Vol. 4, No. 3, September 2026, pp. 1900-1912
INTERNATIONAL JOURNAL OF
POST AXIAL
FUTURISTIC TEACHING AND LEARNING
https://journal.amorfati.id/index.php/postaxial | | ISSN 3025-7549

Japanese Work Culture as a Framework for Vocational Education: A Literature Review

Ranu Iskandar[1]*, Bambang Sugeng Suryatna[2]
[1,2]Universitas Negeri Semarang, Indonesia

[a]ranuiskandar@mail.unnes.ac.id, [b]sugengs@mail.unnes.ac.id

Article History:
Received:
24-07-2026
Revised:
23-08-2026
Accepted:
21-09-2026

Keywords:
Framework;
Japanese Work Culture,
Literature Review,
Vocational Education

***Correspondence Address:**
ranuiskandar@mail.unnes.ac.id

Abstract:
Vocational education must develop technical competence together with the discipline, quality awareness, safety behavior, problem-solving capability, and continuous-improvement orientation required in contemporary workplaces. This systematic literature review identified Japanese work-culture concepts relevant to vocational education and synthesized them into an integrative framework. Google Scholar was used as the primary information source to locate peer-reviewed journal articles published from 2010 to 2026 concerning 9S, Kaizen, Gemba, Kanban, Poka-Yoke, Muda, Jidoka, Andon, Heijunka, Takt Time, Hoshin Kanri, or Genchi Genbutsu. Following eligibility screening, 12 studies were included in the qualitative synthesis. Evidence was extracted across seven dimensions: meaning, purpose, typical tools, implementation examples, involvement level, impact area, and benefits. The four-layer framework was developed by coding each concept according to its dominant educational function, grouping concepts with complementary mechanisms, and ordering the groups from learner and workplace foundations to institutional alignment. The resulting layers are Work Culture Foundation; Evidence-Based Problem Solving and Built-in Quality; Work and Production Flow; and Strategic Alignment. The synthesis indicates that these practices should be adapted rather than transferred mechanically. Their implementation should reflect the occupational field, learner readiness, workshop resources, safety risks, production authenticity, and institutional capacity. The framework therefore offers a context-sensitive basis for integrating Japanese work-culture principles into practical learning, Teaching Factory programs, internships, assessment, workshop management, and vocational governance.

Introduction (مقدمة)

Vocational education is expected to produce graduates who can transition effectively from learning environments to workplaces governed by stricter standards of productivity, quality, safety, and professional conduct. This need is increasingly important as education–industry linkages become central to strengthening curriculum relevance, work-based learning experiences, and the mastery of competencies that align with changing industry needs. Studies of industry involvement in vocational curriculum implementation indicate that industry participation can strengthen the alignment of learning, work-based practice, and the competencies students need to enter the workforce (Yoto et al., 2024).

Workplace readiness extends beyond the mastery of technical skills. Vocational education must also develop students' ability to follow procedures, recognize risks, manage work, and internalize safe work behaviors. Research on occupational safety and health in vocational education shows that integrating workplace demands into learning activities is an important pedagogical issue because students must learn to connect rules, real-world situations, and professional actions during practice (Chatigny, 2022). Accordingly, work culture can be understood as part of vocational competence rather than as an additional attribute acquired only after technical competence has been mastered.

In operations and manufacturing research, Japanese work practices have been widely discussed through the development of Lean and Toyota-inspired management. However, successful implementation is not determined solely by the use of technical tools. Cross-plant research shows that organizational culture and social Lean practices—such as employee involvement, problem-solving capability development, and commitment to improvement—distinguish successful Lean implementation from implementation that focuses only on technical tools (Bortolotti et al., 2015). This perspective is relevant to education because transforming work culture requires habituation and participation, not merely the introduction of terminology.

The Lean literature also shows that concepts developed within Japanese production systems form an interconnected set of philosophies, principles, and mechanisms. Reviews of Lean development identify waste elimination, flow, quality, human involvement, standardization, and continuous improvement as recurring themes in operations research (Jasti & Kodali, 2015). Therefore, concepts such as Kaizen, Gemba, Kanban, Poka-Yoke, Jidoka, Andon, Heijunka, Takt Time, Hoshin Kanri, and Genchi Genbutsu should not be treated merely as a list of stand-alone techniques.

The relevance of this work culture becomes stronger when vocational education employs Teaching Factory models and other forms of production-based learning. Evaluations of Teaching Factory readiness in Indonesia indicate that industry linkages, process standards, resource readiness, and production mechanisms are important for making learning experiences approximate actual workplace conditions (Pradipta et al., 2021). In other words, practical learning requires a work-culture framework that connects individual skills with work systems, quality, time, workflow, and collective responsibility.

Competency development through Teaching Factory models also requires supportive organizational conditions. Studies of critical success factors for Teaching Factory implementation show that leadership, industry involvement, facilities, teacher competence, and the organization of learning processes influence implementation effectiveness (Wahjusaputri et al., 2021). These conditions create opportunities to adapt Japanese work-culture principles at multiple levels, ranging from individual behavior and team-based work systems to workshop management and institutional goal alignment.

