

Developing Human Expertise Through Training and Development: Lesson from Japan and Indonesia

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Abstract

This study aims to analyze and compare human expertise development models through Human Resource Development (HRD) and Technical and Vocational Education and Training (TVET) systems in Japan and Indonesia. The study focuses on understanding how institutional, cultural, and technological factors shape expertise formation across different contexts. A Systematic Literature Review (SLR) approach based on the PRISMA framework was employed to synthesize relevant peer-reviewed studies published between 2020 and 2025. The analysis was conducted using thematic synthesis to identify key patterns, dimensions, and relationships in human expertise development. The findings reveal that Japan represents a mature, firm-centered model characterized by experiential learning, continuous improvement (*Kaizen*), and socially embedded workplace training (*shokuba gakushu*), enabling incremental and long-term expertise accumulation. In contrast, Indonesia reflects a developing, system-oriented model, where expertise development depends on policy-driven initiatives, institutional alignment, and efforts to strengthen education–industry linkages through TVET reforms. The study also finds that digital transformation, organizational learning culture, and cross-sector collaboration play a critical role in shaping adaptive and sustainable human resource development systems across both contexts. The study concludes that effective human expertise development requires a hybrid approach that integrates experiential learning, competency-based systems, and digital transformation. Such an integrative model is essential for addressing the challenges of Industry 4.0, reducing skill mismatches, and enhancing workforce adaptability and long-term employability in diverse institutional settings.

Keywords: Human expertise development; Human Resource Development; TVET; Japan–Indonesia comparison; Digital transformation

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1. Introduction

Human expertise development has become a central concern in contemporary organizational and educational systems in response to rapid technological advancement, digital transformation, and the demands of Industry 4.0 (J. Lee, 2024). Human expertise encompasses

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vocational competencies, tacit knowledge, professional capabilities, and adaptive skills developed through formal education, workplace learning, and continuous professional development. In this context, Human Resource Development (HRD) and Technical and Vocational Education and Training (TVET) serve as essential mechanisms for aligning workforce competencies with evolving labor market demands (Conrad & Meyer-Ohle, 2024). The urgency of strengthening human capital is particularly evident in emerging economies such as Indonesia, where structural disparities in education, workforce readiness, and gender inclusion continue to shape long-term competitiveness (Indriyani et al., 2024). Japan offers a contrasting yet influential model of expertise development through firm-centered training, long-term employment, and socially embedded learning mechanisms (Awu et al., 2025; Hoshino & Ikeda, 2025). Workplace-based learning (*shokuba gakushu*), continuous improvement (*Kaizen*), and *senpai-kōhai* mentoring facilitate the accumulation of tacit knowledge and firm-specific capabilities, while the global diffusion of Japanese management practices demonstrates the influence of cultural values on organizational learning across countries (Panjaitan & Fatimah, 2025). In contrast, Indonesia adopts a policy-driven and system-oriented approach in which expertise development relies on education–industry alignment through TVET reforms, competency-based training, and industry partnerships (Ominami et al., 2022). Nevertheless, these efforts remain constrained by uneven institutional capacity, limited employer engagement, and community-based HRD practices that differ from Japan’s structured and discipline-oriented model (Effendi et al., 2025).

Recent literature shows that HRD has evolved into a multi-level and integrative system emphasizing organizational, regional, and global collaboration (Bozkurt et al., 2024; Hassard & Morris, 2025). Sustainability, Green HRM, digital transformation, and Japanese work ethics have also become increasingly important in enhancing workforce adaptability and preparedness (Handayani et al., 2026). Existing research can be grouped into four major streams: HRD (Crocco & Tkachenko, 2022; Hassard & Morris, 2025), TVET (Indrawati & Kuncoro, 2021; Yusop et al., 2022), workplace learning (Semaan et al., 2021; Yoshioka-Kobayashi & Shibayama, 2021), and digital transformation (Valverde & Muniz, n.d.; Setyadi et al., 2025). However, these streams are generally examined separately, resulting in fragmented explanations of expertise development across organizational, educational, institutional, and technological dimensions. To address this gap, the present study proposes a Hybrid Human Expertise Development Framework that integrates HRD, TVET, workplace learning, digital transformation, and institutional-cultural factors into a multi-level model. By comparing Japan’s experiential, firm-centered system with Indonesia’s policy-driven and competency-based approach, the study provides a more comprehensive understanding of expertise development and offers a conceptual foundation for future research and policy design. Using a Systematic Literature Review (SLR) based on the PRISMA framework, this study aims to identify key determinants of expertise development, examine institutional differences between developed and developing contexts, and formulate an adaptive framework that combines experiential learning, institutional alignment, and technological integration to support human resource development in the era of Industry 4.0 (Society 5.0).

