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# Developing an AI Driven Human Resource Development Framework for Sustainable Tourism Villages

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**ABSTRACT**

**The rapid advancement** of Artificial Intelligence (AI) is transforming the tourism industry, requiring tourism villages to strengthen their human resource capabilities in order to remain competitive while preserving local cultural values. **This study** aims to develop a comprehensive Human Resource Development (HRD) framework that supports the digital transformation of Indonesian tourism villages in the AI era. **A sequential explanatory** mixed-methods design was employed by combining quantitative and qualitative approaches. Quantitative data were collected through structured questionnaires administered to 215 tourism village workers across Java and Bali, while qualitative data were obtained from 15 semi-structured interviews with village leaders and three Focus Group Discussions (FGDs) involving tourism stakeholders. **The findings** reveal substantial gaps in digital competence and AI readiness, with only 18% of respondents reporting prior exposure to AI technologies and 82% demonstrating low-to-moderate digital literacy. Qualitative analysis further identified concerns regarding workforce displacement, the importance of community-based learning, and the need for locally contextualized training programs. Based on these findings, this study proposes a four-pillar HRD framework consisting of digital literacy and AI awareness, contextualized training programs, collaborative learning models, and continuous monitoring and evaluation. **The proposed framework** provides a culturally responsive and scalable strategy to enhance workforce adaptability, foster sustainable tourism development, and strengthen the resilience of Indonesian tourism villages in the era of AI-driven transformation.

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## 1. INTRODUCTION

Tourism villages have become one of Indonesia's strategic approaches to promoting sustainable rural development by preserving cultural heritage, empowering local communities, and creating inclusive economic opportunities [1]. With more than 4,000 identified tourism villages, Indonesia has considerable potential to strengthen community-based tourism while enhancing regional competitiveness. However, the rapid advancement of AI and digital technologies has transformed the tourism industry through intelligent reservation systems, personalized services, digital marketing, predictive analytics, and smart destination management. These

developments require tourism villages to strengthen their human resource capabilities to remain competitive while preserving local cultural identity [2]. Accordingly, HRD has become a strategic priority for supporting AI-driven transformation and sustainable tourism development, contributing to SDG 4 (Quality Education), SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation and Infrastructure), and SDG 11 (Sustainable Cities and Communities).

Recent studies have highlighted the growing role of AI and digital technologies in improving tourism performance through enhanced service quality, operational efficiency, digital marketing, and decision-making [3]. Community-based tourism has also demonstrated its ability to generate socio-economic benefits while preserving local culture through active stakeholder participation. Nevertheless, the implementation of AI in tourism villages continues to face significant challenges, including limited digital literacy, inadequate technological infrastructure, unequal access to training, financial constraints, and concerns regarding cultural preservation [4]. Moreover, previous studies have generally examined HRD, AI adoption, digital transformation, and community empowerment separately, providing limited empirical evidence on how these dimensions can be integrated into a comprehensive framework that prepares tourism village workers for AI-driven transformation while maintaining sustainable community development [5].

To address this gap, this study develops a comprehensive HRD framework for tourism villages in the AI era using a sequential explanatory mixed-methods approach that combines quantitative and qualitative evidence collected from tourism stakeholders across Java and Bali [6]. The proposed framework integrates four complementary pillars, namely digital literacy and AI awareness, contextual training programs, collaborative learning models, and monitoring and evaluation, into a unified model that supports workforce readiness for digital transformation [7]. By integrating technological capability development, localized learning, stakeholder collaboration, and continuous workforce evaluation, this study contributes to the literature on AI-enabled HRD and community-based tourism while providing practical guidance for policymakers, local governments, tourism practitioners, and local communities in promoting sustainable tourism development aligned with SDGs 4, 8, 9, and 11 [8].

## 2. LITERATURE REVIEW

Theoretical and empirical studies on HRD, AI, and community-based tourism provide the foundation for understanding workforce readiness in tourism villages [9]. Existing literature highlights the growing importance of digital competency, AI adoption, stakeholder collaboration, and sustainable capacity building in supporting tourism development. Reviewing these studies helps identify current knowledge, research gaps, and conceptual relationships that underpin the development of the proposed HRD framework for tourism villages in the AI era [10].