At the learner level, the relationship between work culture and work readiness has also begun to receive empirical support. Research involving vocational students shows that 5S culture, together with soft skills and vocational knowledge, is associated with work readiness (Maulidina & Wijanarka, 2023). This finding supports the view that work culture can be developed as a competence that is learned and habituated in vocational education. However, a focus on 5S alone does not encompass fact-based problem solving, error prevention, visual management, flow management, and strategic alignment.

Research on Lean implementation also cautions against mechanically transferring practices from one organization to another. Contextual factors influence Lean success, meaning that implementation must be adapted to the characteristics, processes, and resources of a particular organization (Netland, 2016). For vocational education, the implication is that Japanese work-culture principles should not be replicated as a complete production system; rather, they should be transformed into pedagogical experiences that are consistent with educational goals.

This need is increasingly relevant in the context of workforce transformation and Industry 4.0. Recent research on partnerships between vocational education and industry emphasizes the importance of collaboration with industry partners in preparing the workforce for changes in technology, work organization, and emerging competencies (Safrani et al., 2026). A systematic work-culture framework can help vocational education develop not only technical skills but also precision, process discipline, diagnostic capability, quality awareness, visual communication, and a continuous-improvement orientation.

Although the Lean literature has expanded substantially, earlier reviews show considerable variation in the definitions, principles, and tools used under the term Lean manufacturing and highlight the continuing need for clearer classification to avoid fragmented use of the concepts (Bhamu & Sangwan, 2014). In response to this gap, the present study conducted a systematic review to identify and synthesize twelve concepts: 9S, Kaizen, Gemba, Kanban, Poka-Yoke, Muda, Jidoka, Andon, Heijunka, Takt Time, Hoshin Kanri, and Genchi Genbutsu. Each concept was analyzed according to seven dimensions: meaning, purpose, typical tools, example, involvement level, impact area, and benefits. The ultimate objective was to develop a Japanese Work Culture Framework for Vocational Education that organizes these concepts into layers that can be adapted to curricula, practical learning, Teaching Factory programs, internships, workshop management, and institutional quality development

Research on Japanese work culture and successful Lean implementation emphasizes employee involvement, organizational culture, and social practices (Bortolotti et al., 2015). Kaizen studies explain continuous improvement and structured improvement events (Glover et al., 2014; Iwao, 2017), while Lean reviews classify tools concerned with waste, flow, quality, and standardization (Bhamu & Sangwan, 2014; Jasti & Kodali, 2015). Vocational-education studies, by contrast, primarily examine 5S and work readiness, Teaching Factory readiness, or the organizational conditions required for industry-oriented learning (Maulidina & Wijanarka, 2023; Pradipta et al., 2021; Wahjusaputri et al., 2021). These streams establish the value of individual practices, but they do not explain how cultural foundations, evidence-based problem solving, built-in quality, production flow, and institutional strategy can operate as a coherent pedagogical system. Consequently, vocational educators lack an integrative structure for deciding what should be developed at the learner, team, workshop, and institutional levels. The novelty of this review lies in synthesizing twelve Japanese work-culture concepts across seven comparable dimensions and organizing them into a four-layer framework that connects daily behavior with operational and strategic learning. The study therefore asks not only which Japanese practices are relevant, but also how their functions can be sequenced and contextually adapted for curricula, practical learning, Teaching Factory programs, internships, workshop management, and institutional quality development.

Method (منهج)

Research Design

This study employed a systematic literature review (SLR) with a descriptive qualitative synthesis approach. An SLR was used because it provides explicit procedures for defining review objectives, searching the literature, applying selection criteria, assessing source relevance, and synthesizing evidence in a structured manner. This approach helps reduce ad hoc literature selection and improves the traceability of the review process (Okoli, 2015).

The synthesis was designed to answer three research questions: (1) Which Japanese work-culture concepts are relevant to vocational education? (2) What are the characteristics of each concept in terms of meaning, purpose, typical tools, example, involvement level, impact area, and benefits? and (3) How can these concepts be organized into a work-culture framework that is applicable to vocational education? The research questions, search process, eligibility assessment, extraction, and synthesis were structured sequentially in accordance with systematic-review principles that emphasize transparency between the research questions and review procedures (Xiao & Watson, 2019).

Information Sources and Search Strategy

The primary search source was Google Scholar. This platform was selected because it can capture literature across multiple disciplines and publishers relevant to a cross-disciplinary topic involving vocational education, Lean management, industrial culture, and Japanese management. Google Scholar is also useful in evidence reviews when broad search coverage is needed, although its results must be screened systematically (Haddaway et al., 2015).

The use of Google Scholar was nevertheless treated critically. Bibliographic comparison studies indicate that Google Scholar can provide broader coverage than Web of Science and Scopus in many fields, although its indexing characteristics and search mechanisms differ from those of curated citation databases (Harzing & Alakangas, 2016). Other research also shows that Google Scholar covers a wide range of documents, including a substantial proportion that may not be indexed in traditional databases, making verification of document type and relevance essential (Martín et al., 2018).

