



Perception and Adoption of Artificial Intelligence Technology in Sports in Indonesia: A Quantitative Analysis from the Perspectives of Coaches, Athletes, and Referees

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Article Info

Article History

Submitted: March 9, 2025

Accepted: May 28, 2025

Published: May 31, 2025

Article Access



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Abstract

This study aims to analyze the perceptions of coaches, athletes, and referees regarding the use of Artificial Intelligence (AI) technology in sports in Indonesia, as well as the factors influencing its adoption. A descriptive quantitative research method was employed, involving 40 respondents consisting of coaches (55%), athletes (25%), and referees (20%). Data were collected using a Likert-scale-based questionnaire and analyzed using inferential statistical tests (ANOVA, simple linear regression) and reliability testing (Cronbach's Alpha). The results show that coaches had the most positive perception of AI (score 4.1/5), while referees were the most skeptical (score 3.4/5), with a statistically significant difference between the groups ($p = 0.015$). Experience with AI was found to significantly increase perceived ease of use ($\beta = 0.8$, $p = 0.002$), while no significant differences were found based on gender ($p = 0.65$). The study identifies key challenges such as limited infrastructure, low digital literacy, and the need for practical training. Practical implications include recommendations to develop AI applications in the Indonesian language, organize simulation workshops for referees, and foster multisector collaboration to equalize access. This study concludes that AI has the potential to drive the transformation of Indonesian sports, but inclusive strategies are required strategies that consider the local context and the specific needs of stakeholders.

Keywords: artificial intelligence; adoption technology; coach; perspective; referees.



Introduction

The development of Artificial Intelligence (AI) technology has brought significant changes across various sectors, including the world of sports (Chen, 2024; Gajendra.K, 2023). Globally, AI has been utilized to enhance athlete performance through biomechanical data analysis, assist coaches in designing more precise training programs, and support referees in making more accurate decisions during matches (Pisaniello, 2024). However, in Indonesia, the adoption of this technology remains limited. Preliminary surveys indicate that although some coaches, athletes, and referees recognize the potential of AI, many remain skeptical about its effectiveness—or have never used it at all. This raises the question of how prepared Indonesian sports are to face this technological revolution.

Challenges stemming from technological developments include the lack of outreach regarding the benefits of AI among sports practitioners, a human resource gap where many coaches and referees lack the skills to operate AI-based technologies, and limited access to AI tools—especially in remote areas. If these challenges are not addressed soon, Indonesia risks falling behind in the use of modern sports technology, which may ultimately impact the international competitiveness of its athletes.

One of the main identified obstacles is the low level of digital literacy among sports practitioners. Many respondents admitted to not understanding how AI works or its concrete benefits for training and competition. In addition, limited infrastructure poses a significant barrier, particularly in regions not yet reached by advanced technologies (Sekhar, 2024). Without technological support, Indonesian coaches and athletes are at risk of falling behind in the global arena (Ramadan & Samin, 2022). A clear example is the implementation of Video Assistant Referee (VAR) in football, which has become an international standard but is still rarely applied in local competitions. If this continues, Indonesia's sports achievements may further lag.

The purpose of this study is to analyze the perceptions of coaches, athletes, and referees regarding the use of AI in sports; identify both the barriers and driving factors for AI implementation in Indonesia; and provide strategic recommendations to enhance AI adoption in national training and competition systems.

This research aims to address these challenges by first mapping the perceptions and needs of key sports stakeholders regarding AI. To date, studies on the use of AI in sports have been dominated by research from developed countries, while research in Indonesia remains very limited. Yet, each country has its own unique

characteristics and needs. For instance, traditional Indonesian sports may require different AI approaches compared to more globally popular sports such as football. Therefore, this study not only aims to identify knowledge and infrastructure gaps but also to formulate AI implementation strategies tailored to the local context.

In the long term, the adoption of AI could be a game changer for Indonesian sports. This technology has the potential to improve the quality of training and competition, while also creating new opportunities for talent development among young athletes (Aidar et al., 2021; Nagovitsyn et al., 2023; Park et al., 2024). By providing data and evidence-based recommendations, this study is expected to serve as a guide for the government, sports federations, and other relevant stakeholders in developing policies that support AI integration. Ultimately, this effort is not just about following a global trend—it is about preparing Indonesian sports to be more competitive in the future.

The novelty of this study lies in mapping the readiness of Indonesian sports human resources to adopt AI and providing data-driven recommendations for the development of AI aligned with local needs. The urgency of this research is to promote digital transformation within Indonesian sports so that it does not fall behind other countries, to enhance training and competition quality through data-driven technologies, and to provide a foundation for policy formulation by the government and sports federations for AI integration. Thus, this study is not only academically relevant but also carries significant practical implications. The findings and recommendations can serve as a foundation for the development of a technology-based sports ecosystem in Indonesia while addressing real-world needs. Now is the time for Indonesian sports to embrace the opportunities offered by AI and ensure they are no longer left behind on the global stage.