### 2.1. HRD in Tourism Villages

HRD is recognized as a strategic process for improving employees knowledge, competencies, and adaptability to organizational change [11]. Within the tourism sector, HRD extends beyond workforce training by fostering innovation, service excellence, leadership, and community participation to ensure sustainable destination development [12]. Tourism villages, as community-based tourism destinations, rely heavily on the competencies of local residents in managing tourism services, preserving cultural heritage, and responding to changing visitor expectations [13]. Therefore, strengthening human resources has become a fundamental prerequisite for improving tourism competitiveness and achieving long-term sustainability.

Previous studies consistently emphasize that HRD in tourism villages should encompass capacity building, entrepreneurship development, institutional strengthening, and continuous learning [14]. Various initiatives, including coaching, mentoring, tourism awareness programs, MSME product standardization, and vocational training, have demonstrated positive impacts on workforce competence and local economic development [15]. However, most HRD initiatives continue to emphasize conventional skill development while giving limited attention to digital transformation and emerging technologies, particularly AI. Consequently, tourism villages require a more adaptive HRD approach capable of integrating technological innovation with community-based empowerment [16].

### 2.2. AI for Tourism Village Development

AI has become one of the most influential technologies driving digital transformation across the global tourism industry. AI enables tourism organizations to improve operational efficiency through intelligent reser-

vation systems, predictive analytics, personalized travel recommendations, automated customer service, and data-driven decision-making [17]. These technologies facilitate the analysis of large volumes of tourism data, allowing destination managers to better understand visitor preferences, optimize resource allocation, and enhance service quality [18]. As tourism increasingly shifts toward digital ecosystems, AI has become an essential enabler for improving destination competitiveness, operational sustainability, and customer satisfaction [19].

Within tourism villages, AI offers significant opportunities to strengthen tourism management while preserving community-based tourism principles [20]. AI applications can support digital marketing strategies, improve visitor engagement through personalized promotional content, optimize workforce scheduling, and facilitate more efficient management of tourism resources. Furthermore, AI enables local tourism enterprises to respond more effectively to changing market demands and visitor behavior through data-driven insights [21]. Despite these advantages, the implementation of AI in tourism villages remains uneven, particularly in developing countries, where technological infrastructure, financial resources, and digital competencies are often limited. In addition, tourism stakeholders continue to face challenges in balancing technological innovation with the preservation of local culture, traditions, and community values, highlighting the importance of integrating AI adoption with sustainable HRD strategies [22].

Table 1. Opportunities and Challenges of AI Adoption in Tourism Villages

| **Opportunities** | **Challenges** |
|---|---|
| Workforce efficiency | Digital literacy |
| Customer experience | Infrastructure |
| Smart marketing | Financial constraints |
| Data analytics | Cultural authenticity |
| Resource optimization | Technology accessibility |

Table 1 summarizes the primary opportunities and challenges associated with AI adoption in tourism villages. On the one hand, AI creates considerable opportunities to improve workforce productivity, enhance visitor experiences, optimize tourism resource management, and strengthen digital marketing performance through data-driven decision-making [23]. These benefits contribute to greater operational efficiency and increased competitiveness of tourism villages. On the other hand, several barriers continue to hinder successful implementation, including limited digital literacy, inadequate technological infrastructure, financial constraints, restricted access to advanced technologies, and concerns regarding the preservation of cultural authenticity [24]. These findings suggest that the successful adoption of AI requires not only technological investment but also comprehensive HRD initiatives that strengthen workforce capabilities while maintaining the cultural values that distinguish tourism villages.

### 2.3. HRD and AI Integration

The convergence of HRD and AI has attracted increasing attention across various industries. HRD is no longer limited to workforce training but also encompasses digital competency development, technological readiness, continuous learning, and organizational adaptability. AI-driven organizations require employees who possess both technical competencies and the ability to collaborate with intelligent systems [25].