The present study addresses this gap by proposing a Hybrid Human Expertise Development Framework that integrates HRD, TVET, workplace learning, digital transformation, and institutional-cultural factors into a unified model. Unlike previous studies that focus on a single level of analysis, this framework adopts a multi-level perspective that explains how expertise is developed through the interaction of organizational practices, educational systems, policy environments, and technological change. Furthermore, by

comparing Japan and Indonesia as contrasting institutional contexts, the study provides a more comprehensive understanding of expertise development and offers a conceptual foundation for future research and policy design in the era of Industry 4.0 and Society 5.0. Accordingly, this study proposes a comparative and integrative synthesis of human expertise development models across different contexts. Unlike prior research that focuses on single dimensions, this study integrates HRD systems, TVET approaches, digital transformation, and value-based practices into a unified analytical framework. The novelty of this study lies in bridging the divide between experiential, firm-centered models (Japan) and system-based, policy-driven models (Indonesia), thereby offering a more holistic understanding of expertise formation in contemporary settings. This study addresses the following research question: *How can human expertise development be understood and optimized through the integration of HRD, TVET, digital transformation, and institutional-cultural factors across different contexts?* Although no formal hypotheses are proposed due to the systematic review approach, the study is guided by the assumption that effective expertise development requires alignment between workplace learning, policy frameworks, and technological transformation.

To address this question, this study employs a Systematic Literature Review (SLR) based on the PRISMA framework, enabling a structured and evidence-based synthesis of prior studies. Through thematic analysis, the study identifies key patterns, relationships, and emerging trends across different contexts, particularly focusing on Japan and Indonesia as contrasting models. The objective of this study is to analyze, compare, and synthesize human expertise development systems in order to (1) identify key determinants and mechanisms, (2) examine institutional differences between developed and developing contexts, and (3) propose an integrative conceptual perspective. The expected outcome is the formulation of a hybrid and adaptive framework that combines experiential learning, institutional alignment, and technological integration to support effective human resource development in the era of Industry 4.0.

2. Methods

2.1 Research Design

This study employed a Systematic Literature Review (SLR) to synthesize and critically evaluate existing knowledge on human expertise development within the domains of Human Resource Development (HRD), Technical and Vocational Education and Training (TVET), workplace learning, and digital transformation. The review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines to ensure transparency, replicability, and methodological rigor throughout the review process. The SLR approach was selected because the topic spans multiple disciplinary domains and requires a structured synthesis of empirical and conceptual evidence. Furthermore, the review aimed not only to summarize existing findings but also to identify research gaps, compare institutional contexts, and develop an integrative conceptual framework for human expertise development.

2.2 Search Strategy

A comprehensive literature search was conducted between 10 and 15 January 2026 using four major academic databases: Scopus, ScienceDirect, SpringerLink, and Google Scholar. Scopus served as the primary database due to its extensive coverage of high-quality peer-reviewed journals, while the remaining databases were used to ensure broader retrieval of relevant studies.

The search strategy was developed through iterative refinement of keywords derived from the research objectives and preliminary literature mapping. Boolean operators (AND, OR) and truncation techniques were employed to maximize retrieval accuracy. The primary search string used in Scopus was: ("human expertise" OR "expertise development" OR "skill formation" OR "workforce competence") AND ("human resource development" OR HRD OR "training and development") AND ("technical and vocational education" OR TVET OR "vocational education") AND ("workplace learning" OR apprenticeship OR mentoring OR experiential learning) AND ("digital transformation" OR Industry 4.0 OR digitalization). Equivalent search strings were adapted for each database according to their search syntax requirements.