The search was conducted on [actual search date] using groups of search strings to accommodate Google Scholar query-length limitations. The main combinations included: (a) "Japanese work culture" AND ("vocational education" OR TVET OR "vocational school"); (b) (Kaizen OR 5S OR 9S OR Gemba) AND ("vocational education" OR TVET); (c) (Kanban OR "Poka Yoke" OR Muda OR Jidoka OR Andon) AND ("vocational education" OR TVET); and (d) (Heijunka OR "Takt Time" OR "Hoshin Kanri" OR "Genchi Genbutsu") AND ("vocational education" OR TVET). The search strings were developed by combining core concepts, synonyms, and contextual terms in line with systematic-search principles that recommend concept mapping before finalizing search queries (Bramer et al., 2018).

Inclusion and Exclusion Criteria

The inclusion criteria were established before screening to ensure consistency in decision making. Articles were included if they: (1) were published between 2010 and 2026; (2) were peer-reviewed journal articles; (3) were written in English or Indonesian; (4) substantively addressed at least one of the following concepts: 9S, Kaizen, Gemba, Kanban, Poka-Yoke, Muda, Jidoka, Andon, Heijunka, Takt Time, Hoshin Kanri, or Genchi Genbutsu; (5) were relevant to vocational education, work culture, workforce development, work systems, Lean, or an industrial context that allowed conceptual transfer to education; and (6) provided sufficient information for

extracting the seven analytical dimensions. Exclusion criteria included duplicates, nonacademic articles, and articles that did not provide extractable conceptual data. Establishing criteria before synthesis helps improve the consistency and reproducibility of review decisions (Carrera-Rivera et al., 2022).

Study Selection and PRISMA 2020 Reporting

Study selection was conducted through the identification, screening, eligibility, and inclusion stages. During identification, all records retrieved from Google Scholar were documented together with the search date and search string. During screening, titles and abstracts were assessed against the inclusion criteria. Potentially relevant articles were then examined in full text during the eligibility stage. Full-text exclusion decisions were documented using predefined reasons. This procedure emphasizes a transparent decision trail so that the review process can be audited and replicated, consistent with recent recommendations for systematic reviews in management research (Sauer & Seuring, 2023).

The study-selection process was reported using the PRISMA 2020 structure. Because the numbers of retrieved records, duplicates, screened records, and final included articles were not available in the research data provided, all n values in Figure 1 are displayed as placeholders and must be replaced with the actual screening results. The diagram should not be populated with estimated values (PRISMA, 2021).

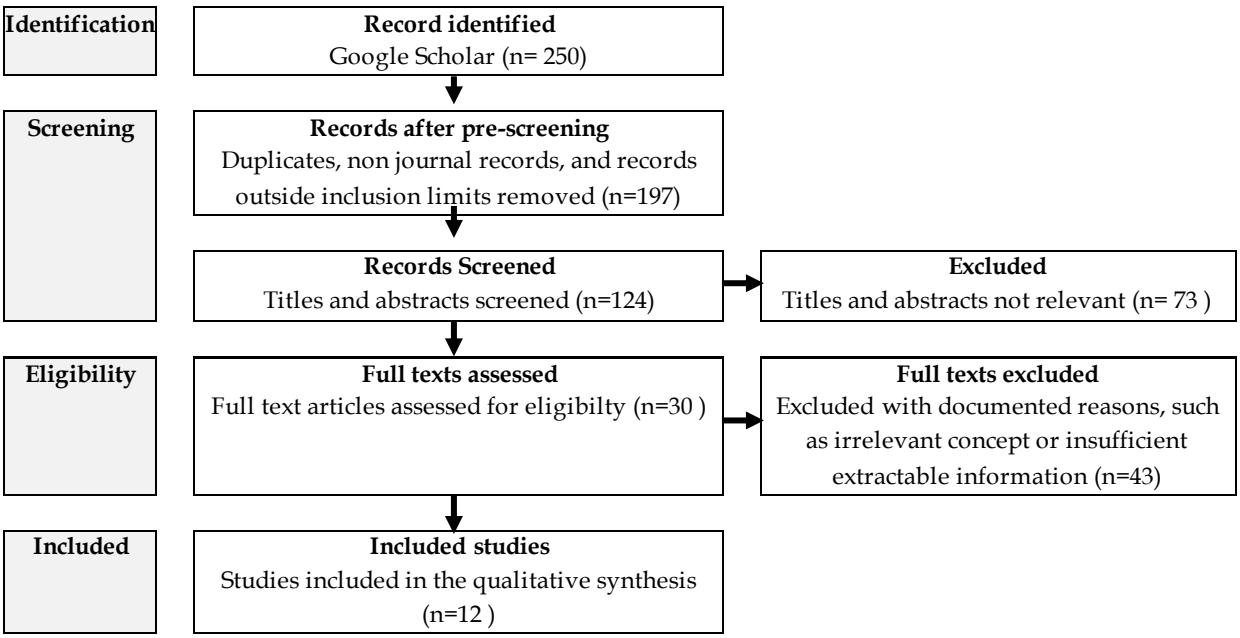

Figure 1. PRISMA 2020-Based Study Selection Flow

Data Extraction and Synthesis

Articles that met the eligibility criteria were entered into an extraction matrix containing the author(s), year, country/context, research design, concepts addressed, and seven dimensions: meaning, purpose, typical tools, example, involvement level, impact area, and benefits. After extraction, findings were compared across articles and coded according to the dominant function of each concept. The synthesis distinguished philosophies/values, problem-solving and built-in-quality mechanisms, flow-management mechanisms, and strategic alignment. An approach based on explicit decisions and documented synthesis procedures helps maintain coherence between article-level evidence and the framework produced (Muka et al., 2020).