Despite growing interest in AI implementation, the integration of HRD and AI within tourism villages remains underexplored. Existing studies generally examine technological adoption and workforce development independently, resulting in fragmented knowledge regarding how local communities can simultaneously enhance digital readiness, preserve cultural identity, and improve tourism competitiveness [26]. Therefore, integrating AI into HRD represents an essential strategy for supporting sustainable tourism transformation.

### 2.4. Research Gap and Proposed Framework

Although previous studies have contributed significantly to the understanding of HRD, AI adoption, tourism marketing, and community empowerment, the literature remains fragmented. Existing research tends to focus on isolated aspects of tourism village development rather than examining the interaction between workforce capability, digital readiness, collaborative learning, and sustainable tourism management [27]. Consequently, policymakers and tourism practitioners continue to lack an integrated framework capable of guiding HRD in the AI era.

To address this gap, the present study proposes an integrated HRD framework consisting of four complementary pillars, including digital literacy and AI awareness, contextual training programs, collaborative learning models, and continuous monitoring and evaluation [28]. By integrating technological capability development, community participation, localized learning, and continuous organizational improvement into a unified operational model, the proposed framework contributes both theoretically and practically to strengthening the resilience and competitiveness of Indonesian tourism villages in the era of AI [29].




Figure 1. Proposed Conceptual Framework

Figure 1 presents the proposed HRD framework for tourism villages in the AI era. The framework consists of four interconnected pillars digital literacy and AI awareness, contextual training programs, collaborative learning models, and continuous monitoring and evaluation, which collectively enhance workforce competencies, organizational adaptability, and technological readiness [30]. The framework begins by strengthening digital literacy and AI awareness, followed by the implementation of contextual training programs tailored to the needs of tourism villages [31]. It then promotes collaborative learning through knowledge sharing and stakeholder engagement while ensuring continuous improvement through systematic monitoring and evaluation [32]. The integration of these four pillars leads to the development of an adaptive workforce and stronger organizational capabilities, ultimately supporting the creation of sustainable and competitive tourism villages. Furthermore, the framework is guided by the principles of community empowerment, technological adaptation, cultural preservation, and sustainable development, ensuring that AI adoption enhances tourism performance while maintaining local cultural values and supporting long-term resilience [23].

## 3. RESEARCH METHODOLOGY

The research methodology was designed to systematically investigate the readiness of tourism village workers for AI driven transformation through an integrated HRD perspective [33]. A sequential explanatory mixed-methods approach was employed to combine quantitative and qualitative evidence, enabling a comprehensive understanding of workforce competencies, AI awareness, training needs, and organizational challenges [34]. This methodological approach provides a robust basis for developing the proposed HRD framework and ensuring that the findings are both empirically grounded and practically relevant to the context of Indonesian tourism villages.

### 3.1. Research Design

This study adopted a sequential explanatory mixed-methods design, which combines quantitative and qualitative approaches in two consecutive phases to obtain a comprehensive understanding of HRD in tourism villages during the AI era. This design was selected because the research aims not only to measure the level of digital readiness among tourism village workers but also to understand the contextual factors influencing

AI adoption from multiple stakeholder perspectives. The quantitative findings served as the foundation for the subsequent qualitative investigation, allowing the researchers to explain statistical trends through participants' real experiences and practical insights.

The sequential explanatory approach enhances methodological rigor by integrating numerical evidence with qualitative interpretations [35]. The quantitative phase identified the current conditions regarding digital competency, AI awareness, training requirements, and job adaptability, while the qualitative phase explored the underlying reasons behind these findings through interviews and FGDs. The integration of both datasets enabled methodological triangulation, strengthened the validity of the research findings, and facilitated the development of an evidence-based HRD framework specifically tailored to Indonesian tourism villages [36].