2.3 Eligibility Criteria

The inclusion and exclusion criteria were established prior to the search process to ensure consistency and relevance. Inclusion Criteria: (1) Peer-reviewed journal articles; (2) Studies published between 2020 and 2025; (3) Articles written in English; (4) Studies focusing on HRD, TVET, workplace learning, expertise development, training and development, or digital transformation; (5) Empirical, conceptual, comparative, and review studies relevant to human expertise development; (6) Full-text articles available for analysis. Exclusion Criteria: (1) Conference proceedings, book chapters, editorials, dissertations, and non-peer-reviewed publications; (2) Articles not directly related to human expertise development; (3) Studies lacking sufficient methodological information; (4) Duplicate publications; (5) Articles with inaccessible full texts.

2.4 Screening and Selection Process

The study selection process followed the PRISMA 2020 framework consisting of four stages: identification, screening, eligibility assessment, and inclusion. The initial database search yielded 455 records. After removing 145 duplicate records, 310 unique studies remained for title and abstract screening. Subsequently, 264 articles were excluded because they did not meet the inclusion criteria or were not directly relevant to the research objectives. The remaining 46 articles underwent full-text assessment. During this stage, 25 articles were excluded for the following reasons:

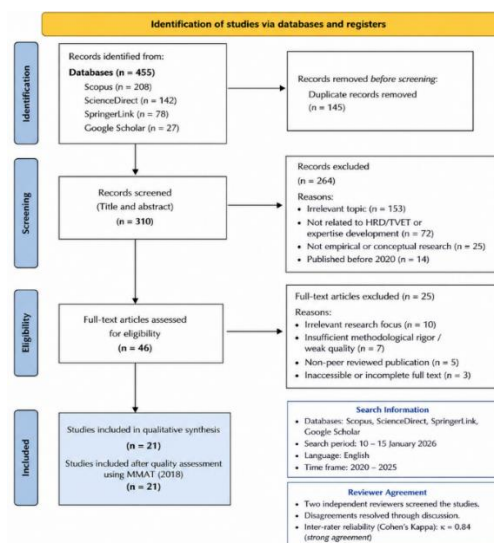


Figure 1. PRIMSA 2020 Flow Diagram of the Study Selection Process

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As a result, 21 studies were retained for the final synthesis. To minimize selection bias, the screening process was conducted independently by two reviewers. Disagreements were resolved through discussion and consensus. Inter-rater reliability was assessed using Cohen's Kappa coefficient, yielding a value of $\kappa = 0.84$, indicating strong agreement between reviewers.

2.5 Data Extraction

A structured data extraction form was developed to ensure consistency across studies. The following information was extracted from each article: Author(s), Publication year, Geographic context, Research design, Study focus, Key findings, Institutional context, Technological dimension, Human expertise development mechanisms, Implications for HRD and TVET. The extracted data were organized using Microsoft Excel to facilitate comparison and coding.

2.6 Data Analysis

The included studies were analyzed using thematic synthesis. The analysis followed three stages: (1) Initial coding of relevant findings and concepts; (2) Development of descriptive themes based on recurring patterns; (3) Generation of analytical themes to identify relationships among HRD, TVET, workplace learning, digital transformation, and institutional factors. Thematic synthesis enabled the integration of evidence from diverse methodological traditions and supported the development of the Hybrid Human Expertise Development Framework proposed in this study.

