Utilization of Virtual Reality (VR) for Employee Training in Indonesia: A Systematic Literature Review

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Utilization of Virtual Reality (VR) for Employee Training in Indonesia: A Systematic Literature Review

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ABSTRACT

This study aims to examine the trends and implementation of Virtual Reality (VR) in employee training in Indonesia through a systematic literature review of 18 articles published between 2020 and 2025. The analysis shows that the use of VR in employee training began to develop in 2020 and has increased rapidly in the past five years. VR applications span various sectors such as construction, energy, healthcare, fintech, MSMEs, and tourism. The types of training developed include technical simulations, occupational safety, soft skills development, leadership, and disaster preparedness. Furthermore, recent trends show the integration of VR with other technologies such as Artificial Intelligence and Augmented Reality. These findings confirm that VR has become a strategic approach in developing employee competencies across sectors in Indonesia.

Keywords: Virtual Reality; Employee Training; Industry 4.0; Indonesia; Systematic Literature Review

Field: Management; Education; Technology

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SDGs: Decent Work and Economic Growth (8); Industry, Innovation and Infrastructure (9); Quality Education (4); Responsible Consumption and Production (12); Climate Action (13); Good Health and Well-being (3)

INTRODUCTION

With the rapid development of technology, various sectors have begun to keep pace with technological developments by implementing them. Currently, Indonesia has entered the era of Industry 4.0, marked by digitalization efforts. Examples of 4.0 applications include VR, automation, robotics, AI, and big data management. Technology in the 4.0 era focuses on supporting digitalization and automation. Virtual Reality (VR) is one immersive technology that plays a crucial role in this context (Paszkiewicz et al., 2021). VR allows users to experience interactive three-dimensional simulated environments, making it suitable for use in training, education, and work simulations.

VR has become a popular technology in the last decade (Epp et al., 2021). In Indonesia, VR is still primarily used in the entertainment sector, such as VR games and VR-based amusement parks (Ramadhanti et al., 2024). In various developed countries around the world, VR can be used to simulate real-life work environments that pose risks (Setiawan, 2024). For example, VR has been widely used in professional sectors such as healthcare (surgical simulations), aviation (pilot simulators), and even the manufacturing industry (occupational safety training). The application of VR in professional environments offers the advantage of safe, interactive, and efficient learning without any real risks. Unfortunately, the implementation of VR in employee training in Indonesia remains very limited. The application of VR for employee training in Indonesia is still rare and tends to be more of a projection and discourse than a concrete implementation. The challenges faced are generally the same as those facing technology implementation in general, including the availability of technological infrastructure, relatively high investment costs for devices, limited availability of relevant local content, and organizational readiness to adopt immersive technology-based training methods (Setiawan, 2024).

Nevertheless, the opportunity for VR utilization in Indonesia remains wide open, along with the increasing penetration of technological devices, the government's commitment to digital transformation, and the industry's push towards more human-centric learning innovations. Therefore, a Systematic Literature Review

(SLR) is needed to determine the extent of research and implementation of VR in employee training in Indonesia, which is the primary focus of this study. To date, there has been research on the use of VR in training, but the discussion has not focused on cases occurring in Indonesia (Setiawan, 2024).

Therefore, the research questions used in this study include:

- RQ1: What are the trends in VR research and implementation for employee training in Indonesia over the past decade?
- RQ2: In which sectors or industries has VR been used for employee training in Indonesia?

METHODOLOGY

This study employed a Systematic Literature Review (SLR) using the PRISMA scholarly method (Cabrera et al., 2023; Rabin et al., 2022). Briefly, an SLR is a comprehensive and credible search of existing research findings, identifying research gaps for future studies (Wijaya, 2024). The scholarly method was chosen to capture perspectives from the scientific community or scientific sources. The researchers used Google Scholar (https://scholar.google.com/), Semantic Scholar (https://www.semanticscholar.org/), and ScienceDirect (https://www.sciencedirect.com/) as scientific sources for the SLR. The selection of data sources was based on the broad scope of Google Scholar, Semantic Scholar, and ScienceDirect's focus on science and technology. The following are the SLR stages implemented in this study:

a. Problem Formulation

- RQ1: What are the trends in VR research and implementation for employee training in Indonesia over the past decade?
- RQ2: In which sectors or industries has VR been used for employee training in Indonesia?