Result (نتائج) and Discussion (مناقشة)

Japanese Work Culture in the Context of Vocational Education

The synthesis indicates that industrial work culture in vocational education should be embedded in the learning experience rather than treated merely as theoretical content. Teaching Factory implementation in vocational education demonstrates that learning processes modeled on production practices can integrate competencies, process standards, collaboration, and workplace demands within a single learning environment (Saputro et al., 2021). This setting provides a pedagogical context in which Japanese work-culture principles can be practiced authentically.

Beyond orderliness and discipline, practical learning environments also require cultures of safety, quality, and problem solving. A recent framework linking occupational safety and health with 5S positions workplace organization as a foundation of industrial culture that can be developed through vocational education (Sujastika et al., 2026). Therefore, 9S/5S is more appropriately positioned as a foundation for workplace behavior and the work environment before learners are introduced to more complex quality and flow mechanisms.

The internalization of work values also requires sustained habituation. A qualitative study in vocational schools shows that Kaizen can be internalized through routines, practice, role modeling, and repeated improvement processes, allowing work ethic to develop through experience rather than through declarative knowledge alone (Insani & Wardhani, 2026). This finding provides a basis for interpreting Japanese work-culture concepts in this review as a set of principles that must be translated into pedagogical activities.

Characteristics of Japanese Work-Culture Concepts

Table 1 summarizes the twelve concepts according to the seven analytical dimensions. The examples in the vocational-education column are pedagogical adaptations derived from the characteristics of each concept identified in the literature; therefore, they should not be interpreted as evidence that every proposed form of implementation has been empirically tested in every type of vocational institution.

Table 1. Synthesis of Japanese Work-Culture Characteristics and Their Adaptation to Vocational Education

Concept	Meaning	Purpose	Typical tools	Example of adaptation to vocational education	Involvement level	Impact area	Benefits	Source
9S	An extension of workplace organization and discipline into nine elements: Seiri, Seiton, Seiso, Seiketsu, Shitsuke, Shikari, Shitsukoku, Seishoo, and Seido.	Build orderliness, discipline, consistency, commitment, coordination, and standardization.	Audits, checklists, visual standards, area marking, SOPs.	Workshop audits before and after practical sessions; standardized locations for tools and materials.	Individual–team–institution	Work environment, behavior, safety	Orderliness, discipline, consistency, responsibility	Hernández-Castorena et al. (2018)
Kaizen	Continuous improvement through experimentation and incremental change.	Consistently improve processes through the involvement of people who perform the work.	PDCA, 5 Why, Kaizen events, suggestion systems.	Students identify a problem in a practical task, test an improvement, evaluate it, and standardize the improved method.	All levels	Process, quality, learning	Continuous-improvement mindset, problem solving	Iwao (2017)

Gemba	The actual place where processes and value creation occur.	Understand processes through direct observation of actual conditions.	Gemba walks, observation, process mapping.	Teachers and students directly observe bottlenecks, deviations, and safety conditions at workstations.	Individual–team	Process, quality, diagnosis	Fact-based understanding and problem identification	García-Alcaraz et al. (2022)
Kanban	A visual/pull control mechanism for regulating the flow of work or materials.	Control work in process (WIP) and align flow with demand.	Kanban cards/boards, WIP limits, signals.	Teaching Factory job-order boards; monitoring task and material status.	Team–unit	Flow, logistics, time	Work transparency and reduced waiting	Thürer et al. (2016)
Poka-Yoke	Mistake-proofing used to prevent or detect errors before they become defects.	Reduce errors and improve process reliability.	Jigs, interlocks, sensors, coding, checklists.	Connectors that cannot be installed incorrectly; pre-operation safety checklists.	Individual–team	Quality, safety	Prevention of errors, rework, and defects	Pötters et al. (2018)
Muda	Activities that consume resources without creating value.	Identify and eliminate waste.	Waste identification, VSM, 5 Why, process analysis.	Identifying tool waiting time, unnecessary motion, rework, and excess materials during practical work.	Individual–team	Efficiency, process, resources	Savings in time/materials and leaner processes	Kumar et al. (2022)
Jidoka	A built-in-quality principle based on detecting abnormalities and stopping the process.	Prevent deviations from being passed to the next stage.	Stop mechanisms, sensors, autonomation.	Students stop a machine or process when parameters are unsafe or outside standards.	Individual–team	Quality, safety	Quality at the source and early detection	Åhlström (2015)
Andon	A visual/audio signal indicating process status or abnormalities.	Communicate problems quickly and trigger a response.	Lights, displays, dashboards, alarms.	Workstation status: normal, assistance required, or stopped.	Individual–team	Communication, flow, quality	Rapid response, transparency, coordination	Díaz Reza et al. (2023)
Heijunka	Leveling workload and variation in work/production.	Create more stable flow and reduce fluctuations.	Heijunka boxes, workload leveling, scheduling.	Balancing practical jobs across workstations in a Teaching Factory.	Team–unit	Scheduling, flow	Flow stability and reduced bottlenecks	Matzka et al. (2012)
Takt Time	The work pace required to meet an output target within the available time.	Align process pace with demand.	Takt calculations, cycle-time charts, line balancing.	Comparing workstation target time with actual cycle time.	Team–unit	Time, productivity, flow	Time discipline and identification of imbalances	Ali & Deif (2014)
Hoshin Kanri	A system for deploying strategic objectives to the operational level.	Align strategy, objectives, indicators, and actions.	X-Matrix, Catchball, KPIs, PDCA.	Translating the goal of graduates with industrial work culture into curriculum, workshop, and practical-learning indicators.	Institution–unit–team	Strategy, governance, quality	Alignment and accountability	Nicholas (2016)
Genchi Genbutsu	The principle of going to the source and examining facts directly.	Base diagnosis and decisions on actual evidence.	Direct observation, measurement, root-cause analysis.	Students verify actual symptoms and parameters before determining the cause of a fault.	Individual–team	Diagnosis, decision making, problem solving	Precision and evidence-based technical judgment	New et al. (2016)