3. Result and Discussion

3.1 Developing Human Expertise through Training and Development in Japan: Strengths and Structural Limitations

3.1.1 Institutional Foundations: Firm-Centered Training and Human Capital Formation

The development of human expertise in Japan is deeply rooted in a well-established institutional system that integrates employment practices with firm-based training mechanisms. Core elements such as *shūshin koyō* (lifetime employment), *nenkō joretsu* (seniority-based wage system), and *kigyō betsu kumiai* (enterprise unionism) create a stable environment that enables long-term investment in employee capability development (Ardianata et al., 2024; Ioakimidis, 2022). Within this framework, *on-the-job training* (OJT) serves as the primary mechanism for expertise formation, complemented by *off-the-job training* to create an integrated learning system oriented toward the accumulation of *firm-specific skills* (Majeed & Shakeel, 2020). Empirical evidence indicates that in many Japanese industries, skill development is predominantly internalized, relying heavily on senior-led training rather than formalized external systems (Ezoe, 2024). Moreover, the Japanese training model has demonstrated transnational influence through the diffusion of HR practices across countries, highlighting its broader relevance beyond national boundaries. This aligns with the evolution of *Human Resource Development (HRD)*, which has expanded from organizational-level practices to encompass regional and global dimensions (Hennig & Romar, 2023). However, the emergence of Industry 4.0 introduces significant challenges to this model. Digitalization and increasing labor market flexibility require faster, more adaptive, and portable skill development systems, thereby creating tension between Japan's traditional long-term experiential learning model and the need for rapid competency acquisition (Lok et al., 2021; Saul et al., 2023).

3.1.2 Learning Mechanisms: *Shokuba Gakushu*, *Kaizen*, and Socially Embedded Training

Japan's strength in human expertise development lies in its deeply embedded workplace learning system, known as *shokuba gakushu* (workplace learning), where learning is seamlessly integrated into daily work practices. In this system, employees acquire skills through social interaction, direct observation, and hands-on experience in the *gemba* (actual workplace), guided by *senpai-kōhai* relationships and mentorship from *sensei* (El Zein et al., 2025; Hosen et al., 2024; Le et al., 2023). This approach positions OJT not merely as “learning by doing,” but as “learning by doing under continuous supervision,” where tacit knowledge is transferred through socialization processes. The communication culture reflected in *hō-ren-sō* (reporting, communication, consultation) further strengthens knowledge exchange and collaborative learning. Similar patterns are observed in academic training systems in Japan, where early-career supervision and experiential learning significantly shape long-term professional independence (S. S. Y. Lee & Nahm, 2024). In addition, the philosophy of *Kaizen* (continuous improvement) plays a crucial role in the gradual accumulation of expertise. *Kaizen* functions not only as a managerial tool but also as a learning system embedded in everyday work activities through iterative cycles of reflection and improvement. This enables organizations to systematically build competencies over time (Arifin et al., 2024). Nevertheless, the strong reliance on face-to-face interaction and observation-based learning presents challenges in the context of digital transformation. The shift toward remote and hybrid work environments limits the effectiveness of traditional *gemba*-based learning processes, requiring significant adaptation in training design.

3.1.3 Adaptation under Industry 4.0: Toward Hybrid and Competency-Based Systems

The advancement of Industry 4.0 has significantly reshaped the demands for human expertise in Japan, particularly in terms of the need for more complex, interdisciplinary, and technology-driven competencies. Empirical findings indicate a growing demand for highly specialized skills and more structured training systems to meet evolving industrial needs (Soehardjojo & Delbridge, 2023). In this context, *competency-based training* (CBT) becomes increasingly important, as it allows for clearer identification, assessment, and certification of skills. Furthermore, the growing need for rapid *upskilling* and *reskilling* highlights the limitations of traditional seniority-based progression systems, which are often too slow to respond to fast-changing skill requirements. At a broader level, HRD trends in Asia indicate a shift toward more context-sensitive and integrated approaches that emphasize alignment between education systems, industry needs, and public policy. Evidence from other national contexts also suggests that strengthening linkages between vocational education, industry, and government is essential for enhancing workforce competitiveness in the digital era.