b. Implementation of SLR

In the identification stage, all potential articles matching the search keywords were collected. Next, in the screening stage, these articles were screened to determine whether they met the established inclusion criteria and to assess their relevance based on the title and abstract, to reduce the number of articles subject to further analysis. The final stage was the eligibility stage, which ensured that only truly eligible and relevant articles would be used in the in-depth data analysis stage. The following is the breakdown of the stages and the conditions applied:

i. Identification Stage

Keywords:

("Virtual Reality" OR "VR") AND ("employee training" OR "workforce training" OR "training") AND "Indonesia"

Article publication period: 2015 to 2025.

ii. Screening Stage

Inclusion Criteria:

IN1: Article published between 2015 and 2025

IN2: Article discussing cases in Indonesia

IN3: Discussing VR for employee training

IN4: Accessible (open access)

Exclusion Criteria:

EX1: In the form of a book or poster

EX2: Outside the field of computer science or human resource management

iii. Eligibility Stage

Criteria: The overall content of the article aligns with the research problem formulation.

c. Discussion of Results

The final SLR results are presented systematically to provide a comprehensive overview. Articles that have passed the eligibility stage are summarized in a summary table containing key information such as title, author, year of publication, sector of application, and form of VR implementation. Additionally, a distribution graph by year of publication is presented to show the growth in the number of articles from year to year.

RESULTS AND DISCUSSION

SLR Implementation

a) Identification Stage

Using the keywords "("Virtual Reality" OR "VR") AND ("employee training" OR "workforce training" OR "training") AND "Indonesia", the following combinations were obtained when broken down:

"Virtual Reality" AND "employee training" AND "Indonesia"

"Virtual Reality" AND "workforce training" AND "Indonesia"

"Virtual Reality" AND "training" AND "Indonesia"

"VR" AND "employee training" AND "Indonesia"

"VR" AND "workforce training" AND "Indonesia"

"VR" AND "training" AND "Indonesia"

Table 1. Identification Details

No	Data source	Number of Articles
1	Google Scholar	17,100
2	Semantic Scholar	262
3	ScienceDirect	26
	Total	**17,388**

b) Screening Stage

More than half of the submitted articles were screened during the screening stage. This was because most of the articles did not discuss real-life cases in Indonesia, focused on the use of VR for education at the school and university levels, and were books.

Table 2. Screening Details

No	Data source	Number of Articles
1	Google Scholar	42
2	Semantic Scholar	7
3	ScienceDirect	1
	Total	**50**

c) Eligibility Stage

In this stage, irrelevant articles were removed. This resulted in a total of 18 articles for further analysis.

Table 3. Screening Details

No	Data source	Number of Articles
1	Google Scholar	15
2	Semantic Scholar	2
3	ScienceDirect	1
	Total	**18**

Figure 1 below contains the flow of each stage carried out in this SLR.

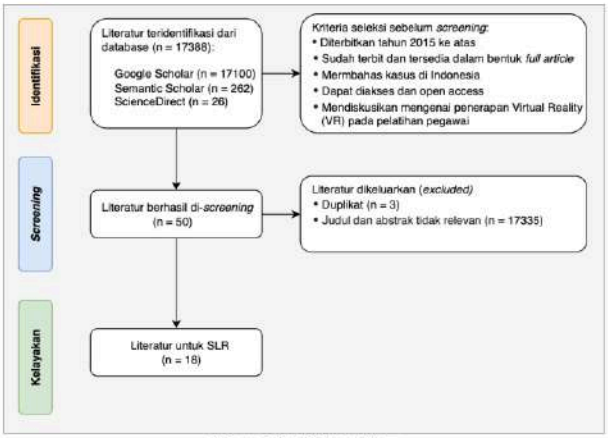

Figure 1. SLR Stage Flow

Discussion of Results

RQ1: What are the trends in VR research and implementation for employee training in Indonesia over the past decade?

Table 4. Distribution of Publication Years

Year	Number of Articles
2020	1
2021	2
2022	1
2023	5
2024	7
2025	2

Research and implementation of Virtual Reality (VR) for employee training in Indonesia began to grow significantly since 2020. Based on the 18 studies analyzed, the distribution of publications is summarized in Table 4. No relevant publications were found before that period, indicating that the adoption of VR in the context of HR training is a relatively new phenomenon in Indonesia. Initial studies, such as those conducted by Nainggolan et al., 2020, focused on the construction sector, followed by expansion into the energy sector (Imron et al., 2024; Hadi et al., 2024), healthcare (Efendi et al., 2023; Pratiwi et al., 2021), fintech (Kurniawan, 2025), MSMEs (Nurhayati et al., 2023), and tourism (Parung et al., 2024).