### 3.2. Study Area and Participant Selection

The research was conducted across tourism villages located in Java and Bali, two provinces representing Indonesia's most established tourism destinations while exhibiting different levels of digital transformation and community-based tourism development. These regions were purposely selected because they contain a large concentration of tourism villages actively involved in cultural tourism, ecotourism, and rural tourism development [37]. Furthermore, the diversity of tourism management practices across both islands provides an appropriate setting for examining the readiness of local human resources to adapt to AI technologies.

A purposive sampling strategy was employed to recruit respondents who possessed direct involvement in tourism village operations and practical knowledge regarding tourism management. The inclusion criteria required participants to have active responsibilities within tourism villages, including homestay operators, local tour guides, tourism administrators, cultural performance coordinators, MSME owners, and tourism entrepreneurs [38]. A total of 215 respondents participated in the quantitative survey, while 15 tourism village leaders were selected for semi-structured interviews and three FGDs were conducted involving representatives from local governments, tourism organizations, academics, and community leaders. This sampling strategy ensured that multiple stakeholder perspectives were incorporated into the framework development process.

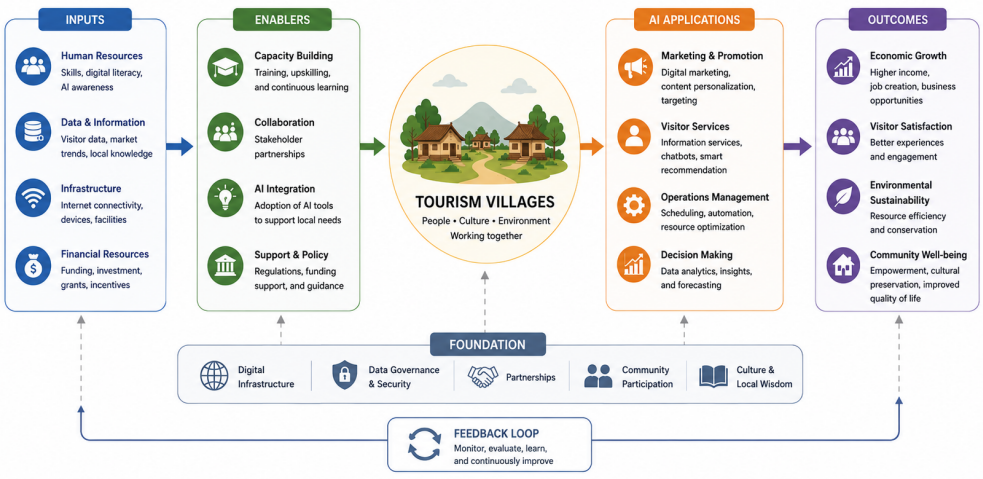



Figure 2. AI Adoption Ecosystem in Tourism Villages

The Figure 2 illustrates the proposed AI adoption ecosystem for tourism villages, demonstrating how various components interact to support sustainable digital transformation. The ecosystem begins with key inputs comprising human resources, data and information, infrastructure, and financial resources, which are strengthened through enabling factors such as capacity building, stakeholder collaboration, AI integration, and policy support [39]. These elements facilitate the implementation of AI applications in marketing, visitor services, operations management, and decision-making, ultimately contributing to improved economic growth, visitor satisfaction, environmental sustainability, and community well-being. The ecosystem is further supported by foundational elements, including digital infrastructure, data governance, partnerships, community

participation, and local cultural values, while a continuous feedback loop promotes ongoing monitoring and improvement to ensure the long-term sustainability and competitiveness of tourism villages [40].

### 3.3. Data Collection Procedures

Data collection was conducted in two sequential phases following the explanatory mixed-methods strategy. During the first phase, structured questionnaires were distributed to tourism village workers to obtain quantitative information regarding their digital competency, awareness of AI, perceived training needs, and adaptability toward technological change [41]. The questionnaire consisted of closed-ended questions measured using a five-point likert scale ranging from strongly disagree to strongly agree. Prior to the full survey administration, the instrument was reviewed by tourism management experts and piloted with a small group of respondents to ensure clarity and content validity [42].