9S as a Foundation for the Work Environment and Work Character

9S can be positioned as a foundation because its scope extends from organizing objects and the workplace to behavioral consistency, commitment, coordination, and standardization. A literature review of 5S emphasizes that sustainable workplace organization depends not only on cleaning and orderliness but also on involvement, discipline, standardization, and the continuous maintenance of established habits (Randhawa & Ahuja, 2017). In vocational education, this implies that 9S should be embedded in workshop routines, tool management, safety practices, end-of-session procedures, and work-area audits rather than taught as a separate theoretical topic.

Kaizen as a Philosophy of Continuous Improvement

Kaizen occupies a different position from more operational Lean techniques because it functions as an ongoing orientation toward process improvement. Research on Kaizen events shows that structured improvement can combine team involvement, analysis of initial conditions, implementation of changes, and follow-up activities to sustain results (Glover et al., 2014). In vocational learning, this logic can be translated into a cycle in which students observe a work process, identify a problem, test an improvement, compare outcomes, and establish a better procedure. In this way, assessment can evaluate the improvement process in addition to the quality of the final product.

Gemba and Genchi Genbutsu as a Basis for Reality-Based Learning

Gemba and Genchi Genbutsu establish a strong relationship between decision making and actual conditions. Recent evidence indicates that Gemba can serve as a link between the Kaizen philosophy and waste identification because direct observation makes hidden process problems more visible and analyzable (García Alcaraz et al., 2026). In vocational education, both principles are particularly relevant to diagnosis and troubleshooting: students should inspect symptoms, take measurements, compare findings with standards, and formulate conclusions from evidence rather than replace components or take action based solely on assumptions.

Muda, Poka-Yoke, Jidoka, and Andon as Built-in Quality Mechanisms

These four concepts can be organized as a logical quality chain. Muda develops awareness of non-value-adding activities; Poka-Yoke prevents or detects errors; Jidoka stops or controls a process when an abnormality occurs; and Andon makes process conditions visible to those who need to respond. A framework for assessing Poka-Yoke devices shows that mistake-proofing can be analyzed in terms of prevention/detection functions, mechanisms, and their relationship to process characteristics (Saurin et al., 2012). In vocational education, these principles make it possible for practical assessments to include indicators of error prevention, responses to abnormalities, and problem communication rather than focusing solely on the accuracy of the final result.

Kanban, Heijunka, and Takt Time as Approaches to Learning Flow Management

Kanban, Heijunka, and Takt Time shift the focus of learning from individual skill performance toward an understanding of the work system. The Lean 4.0 literature shows that visual control, material flow, time measurement, and real-time information remain important even as Lean tools become integrated with digital technologies (Rossi et al., 2022). In Teaching Factory settings, the three concepts can be adapted through workflow boards, work-in-process limits, workload leveling across groups, comparisons between cycle time and target time, and reflection on bottlenecks. Students therefore learn that productivity results from system coordination rather than individual speed alone.

Hoshin Kanri as Strategic Alignment in Vocational Education

Hoshin Kanri operates at a different level from shop-floor techniques because it connects strategic direction with unit- and individual-level activities. Research on its implementation in small and medium-sized manufacturing enterprises shows that goal deployment requires two-way communication, organizational involvement, clear priorities, and implementation monitoring (Melander, 2016). In vocational institutions, this logic can be used to translate goals such as graduates demonstrate industrial work culture into curriculum indicators, standards for practical learning, Teaching Factory targets, internship programs, and workshop performance measures.

Japanese Work Culture Framework for Vocational Education

The synthesis produced a four-layer framework. The first layer is Work Culture Foundation (9S and Kaizen), which develops orderliness, discipline, commitment, and continuous improvement. The second layer is Evidence-Based Problem Solving and Built-in Quality (Gemba, Genchi Genbutsu, Muda, Poka-Yoke, Jidoka, and Andon), which develops fact-based observation, error prevention, abnormality detection, and problem communication. The third layer is Work and Production Flow (Kanban, Heijunka, and Takt Time), which develops the ability to manage work, time, materials, capacity, and flow. The fourth layer is Strategic Alignment (Hoshin Kanri), which ensures that work-culture principles are connected to institutional goals. The potential of Hoshin Kanri in educational institutions has been discussed as a systematic approach for translating strategic objectives into more operational processes and indicators (Ahmed, 2016).