The period from 2023 to 2025 saw a significant surge in the number and variety of studies, highlighting not only technical and occupational safety training but also soft skills development, leadership, collaboration, language, and disaster preparedness (Ahlam et al., 2024; Kurniawan, 2025; Siregar & Theresia, 2023). Furthermore, innovation is beginning to emerge through the integration of technologies such as Artificial Intelligence and Augmented Reality into the VR training ecosystem (Widihartono & Ahmadi, 2024). This indicates that since 2020, the trend of VR use for training in Indonesia has grown rapidly in terms of sectors, training functions, and technologies used. Thus, although not yet a full decade old, the trend over the past five years reflects a transition towards a more digital, interactive, and multidisciplinary approach to employee training.

RQ2: In which sectors or industries has VR been used for employee training in Indonesia?

Based on a review of 18 studies, the use of Virtual Reality (VR) for employee training in Indonesia has encompassed various healthcare sectors. In the construction sector, VR is used for technical simulations of steel construction (Nainggolan et al., 2020), training heavy equipment operators in an environment (Sri Nugraha & Naimatul Firda, 2021), and worker training to support occupational safety and health (K3) (Putriwardani & Susilawati, 2024). In the shipping industry, VR technology is applied to K3 simulations and firefighting in

shipyards (Wahidi et al., 2022). In the energy sector, specifically power plants (PLN), VR is used in technician efficiency and safety training (Pribadi et al., 2024), as well as competency-based human resource development with the integration of AI and VR (Imron et al., 2024). The healthcare sector also utilizes VR for technical training on IUD insertion for midwives (Pratiwi et al., 2021) and to improve nurse competency (Efendi et al., 2023). In the fintech sector, VR is used in soft skills training and collaborative inter-employee engagement (Kurniawan, 2025). General categories include technology-based digital K3 training (Maulana et al., 2025), human resource development (Guruh Suksmono Aji & Iva Khoiril Mala, 2024), occupational safety training (Pribadi et al., 2023), natural disaster preparedness/response training (Siregar & Theresia, 2023), AI, VR, and AR-based training to improve employee performance and retention (Widihartono & Ahmadi, 2024), and earthquake evacuation simulations (Siregar & Theresia, 2023). The tourism sector has also adopted VR for first aid training for mountain tour guides (Parung et al., 2024). In the startup and technology context, VR is used for next-generation leadership training (Ahlam et al., 2024), while in the MSME sector, this technology is used in English language training (Nurhayati et al., 2023). These findings indicate that VR has been widely implemented for employee training in Indonesia, from large-scale sectors to micro-enterprises and the education sector. A summary of this distribution is presented in Table 5.

Table 5. Distribution of Sectors Utilizing VR in Employee Training

No	Source	Sector / Industry	Types of Training
1	(Nainggolan et al., 2020)	Construction	Steel construction technical simulation using VR
2	(Wahidi et al., 2022)	Shipping Industry	K3 and firefighting simulation using VR at shipyards (shipbuilding sites)
3	(Pribadi et al., 2024)	Power Plant (PLN)	VR-based training simulation for efficiency and safety training for PLN technicians
4	(Imron et al., 2024)	Power Plant (PLN)	Competency-based human resource development at PLN using AI-VR
5	(Pratiwi et al., 2021)	Health	IUD insertion technical training for midwives (permanent employees) in the West Lombok Regency work area
6	(Kurniawan, 2025)	Fintech	Soft skills training and collaborative interaction for fintech employees using VR
7	(Maulana et al., 2025)	General	Technology-based digital OHS
8	(Efendi et al., 2023)	Health	Nursing competency improvement using VR
9	(Guruh Suksmono Aji & Iva Khoiril Mala, 2024)	General	Human resource development through VR
10	(Pribadi et al., 2023)	Occupational Health and Safety	Occupational safety training using VR
11	(Siregar & Theresia, 2023)	General	Earthquake evacuation simulation for workers using VR
12	(Parung et al., 2024)	Tourism	First aid training using VR to train tour guides at Mount Penanggungan, East Java
13	(Ahlam et al., 2024)	Startups	New generation leadership training using VR
14	(Nurhayati et al., 2023)	MSMEs	English language training for MSME managers and employees using VR
15	(Sri Nugraha & Naimatul Firda, 2021)	Construction	Heavy equipment operator training using VR in a 3D environment
16	(Widihartono & Ahmadi, 2024)	General	Employee training using AI, VR, and AR to improve employee performance and retention
17	(Putriwardani & Susilawati, 2024)	Construction	Employee training using VR to support OHS
18	(Siregar & Theresia, 2023)	General	Earthquake disaster preparedness/response training for individuals and employees using VR