Following the quantitative analysis, the qualitative phase was conducted to explain and enrich the statistical findings. Semi-structured interviews allowed tourism village leaders to describe their experiences regarding AI implementation, workforce preparedness, digital transformation challenges, and future HRD priorities. In addition, three FGDs were organized to facilitate interactive discussions among tourism stakeholders regarding collaborative learning, policy support, infrastructure limitations, and strategic recommendations. Combining interviews and FGDs enabled the researchers to obtain both individual perspectives and collective insights into AI-driven HRD.

### 3.4. Research Variables and Measurement

To ensure a systematic and rigorous measurement process, each research variable was operationalized into a set of measurable indicators that reflect the key dimensions of HRD and workforce readiness for AI adoption in tourism villages. The selection of these variables was guided by an extensive review of previous studies on HRD, digital transformation, technology acceptance, and AI implementation within tourism and community-based development contexts. Furthermore, the measurement indicators were designed to capture respondents' knowledge, perceptions, competencies, and behavioral readiness, enabling a comprehensive assessment of the factors influencing AI adoption in tourism village operations [43]. This operationalization also ensured that the questionnaire accurately represented the theoretical constructs investigated in this study while providing reliable empirical evidence for subsequent quantitative and qualitative analyses. By translating abstract concepts into observable and measurable indicators, the research instrument facilitates a structured evaluation of workforce capabilities and competency gaps, thereby supporting the development of an evidence-based HRD framework tailored to the needs of Indonesian tourism villages [44]. The operational definitions of the research variables and their corresponding measurement indicators are presented in Table 2.

Table 2. Research Variables and Indicators

| **Variable** | **Indicators** |
|---|---|
| Digital Competency | Digital literacy, ICT utilization, online communication |
| AI Awareness | Knowledge of AI, AI applications, perceived usefulness |
| Training Needs | Skill gaps, learning preferences, competency development |
| Job Adaptability | Technology acceptance, willingness to learn, adaptability |

Table 2 presents the research variables and their corresponding measurement indicators used to assess the readiness of tourism village workers for AI adoption. The four variables were selected based on the HRD and digital transformation literature, encompassing digital competency, AI awareness, training needs, and job adaptability. Digital competency evaluates respondents' ability to utilize digital technologies in tourism-related activities, while AI awareness measures their understanding of AI concepts, applications, and perceived usefulness. Training Needs identifies existing competency gaps and preferred learning approaches to support workforce development, whereas job adaptability assesses respondents' acceptance of technological change, willingness to acquire new skills, and flexibility in adapting to AI-driven work environments. Collectively, these variables provide a comprehensive assessment of workforce preparedness and serve as the empirical foundation for developing the proposed HRD framework for tourism villages in the AI era.

# 4. RESULT

## 4.1. Respondent Profile and AI Readiness in Tourism Villages

The quantitative survey involved 215 respondents representing tourism village workers from various tourism destinations across Java and Bali. The respondents consisted of homestay operators, local tour guides, tourism administrators, cultural performance coordinators, and local entrepreneurs actively involved in community-based tourism management. The diversity of respondents provided comprehensive insights into the current state of human resource capacity within Indonesian tourism villages. Since Java and Bali represent different levels of tourism development and digital transformation, the collected data capture a broad representation of workforce readiness for AI implementation [45].

The survey findings reveal that the level of AI readiness among tourism village workers remains relatively low. Only 18% of respondents reported having prior experience using AI-related applications in tourism activities, while the remaining respondents indicated little or no exposure to AI technologies. Furthermore, approximately 82% of respondents assessed their digital competency at a low-to-moderate level, indicating that many tourism village workers continue to experience difficulties in utilizing digital platforms for tourism management [46]. Most respondents also expressed a strong interest in participating in AI-oriented capacity-building programs, suggesting that workforce development has become a strategic priority for accelerating digital transformation within tourism villages.

