. This aligns with the Digital Ethics Framework in Islamic education (Huda et al., 2023).

Collaboration with digital industries and creative communities strengthens the link and match between school training and industry needs. Internship programs, entrepreneurship bootcamps, and collaborative digital projects improve employability skills. The Santri Digitalpreneur initiative at PQR VHS BS serves as a best-practice model for developing value-based digital entrepreneurship. Strategic industry partnerships help bridge the gap between academic training and labor market demands (Rajamanickam et al., 2024).

Character education must remain the foundation of digitalization efforts. Activities such as Islamic digital storytelling, technology ethics case studies, and digital reflective journaling help reinforce moral integrity and digital responsibility. Assessments should also measure soft skills such as collaboration and empathy, in accordance with the Character-Based Digital Pedagogy framework (Huda et al., 2023).

It is recommended to establish a Digital Innovation Center (DIC) as a hub for research, digital training, and student innovation incubation. Programs such as Santri

Hackathon, Coding for Charity, and Tech for Ummah can foster Islamic value-based social innovation.

Digitalization requires sustained, data-driven evaluation. Suggested indicators include the Digital Competence Index (DCI) for teachers, the Santri Employability Index (SEI), and the Stakeholder Satisfaction Index (SSI). Annual digital audits should measure the effectiveness of technological integration and its impact on learning outcomes, consistent with Continuous Digital Improvement principles (Rajamanickam et al., 2024).

Research conducted at ABC VHS BS, PQR VHS BS, and XYZ VHHS BS shows that industry-based digital education has had a significant impact on alumni employability. Across the 2022–2025 period, there has been a consistent increase in graduates' absorption into the industrial sector, entrepreneurship pathways, and higher education institutions.

The implementation of industry-oriented, project-based digital curriculum including entrepreneurship bootcamps and dual-track programs has enhanced students' work readiness. ABC VHS BS, for example, has produced graduates who are independent and adaptable, consistent with Human Capital Development Theory (Becker, 1993). These findings align with Rajamanickam et al. (2024), who emphasize that project-based TVET and strong industry partnerships significantly improve employability outcomes.

At PQR VHS BS, more than 40% of alumni from 2022–2025 have entered digital entrepreneurship, particularly in digital marketing, creative content production, and halal e-commerce. The Santri Digitalpreneur program combining project-based digital training with spiritual development demonstrates the effectiveness of a pesantren-based value-driven entrepreneurship model. This is consistent with the Entrepreneurial Learning Model (Rae, 2006) and supported by Widaningsih et al. (2024), who highlight the importance of digital projects and industry collaboration in enhancing graduates' readiness for work and entrepreneurship.

Alumni from XYZ VHS BS show increasing absorption into creative industries, digital media, and the professional IT sector. This success is driven by strengthened digital literacy through LMS use, multimedia projects, and Islamic digital portfolios, aligning with the Digital Employability Framework (Succi & Canovi, 2023). The blended learning approach assesses critical thinking, professional communication, and collaborative project management, increasing employment opportunities by up to 30% compared to graduates without digital integration.

The integration of pesantren values discipline, responsibility, independence, and Islamic work ethics further strengthens alumni employability. The concept of Character-Based Employability (Huda et al., 2023) argues that spiritual values enhance resilience, integrity, and adaptability, enabling graduates to adjust more easily to industrial, educational, and digital entrepreneurial environments.

Longitudinal data from 2022 to 2025 indicate a strong upward trend in employability outcomes:

- a. ABC VHS BS: Alumni are increasingly absorbed into technology industries or continue their studies at partner universities.
- b. PQR VHS BS: Employment absorption ranges from 75% to 87%, with a dominance of graduates working in digital marketing and entrepreneurship.
- c. XYZ VHS BS: Steady increases in employment, with most graduates entering creative media, IT, and higher education pathways.

These outcomes demonstrate the effectiveness of the digital pesantren TVET model, which balances technical competencies, soft skills, and character formation consistent with Rajamanickam et al. (2024).

E. CONCLUSION

This study shows that digital transformation in vocational pesantren is a strategic response to the demands of the Industrial Revolution 4.0 and Society 5.0. At ABC VHS B, PQR VS BS, and XYZ VS BS, digital initiatives have strengthened students' technological competence and work readiness while maintaining Islamic ethical and spiritual values. The transformation covers digital policy development, ICT infrastructure, capacity building, curriculum integration, and the formation of digital employability skills that combine technical abilities with communication, collaboration, and Islamic character. These efforts improve students' digital literacy, professionalism, adaptability, and creativity in workplace and digital entrepreneurship settings. Its effectiveness is driven by visionary leadership, a digital pesantren culture, teacher readiness, industry collaboration, and strong Islamic value integration. Overall, this model offers a potential national prototype for competitive and industry-relevant Islamic vocational education.

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