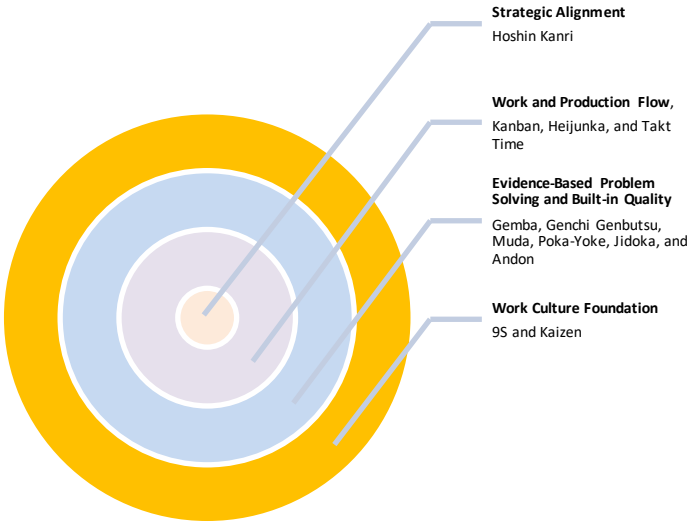

Figure 2. Japanese Work Culture Framework for Vocational Education

Implications for Vocational Education

The framework has three major implications. First, the internalization of work culture should be practice-based: students need to apply the principles while performing authentic work rather than merely explain their definitions. Second, implementation should be integrated with technical competence; for example, Genchi Genbutsu can be embedded in troubleshooting, Poka-Yoke in quality control, Andon in abnormality communication, and Kanban in Teaching Factory operations. Third, implementation requires leadership and organizational learning processes. A systematic review of Lean leadership shows that leadership behaviors, human development, engagement, and problem solving are important components of sustaining Lean implementation (Aij & Teunissen, 2017). The framework therefore should not be applied only to students; teachers, workshop managers, program leaders, and industry partners need to participate in the same system.

Conclusion (خاتمة)

This systematic review shows that Japanese work culture has broader potential for vocational education than the development of discipline, cleanliness, and orderliness alone. The twelve concepts analyzed do not operate at the same conceptual level. 9S and Kaizen function as foundations for culture and improvement; Gemba, Genchi Genbutsu, Muda, Poka-Yoke, Jidoka, and Andon support fact-based problem solving and built-in quality; Kanban, Heijunka, and Takt

Time support an understanding of flow and process management; and Hoshin Kanri connects operational practices with strategic objectives.

Based on this synthesis, the study proposes a Japanese Work Culture Framework for Vocational Education consisting of four layers: Work Culture Foundation, Evidence-Based Problem Solving and Built-in Quality, Work and Production Flow, and Strategic Alignment. The framework is not intended to replicate Japanese production systems directly in vocational schools or higher education institutions. Its value lies in the pedagogical adaptation of relevant principles into workplace-environment routines, diagnosis and troubleshooting activities, quality assurance, Teaching Factory practices, project-based learning, industry placements, and program governance.

Methodologically, this review is limited by its reliance on Google Scholar as the primary search source and by the need for further verification of terminology variations, particularly 9S. Because the framework was generated through conceptual synthesis, the relationships among its layers and their effects on educational outcomes have not yet been tested empirically. Future research could use Delphi studies or expert judgment for content validation, followed by exploratory/confirmatory factor analysis or structural equation modeling (SEM) to test the construct structure. Experimental or quasi-experimental studies are also needed to assess the effects of framework implementation on work readiness, employability skills, safety behavior, quality awareness, problem-solving ability, and industry adaptability.

Acknowledgment (شكر وتقدير)

Thank you to all parties who helped in writing this journal article.

Bibliography ((مراجع

Ählström, P. (2015). Jidoka. In C. L. Cooper (Ed.), *Wiley encyclopedia of management*. Wiley. https://doi.org/10.1002/9781118785317.weom100183

Ahmed, H. O. K. (2016). A proposed systematic framework for applying Hoshin Kanri strategic planning methodology in educational institutions. *European Scientific Journal, 12*(16), 158–194. https://doi.org/10.19044/esj.2016.v12n16p158

Aij, K. H., & Teunissen, M. (2017). Lean leadership attributes: A systematic review of the literature. *Journal of Health Organization and Management, 31*(7/8), 713–729. https://doi.org/10.1108/JHOM-12-2016-0245

Ali, R. M., & Deif, A. M. (2014). Dynamic lean assessment for takt time implementation. *Procedia CIRP, 17*, 577–581. https://doi.org/10.1016/j.procir.2014.01.128

Bhamu, J., & Sangwan, K. S. (2014). Lean manufacturing: Literature review and research issues. *International Journal of Operations & Production Management, 34*(7), 876–940. https://doi.org/10.1108/IJOPM-08-2012-0315

Bortolotti, T., Boscari, S., & Danese, P. (2015). Successful lean implementation: Organizational culture and soft lean practices. *International Journal of Production Economics, 160*, 182–201. https://doi.org/10.1016/j.ijpe.2014.10.013