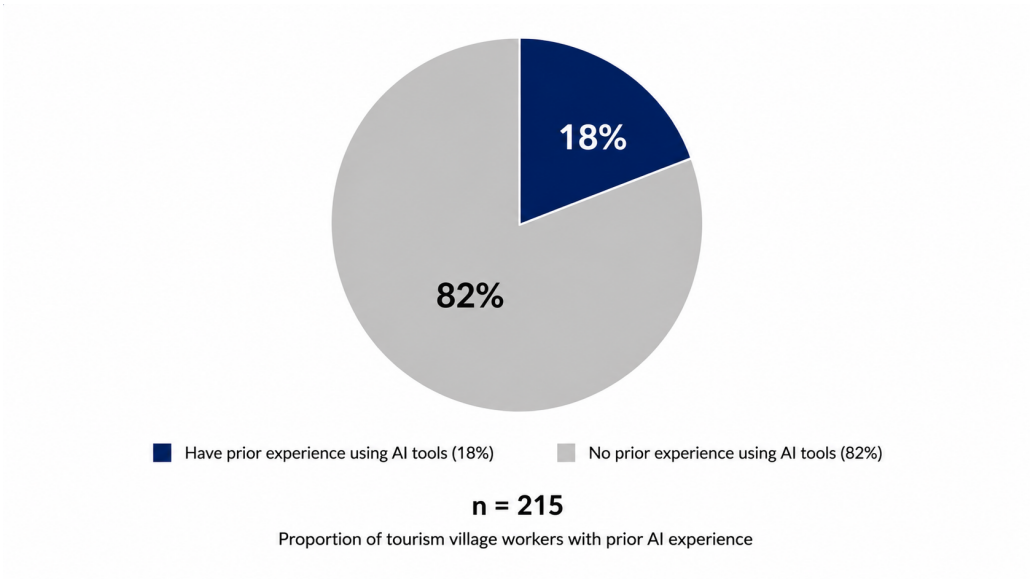



Figure 3. AI Readiness of Tourism Village Workers

Figure 3 presents the level of AI readiness among tourism village workers based on their prior experience in using AI technologies. The results indicate that only 18% of respondents reported having previous experience with AI tools in tourism-related activities, demonstrating that AI adoption among tourism village workers remains limited. This finding suggests that most tourism village communities are still in the early stages of digital transformation and require greater exposure to AI applications. Therefore, strengthening digital literacy, increasing AI awareness, and providing practical training programs should become strategic priorities for HRD to improve workforce readiness and support the sustainable implementation of AI in tourism villages.

## 4.2. Opportunities and Challenges of AI Adoption

The qualitative findings obtained from semi-structured interviews and FGDs demonstrate that tourism stakeholders generally perceive AI as an enabling technology capable of strengthening tourism village competitiveness. Participants highlighted several practical AI applications that could improve operational efficiency, including AI-powered chatbots for customer service, multilingual translation systems for international visitors, predictive analytics for visitor forecasting, recommendation systems for personalized tourism packages, and Generative AI tools for digital marketing content creation [47]. These technologies were considered partic-

ularly beneficial for supporting local tourism promotion while expanding market reach beyond conventional tourism channels.

Despite these opportunities, participants also identified several challenges limiting AI implementation in tourism villages [48]. The most frequently reported barriers include insufficient digital literacy, limited internet infrastructure, financial constraints, and concerns regarding workforce displacement due to technological automation. Several tourism village leaders also emphasized the importance of preserving local cultural identity, arguing that AI should complement rather than replace traditional tourism experiences. These findings indicate that successful AI implementation requires balanced HRD strategies that simultaneously strengthen technological competencies, community participation, and cultural sustainability.