Despite its longstanding reputation as an effective human resource development system, the Japanese model faces several structural challenges that may constrain its adaptability in contemporary labor markets. One of the most prominent issues is labor market dualism, characterized by the growing divide between regular and non-regular workers, which has created unequal access to training opportunities, career advancement, and employment security (Lee & Nahm, 2024). Furthermore, the traditional practice of lifetime employment (*shūshin koyō*), once considered a cornerstone of Japanese HRD, has gradually weakened due to globalization, demographic pressures, and increasing organizational demands for workforce flexibility (Hoshino & Ikeda, 2025). Japan also faces significant demographic challenges, particularly population aging and labor shortages, which place increasing pressure on organizations to accelerate knowledge transfer and workforce renewal. In addition, seniority-

based promotion systems (*nenkō joretsu*) have been criticized for limiting merit-based advancement and slowing organizational responsiveness to technological change. Concerns regarding work–life balance and long working hours further highlight tensions between traditional employment practices and the expectations of younger generations entering the workforce. These challenges suggest that while Japan’s experiential and socially embedded learning model remains highly valuable, its long-term sustainability depends on its capacity to integrate greater flexibility, inclusiveness, and competency-based approaches within the evolving context of Industry 4.0.

3.1.4 Critical Reflection on the Japanese Model

The literature consistently portrays Japan as one of the most successful examples of human expertise development due to its strong workplace learning culture, long-term employment orientation, and continuous improvement philosophy. Through mechanisms such as *shokuba gakushu*, *Kaizen*, and *senpai–kōhai* mentoring systems, Japanese organizations have historically excelled in transferring tacit knowledge and cultivating firm-specific expertise. These mechanisms enable the gradual accumulation of experiential knowledge that is often difficult to codify through formal training systems alone. However, the effectiveness of the Japanese model should not be viewed uncritically. Several structural changes have challenged the sustainability of traditional HRD practices. First, population aging and workforce shrinkage have reduced the availability of experienced workers capable of transferring tacit knowledge to younger employees. As Japan faces one of the world's oldest populations, organizations increasingly struggle to maintain knowledge continuity while simultaneously replacing retiring experts.

Critics have argued that rigid hierarchical structures and seniority-based promotion systems (*nenkō joretsu*) may inhibit innovation and organizational adaptability. While these systems support stability and knowledge transmission, they can also slow decision-making processes and limit opportunities for younger employees to contribute new ideas. This tension becomes particularly visible in the context of Industry 4.0, where rapid technological change requires more agile organizational learning systems. Furthermore, concerns regarding excessive work culture, often associated with the phenomenon of *karoshi* (death from overwork), raise important questions regarding the sustainability of expertise development based primarily on intensive workplace participation. Although strong organizational commitment may facilitate learning, excessive working hours may negatively affect employee well-being, creativity, and long-term productivity. Another emerging challenge is labor market dualism, characterized by the increasing divide between regular and non-regular workers. While regular employees often benefit from extensive training and career development opportunities, non-regular workers frequently receive limited access to organizational learning resources. This creates unequal pathways for expertise development and may reduce the overall effectiveness of Japan's human capital system. Therefore, rather than representing a universally superior model, Japan illustrates a trade-off between deep tacit knowledge development and organizational flexibility. Its strengths in experiential learning are accompanied by structural challenges that may limit adaptability in rapidly changing economic environments.

3.2 Developing Human Expertise through Training and Development in Indonesia

3.2.1 Systemic Perspective: Policy–Institution–Workplace Nexus in Expertise Formation

Human expertise development in Indonesia is best understood as a systemic interaction between policy frameworks, institutional arrangements, and workplace learning practices

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rather than a linear education-to-employment pipeline. Recent empirical evidence consistently demonstrates that workforce readiness is co-determined by both supply-side factors (training capacity, curriculum relevance, and institutional quality) and demand-side dynamics (firm incentives, training costs, and employer engagement) (Taniguchi et al., 2026; Yanindah, 2021). Within the context of Industry 4.0, this interaction becomes increasingly critical as vocational education and training (TVET) systems are required to deliver multi-competency profiles while firms simultaneously demand rapid adaptation to technological change (Hussain et al., 2023; Omar & Nik Mahmood, 2020; Putra, 2023). Consequently, expertise formation is no longer confined to formal education systems but emerges through continuous interactions between training institutions and labor market needs. This systemic perspective reframes human capital development in Indonesia as a governance challenge, where alignment across subsystems becomes a prerequisite for effective skill formation rather than a complementary objective (Wibowo et al., 2022).