Bramer, W. M., de Jonge, G. B., Rethlefsen, M. L., Mast, F., & Kleijnen, J. (2018). A systematic approach to searching: An efficient and complete method to develop literature searches. *Journal of the Medical Library Association, 106*(4), 531–541. https://doi.org/10.5195/jmla.2018.283

Carrera-Rivera, A., Ochoa, W., Larrinaga, F., & Lasa, G. (2022). How-to conduct a systematic literature review: A quick guide for computer science research. *MethodsX, 9*, 101895. https://doi.org/10.1016/j.mex.2022.101895

Chatigny, C. (2022). Occupational health and safety in initial vocational training: Reflection on the issues of prescription and integration in teaching and learning activities. *Safety Science, 147*, 105580. https://doi.org/10.1016/j.ssci.2021.105580

Díaz Reza, J. R., García Alcaraz, J. L., & Márquez Figueroa, L. J. (2023). Beneficios de gestión visual sobre Justo a Tiempo en la industria maquiladora. Cultura Científica y Tecnológica, 20(2). https://doi.org/10.20983/culcyt.2023.2.2a.3

García Alcaraz, J. L., Limon-Romero, J., Jiménez Macías, E., Aryanfar, Y., Barragán, A. J., & Reallyvásquez Vargas, A. (2026). From Kaizen to sustainability: How operational lean tools drive the Triple Bottom Line. *Journal of Cleaner Production, 574*, 149103. https://doi.org/10.1016/j.jclepro.2026.149103

García-Alcaraz, J. L., Morales García, A. S., Díaz-Reza, J. R., Jiménez Macías, E., Javierre Lardies, C., & Blanco Fernández, J. (2022). Effect of lean manufacturing tools on sustainability: The case of Mexican maquiladoras. *Environmental Science and Pollution Research, 29*(26), 39622–39637. https://doi.org/10.1007/s11356-022-18978-6

Glover, W. J., Farris, J. A., & Van Aken, E. M. (2014). Kaizen events: Assessing the existing literature and convergence of practices. *Engineering Management Journal, 26*(1), 39–61. https://doi.org/10.1080/10429247.2014.11432003

Haddaway, N. R., Collins, A. M., Coughlin, D., & Kirk, S. (2015). The role of Google Scholar in evidence reviews and its applicability to grey literature searching. *PLOS ONE, 10*(9), e0138237. https://doi.org/10.1371/journal.pone.0138237

Harzing, A.-W., & Alakangas, S. (2016). Google Scholar, Scopus and the Web of Science: A longitudinal and cross-disciplinary comparison. *Scientometrics, 106*(2), 787–804. https://doi.org/10.1007/s11192-015-1798-9

Hernández-Castorena, O., Colín-Salgado, M., & Velásquez-Espinosa, N. (2018). Análisis de la relación hábitos y aceptación de 9's como elemento de competitividad en la pyme manufacturera de Aguascalientes, México. *Revista CEA, 4*(7), 29–47. https://doi.org/10.22430/24223182.757

Insani, L. A. B., & Wardhani, N. W. (2026). Internalisasi etos kerja siswa SMK melalui budaya Kaizen: Studi kualitatif di SMKN 1 Magelang. *Nusantara: Jurnal Pendidikan Indonesia, 6*(2), 346–359. https://doi.org/10.62491/njpi.2026.v6i2-6

Iwao, S. (2017). Revisiting the existing notion of continuous improvement (Kaizen): Literature review and field research of Toyota from a perspective of innovation. *Evolutionary and Institutional Economics Review, 14*(1), 29–59. https://doi.org/10.1007/s40844-017-0067-4

Jasti, N. V. K., & Kodali, R. (2015). Lean production: Literature review and trends. *International Journal of Production Research, 53*(3), 867–885. https://doi.org/10.1080/00207543.2014.937508

Kumar, N., Hasan, S. S., Srivastava, K., Akhtar, R., Yadav, R. K., & Choubey, V. K. (2022). Lean manufacturing techniques and its implementation: A review. *Materials Today: Proceedings, 64*(3), 1188–1192. https://doi.org/10.1016/j.matpr.2022.03.481

Martín-Martín, A., Orduna-Malea, E., & Delgado López-Cózar, E. (2018). Coverage of highly-cited documents in Google Scholar, Web of Science, and Scopus: A multidisciplinary comparison. *Scientometrics, 116*(3), 2175–2188. https://doi.org/10.1007/s11192-018-2820-9

Matzka, J., Furmans, K., & Di Mascolo, M. (2012). Buffer sizing of a Heijunka Kanban system. *Journal of Intelligent Manufacturing, 23*(1), 49–60. https://doi.org/10.1007/s10845-009-0317-3

Maulidina, A., & Wijanarka, B. S. (2023). Analysis of work readiness based on soft skills, machining knowledge, and 5S work culture. *European Journal of Education and Pedagogy, 4*(4), 53–58. https://doi.org/10.24018/ejedu.2023.4.4.710

Melander, A. (2016). Introducing the Hoshin Kanri strategic management system in manufacturing SMEs. *Management Decision, 54*(10), 2507–2523. https://doi.org/10.1108/MD-03-2016-0148