### 4.3. Development of the HRD Framework

The integration of quantitative and qualitative findings formed the basis for developing the proposed HRD framework. The survey results identified significant competency gaps in digital literacy, AI awareness, and workforce adaptability, whereas interviews and FGDs provided contextual explanations regarding training priorities, collaborative learning mechanisms, and organizational challenges faced by tourism villages [49]. The convergence of these findings confirms that technological readiness alone is insufficient to support sustainable AI implementation without corresponding investments in HRD. Based on this evidence, the study proposes a comprehensive framework consisting of four interconnected pillars, namely digital literacy and AI awareness, contextual training programs, collaborative learning models, and monitoring and evaluation. The first pillar focuses on strengthening digital competencies and increasing awareness of AI applications within tourism activities, while the second emphasizes locally contextualized training programs tailored to the characteristics and needs of tourism villages. The third pillar promotes collaborative learning through partnerships among local governments, universities, tourism practitioners, and community organizations to facilitate continuous knowledge exchange, whereas the fourth establishes systematic monitoring and evaluation mechanisms to ensure that workforce competencies continue to evolve alongside technological advancements. Collectively, these four pillars provide an integrated strategy for enhancing workforce adaptability while preserving the cultural authenticity and supporting the sustainable development of Indonesian tourism villages.

Table 3. Four Pillars of the Proposed HRD Framework

| **Pillar** | **Main Focus** | **Expected Outcome** |
|---|---|---|
| Digital Literacy and AI Awareness | Digital competency | AI readiness |
| Contextual Training Programs | Localized learning | Workforce capability |
| Collaborative Learning Models | Stakeholder collaboration | Knowledge sharing |
| Monitoring and Evaluation | Continuous assessment | Sustainable HRD |

Table 3 summarizes the four pillars of the proposed HRD framework for strengthening AI readiness in tourism villages. The framework consists of digital literacy and AI awareness, contextual training programs, collaborative learning models, and monitoring and evaluation, which collectively aim to enhance digital competency, workforce capability, knowledge sharing, and continuous improvement. Together, these pillars provide an integrated strategy to support sustainable AI adoption while strengthening the adaptability and competitiveness of tourism village workers.

### 4.4. Practical Implications for Sustainable Tourism Villages

The proposed HRD framework provides several practical implications for policymakers and tourism stakeholders. Local governments are encouraged to incorporate AI-oriented competency development into tourism village development programs, while tourism management organizations should prioritize continuous workforce training and digital capacity building. Universities and vocational institutions can contribute by designing community-based learning programs that combine technological knowledge with local cultural values. Furthermore, collaboration between public institutions, private organizations, and local communities is essential to establish a sustainable learning ecosystem capable of supporting long-term digital transformation [50].

Beyond workforce development, the framework also contributes to strengthening sustainable tourism and rural economic resilience. The integration of AI with community-based tourism creates opportunities for tourism villages to improve service quality, expand digital marketing capabilities, develop innovative tourism products, and generate new entrepreneurial opportunities through technopreneurship. These outcomes directly

support the achievement of SDG 4 (Quality Education), SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation and Infrastructure), and SDG 11 (Sustainable Cities and Communities) by promoting inclusive digital transformation while preserving local cultural identity.

## 5. MANAGERIAL IMPLICATIONS

The findings of this study provide practical guidance for policymakers, local governments, tourism village managers, and other tourism stakeholders in preparing the workforce for AI driven transformation. The proposed HRD framework can serve as a strategic reference for designing capacity-building programs that prioritize digital literacy, AI awareness, and workforce adaptability. Rather than focusing solely on technology adoption, tourism development initiatives should integrate continuous HRD to ensure that local communities possess the competencies required to effectively utilize AI while maintaining the unique cultural characteristics of tourism villages.

For tourism village managers and local communities, the framework highlights the importance of implementing contextual training programs that address local needs and operational conditions. Practical training on AI-assisted digital marketing, customer relationship management, multilingual communication, and tourism data analytics can improve service quality and operational efficiency while creating new opportunities for local entrepreneurship. Furthermore, collaborative learning involving universities, government institutions, tourism practitioners, and community organizations should be strengthened to facilitate knowledge sharing, innovation, and the continuous development of workforce capabilities within tourism villages.

At the policy level, this study emphasizes the need for long-term collaboration among public institutions, academia, and the private sector to establish sustainable HRD ecosystems that support AI adoption in rural tourism. Continuous monitoring and evaluation should be incorporated into tourism development programs to assess workforce progress and ensure that training initiatives remain relevant to technological advancements. The implementation of the proposed framework is expected to strengthen workforce resilience, improve tourism competitiveness, and support the sustainable development of Indonesian tourism villages while contributing to the achievement of Sustainable Development Goals (SDGs), particularly SDG 4, SDG 8, SDG 9, and SDG 11.