3.2.2 Institutional Reconfiguration: TVET Reform, Competency Alignment, and Industry Linkages

Current TVET reforms in Indonesia reflect an institutional reconfiguration aimed at strengthening competency alignment through mechanisms such as *link and match* policies, competency-based training (CBT), and dual-system approaches. These reforms are driven by persistent evidence of skill mismatch, where the competencies produced by vocational institutions remain insufficiently aligned with industry requirements (Crocco & Tkachenko, 2022; Fejfarová & Fejfar, 2022; Maqbool et al., 2024). The literature suggests that such reforms should not be interpreted as mere curricular adjustments but as complex institutional transformations requiring coordinated governance among education providers, industry actors, and regulatory bodies (Yusop et al., 2022a). The effectiveness of competency-based approaches, for instance, is contingent upon the credibility of assessment systems and the availability of authentic workplace learning environments. Without these conditions, competency frameworks risk becoming symbolic instruments rather than mechanisms for improving workforce readiness (Hosogaya, 2021). Moreover, while industry partnerships are widely recognized as essential for demand signaling and practical skill development, empirical findings reveal that employer engagement remains uneven due to structural constraints such as high training costs and limited availability of relevant programs. This creates a structural tension in which policy ambitions for collaboration are not fully matched by firm-level capabilities or incentives, thereby limiting the scalability of high-quality training ecosystems (Mampuru et al., 2024; Suravi, 2024).

3.2.3 Transformation under Industry 4.0: Toward Adaptive, Lifelong, and Competency-Based Learning Systems

The transition toward Industry 4.0 necessitates a fundamental shift in Indonesia's expertise development model from initial vocational preparation to continuous, lifelong learning systems. Empirical studies indicate that the impact of vocational education on employment outcomes tends to diminish over time, suggesting that static skill formation is insufficient in dynamic labor markets. This underscores the importance of continuous upskilling and reskilling mechanisms embedded within both institutional and workplace learning pathways (Ana et al., 2021; Ismail et al., 2025). In this regard, competency-based approaches offer a promising framework for enhancing skill transparency and adaptability. Nevertheless, their effectiveness depends on the integration of robust assessment systems, digital learning infrastructures, and workplace-based evidence of competence. The rapid expansion of digital and blended learning during recent disruptions further highlights the need

for institutional capacity to design and evaluate competency-based learning in technologically mediated environments (Scuotto et al., 2025; Semaan et al., 2021). At the same time, persistent structural constraints such as regional disparities, uneven institutional capacity, and differentiated firm capabilities continue to limit equitable access to high-quality training opportunities. As digital transformation increases the premium on advanced and adaptable skills, these disparities risk widening existing inequalities in workforce development. Therefore, the success of Indonesia's Industry 4.0 transition hinges not only on technological adoption but also on the ability to build coherent governance systems that integrate policy, institutions, and workplace learning into a unified expertise development ecosystem (Indrawati & Kuncoro, 2021; Uegami et al., 2022).

3.2.4 Critical Reflection on Indonesian TVET Reform

Indonesia's expertise development system has undergone substantial transformation through TVET reforms, competency-based training initiatives, and industry linkage programs. These reforms demonstrate a strong policy commitment to improving workforce readiness and reducing skills mismatches. Compared with Japan's largely firm-centered approach, Indonesia has adopted a more systemic strategy involving government intervention, educational institutions, and industry collaboration. Nevertheless, the persistence of skills mismatches suggests that the challenge extends beyond curriculum design or competency standards. One of the root causes lies in the uneven quality of institutional capacity across regions. While some vocational institutions have successfully implemented industry-oriented programs, others continue to struggle with outdated facilities, limited industry partnerships, and insufficient instructor competencies. Another structural challenge concerns employer participation. Although policy frameworks strongly emphasize education–industry collaboration, many firms remain reluctant to invest in training partnerships due to cost considerations, uncertainty regarding returns on investment, and limited organizational capacity. As a result, policy objectives often exceed implementation realities.