Muka, T., Glisic, M., Milic, J., Verhoog, S., Bohlius, J., Bramer, W., Chowdhury, R., & Franco, O. H. (2020). A 24-step guide on how to design, conduct, and successfully publish a systematic review and meta-analysis in medical research. *European Journal of Epidemiology, 35*, 49–60. https://doi.org/10.1007/s10654-019-00576-5

Netland, T. H. (2016). Critical success factors for implementing lean production: The effect of contingencies. *International Journal of Production Research, 54*(8), 2433–2448. https://doi.org/10.1080/00207543.2015.1096976

New, S., Hadi, M., Pickering, S., Robertson, E., Morgan, L., Griffin, D., Collins, G., Rivero-Arias, O., Catchpole, K., & McCulloch, P. (2016). Lean participative process improvement: Outcomes and obstacles in trauma orthopaedics. *PLOS ONE, 11*(4), e0152360. https://doi.org/10.1371/journal.pone.0152360

Nicholas, J. (2016). Hoshin kanri and critical success factors in quality management and lean production. *Total Quality Management & Business Excellence, 27*(3–4), 250–264. https://doi.org/10.1080/14783363.2014.976938

Okoli, C. (2015). A guide to conducting a standalone systematic literature review. *Communications of the Association for Information Systems, 37*, 879–910. https://doi.org/10.17705/1CAIS.03743

Pradipta, B. Q., Hirawan, F. B., & Ragamustari, S. K. (2021). Evaluation of policy in the vocational education system revitalization in Indonesia: Examining the teaching factory readiness of industry. *Jurnal Pendidikan Vokasi, 11*(1), 68–77. https://doi.org/10.21831/jpv.v11i1.37693

PRISMA. (2021). *PRISMA 2020 flow diagram*. https://www.prisma-statement.org/prisma-2020-flow-diagram

Pötters, P., Schmitt, R., & Leyendecker, B. (2018). Effectivity of quality methods used on the shop floor of a serial production—How important is Poka Yoke? Total Quality Management & Business Excellence, 29(9–10), 1200–1212. https://doi.org/10.1080/14783363.2018.1488559

Randhawa, J. S., & Ahuja, I. S. (2017). 5S—A quality improvement tool for sustainable performance: Literature review and directions. *International Journal of Quality & Reliability Management, 34*(3), 334–361. https://doi.org/10.1108/IJQRM-03-2015-0045

Rossi, A. H. G., Marcondes, G. B., Pontes, J., Leitão, P., Treinta, F. T., De Resende, L. M. M., Mosconi, E., & Yoshino, R. T. (2022). Lean tools in the context of Industry 4.0: Literature review, implementation and trends. *Sustainability, 14*(19), 12295. https://doi.org/10.3390/su141912295

Safrani, I. D. P., Madhakomala, R., & Mayasari, L. I. (2026). Vocational education partnerships and Industry 4.0 workforce readiness: Pendidikan vokasi di era Industri 4.0: Evaluasi kemitraan dengan dunia usaha dan dunia industri. Academia Open, 11(1). https://doi.org/10.21070/acopen.11.2026.14415

Saputro, I. N., Soenarto, Sofyan, H., Riyanita, M. C., Rebia, P. S., & Listiana, A. (2021). The effectiveness of teaching factory implementation in vocational education: Case studies in Indonesia. *Universal Journal of Educational Research, 9*(11), 1841–1856. https://doi.org/10.13189/ujer.2021.091104

Sauer, P. C., & Seuring, S. (2023). How to conduct systematic literature reviews in management research: A guide in 6 steps and 14 decisions. *Review of Managerial Science, 17*, 1899–1933. https://doi.org/10.1007/s11846-023-00668-3

Saurin, T. A., Ribeiro, J. L. D., & Vidor, G. (2012). A framework for assessing poka-yoke devices. *Journal of Manufacturing Systems, 31*(3), 358–366. https://doi.org/10.1016/j.jmsy.2012.04.001

Sujastika, I., Endarto, D., & Fauzan, A. (2026). A theoretical framework for strengthening occupational safety and health and 5S as a foundation for industrial culture. *Jurnal Kependidikan: Penelitian Inovasi Pembelajaran, 10*(1), 131–142. https://doi.org/10.21831/jk.v10i1.93590

Thürer, M., Stevenson, M., & Protzman, C. W., III. (2016). Card-based production control: A review of the control mechanisms underpinning Kanban, ConWIP, POLCA and COBACABANA systems. *Production Planning & Control, 27*(14), 1143–1157. https://doi.org/10.1080/09537287.2016.1188224

Wahjusaputri, S., Bunyamin, B., & Nastiti, T. I. (2021). Critical success factors in implementing teaching factory-based competency for vocational high school students. *Jurnal Cakrawala Pendidikan, 40*(3), 584–592. https://doi.org/10.21831/cp.v40i3.28877

Xiao, Y., & Watson, M. (2019). Guidance on conducting a systematic literature review. *Journal of Planning Education and Research, 39*(1), 93–112. https://doi.org/10.1177/0739456X17723971

Yoto, Marsono, Suyetno, A., Mawangi, P. A. N., Romadin, A., & Paryono. (2024). The role of industry to unlock the potential of the Merdeka curriculum for vocational school. *Cogent Education, 11*(1), 2335820. https://doi.org/10.1080/2331186X.2024.2335820