## 6. CONCLUSION

This study developed a Human Resource Development (HRD) framework to support the readiness of tourism village workers in responding to Artificial Intelligence (AI)-driven transformation in Indonesia. Using a sequential explanatory mixed-methods approach, the study combined quantitative and qualitative evidence to provide a comprehensive understanding of workforce preparedness for digital transformation. The findings identified significant gaps in digital competency, AI awareness, training needs, and workforce adaptability, indicating that technological readiness alone is insufficient to ensure successful AI adoption within tourism villages. Instead, the results demonstrate that effective AI implementation requires a comprehensive Human Resource Development strategy that integrates digital competency enhancement, contextual learning, stakeholder collaboration, and continuous performance evaluation. Based on these findings, the study proposes a four-pillar HRD framework comprising Digital Literacy and AI Awareness, Contextual Training Programs, Collaborative Learning Models, and Continuous Monitoring and Evaluation. Collectively, these four pillars provide a systematic roadmap for strengthening workforce capabilities, improving organizational adaptability, and supporting sustainable digital transformation within tourism villages.

The proposed framework contributes to the existing literature by integrating digital competency development, localized training, collaborative learning, and continuous evaluation into a unified Human Resource Development model specifically designed for community-based tourism. Unlike previous studies that primarily examine Human Resource Development, AI adoption, tourism marketing, and community empowerment independently, this study offers an integrated framework that connects these dimensions into a practical and operational strategy for tourism villages. From a practical perspective, the framework provides valuable guidance for policymakers, local governments, tourism village managers, and other stakeholders in designing workforce development initiatives that enhance digital capabilities while preserving local cultural identity and strengthening community participation. Furthermore, the framework supports evidence-based decision-making in workforce planning and contributes to the development of more adaptive, resilient, and competitive tourism villages. These contributions are also aligned with the United Nations Sustainable Development Goals (SDGs), particularly SDG 4 (Quality Education) through lifelong learning and digital capacity building, SDG 8 (Decent Work

and Economic Growth) by improving workforce competencies and employment opportunities, SDG 9 (Industry, Innovation and Infrastructure) through the promotion of AI-driven innovation, and SDG 11 (Sustainable Cities and Communities) by supporting sustainable and culturally resilient tourism village development.

This study is limited to tourism villages in Java and Bali, which may not fully represent conditions across Indonesia. Although these regions represent two of the country's most prominent tourism destinations, tourism villages in other provinces may exhibit different socio-economic characteristics, levels of digital readiness, technological infrastructure, and institutional capacities that could influence the implementation of the proposed framework. Future research is encouraged to include broader geographical coverage, larger sample sizes, and comparative studies across regions or countries. Such investigations would improve the generalizability of the findings while providing a broader understanding of Human Resource Development strategies in diverse tourism contexts. In addition, longitudinal studies are recommended to evaluate the long-term effectiveness of the proposed HRD framework and examine the impact of AI implementation on workforce performance, tourism competitiveness, and sustainable tourism development. Future studies may also explore the interaction between technological innovation, organizational adaptability, community participation, and policy support to further validate and refine the proposed framework across different tourism environments.

## 7. DECLARATIONS

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### 7.2. Author Contributions

Conceptualization: DA; Methodology: AP; Software: SW; Validation: MR and DA; Formal Analysis: SW and MR; Investigation: AP; Resources: DA; Data Curation: SW; Writing Original Draft Preparation: AP and MR; Writing Review and Editing: DA and AP; Visualization: SW; All authors, DA, SW, AP, and MR, have read and agreed to the published version of the manuscript.

### 7.3. Data Availability Statement

Data supporting this study are openly available from Zenodo at https://doi.org/10.5281/zenodo.21212488.

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### 7.5. Declaration of Conflicting Interest

The authors declare that they have no conflicts of interest, known competing financial interests, or personal relationships that could have influenced the work reported in this paper.

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