3.3 Comparative Synthesis

The comparative analysis indicates that Japan and Indonesia represent two distinct pathways of human expertise development shaped by different institutional, governance, and labor market contexts. Japan's firm-centered model emphasizes workplace learning, long-term employment, and tacit knowledge transfer through *shokuba gakushu* and *Kaizen*, enabling deep expertise accumulation but limiting flexibility in the face of technological change and increasing labor mobility (Lee & Nahm, 2024; Hoshino & Ikeda, 2025).

3.3.1 Reconsidering the Japanese Model: Institutional Strength or Context-Dependent Success?

The literature frequently portrays Japan as a benchmark for human expertise development because of its strong workplace learning culture, long-term employment orientation, and emphasis on tacit knowledge transfer. However, the evidence suggests that the effectiveness of the Japanese model is closely tied to a specific institutional context characterized by stable employment relationships, strong organizational commitment, and internal labor markets rather than the superiority of its training practices alone. Mechanisms such as *shokuba gakushu*, *Kaizen*, and *senpai–kōhai* mentoring rely heavily on long-term employee–organization relationships, making their transferability to more flexible labor markets increasingly context-dependent. At the same time, demographic aging, labor market dualism, and hierarchical organizational structures present significant challenges by reducing

opportunities for knowledge transfer, creating unequal access to learning, and limiting organizational adaptability. These findings indicate that the Japanese model represents a trade-off between deep expertise accumulation and organizational flexibility, suggesting that its long-term sustainability depends on preserving its experiential learning strengths while adapting to evolving demographic, technological, and labor market conditions.

3.4 Hybrid Human Expertise Development Framework

Based on the comparative synthesis between Japan and Indonesia, this study proposes a Hybrid Human Expertise Development Framework (Figure 2) as an integrative conceptual model for understanding and enhancing expertise development in contemporary workforce systems. The framework conceptualizes human expertise development as a dynamic process emerging from the interaction between Human Resource Development (HRD), Technical and Vocational Education and Training (TVET), institutional arrangements, cultural values, and technological transformation. The proposed Hybrid Human Expertise Development Framework illustrates that expertise development is not determined solely by formal education or organizational training but emerges from the continuous interaction of institutional, cultural, technological, and labor market factors that shape both Human Resource Development (HRD) and Technical and Vocational Education and Training (TVET) systems. Within the HRD domain, expertise is fostered through workplace learning, mentoring, knowledge management, continuous improvement, and organizational learning, reflecting the strengths of the Japanese model with its emphasis on experiential learning, tacit knowledge transfer, *Kaizen*, and socially embedded learning processes. In contrast, the TVET dimension emphasizes competency-based curricula, industry collaboration, apprenticeship programs, and structured assessment systems, representing Indonesia's policy-driven approach to strengthening workforce readiness through institutional reform and education–industry alignment. The framework further highlights the importance of continuous interaction between HRD and TVET through feedback mechanisms involving monitoring, evaluation, workplace experience, industry participation, and policy adjustments, enabling organizations and educational institutions to respond more effectively to technological change and evolving labor market demands. At its core, Human Expertise Development is conceptualized as a multidimensional construct encompassing vocational competence, tacit knowledge, professional capability, adaptive skills, digital literacy, and problem-solving capacity, thereby integrating both explicit and tacit dimensions of expertise.