CONCLUSION

Conclusion

This study aims to evaluate the trends and utilization of Virtual Reality (VR) technology in employee training in Indonesia through a systematic review of 18 studies published between 2020 and 2025. The analysis shows that the implementation of VR in the context of HR training in Indonesia is a relatively new phenomenon, with the first study appearing in 2020. However, over the past five years, there has been a significant increase in

both the quantity of publications and the diversity of sectors adopting this technology. Answering RQ1, the trend of VR research in Indonesia has experienced dynamic development. In the initial phase, VR utilization was more focused on technical and occupational safety training in the construction and energy sectors. However, since 2023, there has been a diversification of training functions to include soft skills development, collaborative training, leadership, foreign language proficiency, and disaster preparedness. In addition, technological innovation has also driven the trend of integrating VR with Artificial Intelligence (AI) and Augmented Reality (AR), which has the potential to produce more personalized, adaptive, and immersive training experiences. As for RQ2, the results of the study indicate that VR technology has been implemented in various industrial sectors in Indonesia, including construction, the shipping industry, energy (PLN), health, fintech, education, tourism, startups/technology, and MSMEs. The types of training provided are also diverse, ranging from technical training, occupational safety (K3) training, medical equipment installation training, to soft skills-based training and general human resource development. Overall, this study confirms that VR has become a strategic and cross-sectoral approach in supporting the improvement of employee work capacity in Indonesia.

Implications

These findings open up opportunities for further research related to the effectiveness of VR training in various contexts, implementation challenges in the public and private sectors, and the integration of VR with other digital learning systems to encourage the development of superior and adaptive human resources in the era of digital transformation. This trend suggests that VR is transitioning from being merely an experimental or entertainment tool to a strategic instrument for human resource development. The integration of VR with Artificial Intelligence (AI) and Augmented Reality (AR) demonstrates a shift toward more personalized, immersive, and adaptive training methods, which can significantly improve skill acquisition, retention, and employee engagement. For policymakers, this highlights the importance of supporting VR infrastructure and content development. For industry practitioners, these results reinforce the potential competitive advantage of investing in immersive training technologies to improve workforce performance and safety.

Limitations

This study is limited by its reliance on secondary data obtained from published articles, which may not fully capture unpublished or proprietary VR training initiatives in Indonesia. The inclusion criteria also excluded non-open-access articles, potentially omitting relevant case studies. Furthermore, this review only included publications from 2020 to 2025, which may have overlooked earlier experimental uses of VR in training. Another limitation lies in the lack of standardized measures of VR training effectiveness across the reviewed studies, making direct comparisons difficult. Furthermore, the SLR did not conduct a meta-analysis to quantitatively assess the impact of VR on learning outcomes.

Recommendations

For the industry, organizations should consider integrating VR into technical and soft skills training programs, with attention to adapting content to local cultural and operational contexts. Governments and policymakers should provide subsidies, tax incentives, or grants to companies adopting immersive technologies, especially for MSMEs with limited budgets. Educational institutions should collaborate with industry to develop VR-based curricula and certification programs to enhance workforce readiness. Technology developers should focus on creating cost-effective and scalable VR training modules that integrate AI and AR for a more adaptive learning experience.

Future Research

Future studies could explore: Quantitative measurement of the effectiveness of VR training across various sectors in Indonesia using standard metrics; Longitudinal studies to evaluate the long-term retention of skills acquired through VR training; Cost-benefit analysis of implementing VR training compared to traditional training methods in large enterprises and MSMEs; Impact of AI-VR-AR integration on learning personalization, engagement, and performance outcomes; Barriers to adoption in rural or resource-constrained areas, and strategies to overcome these challenges; and Comparative research between Indonesia and other developing countries to position VR training adoption in Indonesia in a global context.

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