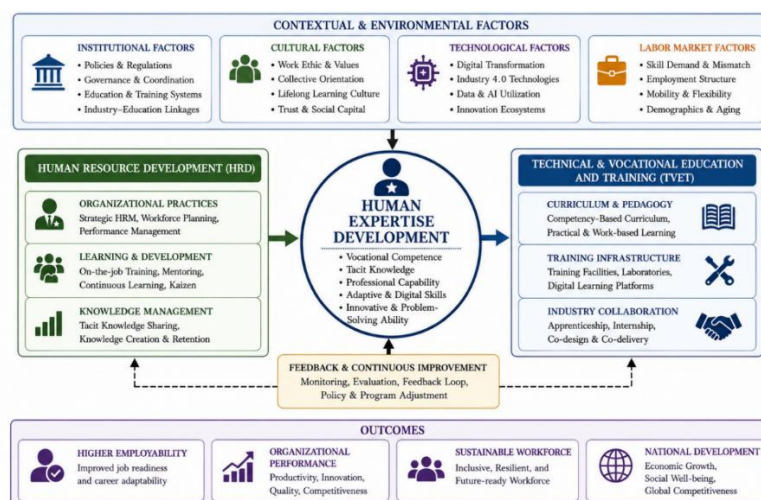


Figure 2. Hybrid Human Expertise Development Framework

Ultimately, the framework suggests that this integrated approach contributes to improved employability, organizational performance, sustainable workforce development, and long-term national competitiveness by combining Japan's experiential and firm-centered learning tradition with Indonesia's competency-based and policy-driven approach to create a more adaptive and context-sensitive model for the Industry 4.0 and Society 5.0 era.

3.5 Critical Reflection on the Hybrid Human Expertise Development Framework

Although the Hybrid Human Expertise Development Framework proposed in this study provides a more comprehensive perspective than existing HRD and TVET models, it remains subject to several limitations. The framework assumes effective collaboration among institutional actors, educational providers, and employers, despite potential governance challenges, competing interests, and resource constraints, while also presuming that experiential learning and competency-based systems can be integrated despite inherent tensions between tacit, context-specific expertise and standardized competency frameworks. Furthermore, because the framework is derived primarily from evidence from Japan and Indonesia, its applicability to other institutional contexts requires empirical validation across different sectors and countries. Nevertheless, the comparative findings suggest that effective human expertise development depends on a balanced integration of experiential learning, institutional alignment, and digital transformation rather than the direct replication of the Japanese model. Instead, selective and context-sensitive adaptation is more appropriate for emerging economies such as Indonesia (Faeni et al., 2025; Sabilatur Rosyidah et al., 2023). In particular, strengthening workplace-based learning through apprenticeships, dual-system TVET, Teaching Factory models, and stronger industry–institution collaboration can enhance expertise formation (Badaruddin et al., 2025), while embedding continuous improvement principles and lifelong learning cultures inspired by Japanese organizational practices can support continuous upskilling and workforce resilience in the face of technological change (Setyadi et al., 2025; Yusop et al., 2022b). Moreover, integrating value-based training emphasizing discipline, teamwork, and responsibility into competency-based frameworks, together with sustained investment in human capital and long-term collaboration among government, industry, and educational institutions, can contribute to a more adaptive, sustainable, and contextually relevant expertise development system in Indonesia.

4. Conclusions

This study provides a comparative and integrative perspective on human expertise development by examining the contrasting yet complementary models of Japan and Indonesia. Japan represents a mature, firm-centered system that emphasizes experiential learning, long-term capability accumulation, and strong cultural integration within organizations. In contrast, Indonesia reflects a developing, system-oriented model in which expertise formation is driven by policy frameworks, institutional coordination, and TVET reforms aimed at strengthening education–industry alignment. The findings demonstrate that expertise development is context-dependent and emerges from the interaction of workplace learning, institutional structures, cultural values, and technological transformation. Accordingly, a hybrid approach that combines experiential learning, competency-based systems, and digital transformation offers a more comprehensive strategy for developing future-ready human resources.

Despite its contributions, this study has several limitations. As a systematic literature review, it relies on secondary sources, which may restrict the depth of contextual interpretation, while its focus on Japan and Indonesia may not fully represent expertise development models

in other regions. Nevertheless, the study enriches the literature by presenting a holistic framework for understanding human expertise development and offers practical insights for policymakers, educators, and organizations. Overall, the findings emphasize that sustainable expertise development depends on both strong institutional foundations and the capacity to continuously adapt to technological advances and evolving labor market demands..

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