Methods

Research Design

This study employed a descriptive quantitative approach to analyze the perceptions of coaches, athletes, and referees regarding the implementation of Artificial Intelligence (AI) technology in the field of sports in Indonesia. The research design was cross-sectional, in which data were collected at a single point in time to capture the actual state of respondents' perceptions (John W. Cresswel, 2009).

Tabel 1*Descriptive Profile of Respondents in the Study on AI Adoption in Indonesian Sports*

Category	Subcategories	Percentage/amount
Total samples	-	40 respondents
Gender	Man	75% (30 people)
	Woman	25% (10 people)
Age	<20 years old	5% (2 people)
	20–30 years	65% (26 people)
	31–40 years	20% (8 people)
	>40 years old	10% (4 people)
Roles in Sports	Coach	55% (22 people)
	Athlete	25% (10 people)
	Referee/Judge	20% (8 people)
Types of Sport	Team Sports	60% (24 people)
	Individual sport	40% (16 people)
Experience with AI	Have You Ever Used AI	32% (13 people)
	Knowing the Types of AI	45% (18 people)
Geographical Origin of the Island	Javanese	55% (22 people)
	Bali	15% (6 persons)
	Sumatra	15% (6 persons)
	Kalimantan	10% (4 people)
	Other	5% (2 people)
Education Level	High School/Equivalent	30% (12 people)
	Bachelor (S1)	55% (22 people)
	Postgraduate (S2/S3)	15% (6 persons)

Participants

The data were obtained through an online survey completed by 40 respondents who were active participants in the sports field, including coaches (55%), athletes (25%), and referees/judges (20%). Respondents represented various sports disciplines such as football, futsal, volleyball, as well as individual sports like athletics and badminton. The sampling technique used was purposive sampling, with the criterion being that respondents must be currently active in sports either professionally or competitively.

Instrument

The research instrument used in this study was a 5-point Likert scale questionnaire, with response options ranging from "Strongly Agree" to "Strongly Disagree." The questionnaire was specifically designed to assess four key aspects related to the perception of Artificial Intelligence (AI) in sports: knowledge of AI, perceived benefits of AI for training, perceived benefits of AI for refereeing, and perceived ease of use of AI technology. To ensure the quality and accuracy of the instrument, it was subjected to validity and reliability testing prior to analysis. Pearson correlation was employed to examine construct validity, while Cronbach's Alpha was utilized to assess the internal consistency and reliability of the questionnaire items.

Table 2*Validity test results with Pearson Correlation*

1			2			3		
Item	Correlation (r)	Conclusion	Item	Correlation (r)	Conclusion	Item	Correlation (r)	Conclusion
Q2	0.68	Valid	Q12	0.65	Valid	Q22	0.45	Valid
Q3	0.72	Valid	Q13	0.58	Valid	Q23	0.51	Valid
Q4	0.25	Invalid*	Q14	0.71	Valid	Q24	0.19	Invalid *
Q5	0.61	Valid	Q15	0.22	Invalid *	Q25	0.63	Valid
Q6	0.55	Valid	Q16	0.63	Valid	Q26	0.28	Invalid *
Q7	0.31	Valid (threshold limit)	Q17	0.68	Valid	Q27	0.55	Valid
Q8	0.45	Valid	Q18	0.27	Invalid *	Q28	0.31	Valid (threshold limit)
Q9	0.67	Valid	Q19	0.60	Valid	Q29	0.48	Valid
Q10	0.70	Valid	Q20	0.69	Valid	Q30	0.42	Valid
Q11	0.29	Invalid*	Q21	0.55	Valid	Q31	0.59	Valid

Tabel 3
Reliability Test with Cronbach's Alpha

Constructs 1, 2 and 3	Item Valid	Cronbach's Alpha	Conclusion
Benefits of AI for Training	8 item	0.82	Excellent
Benefits of AI for Referees/Judges	8 item	0.79	Good
Ease of Use of AI	8 item	0.70	Pretty good

Table 4
Chi-Square I Gender Test vs. AI Perception

AI Perception	Man	Woman	Total	Chi-Square (x ²)	(df)	p-value
Agree/Strongly Agree	20	5	25	0.85	2	0.65
Hesitate	6	3	9			
Disagree	4	2	6			

Procedure

Participants were invited to complete the online questionnaire via distributed survey links. Responses were collected and screened for completeness and eligibility. Ethical considerations were maintained by ensuring anonymity and voluntary participation. The questionnaire was structured to be accessible and understandable to practitioners from diverse sports backgrounds and technological familiarity levels.

Data Analysis

The data analysis process was carried out in several stages. Descriptive statistics were first used to examine the frequency distributions and general trends in respondents' answers. To explore deeper relationships between variables, inferential statistical tests were then applied. The Chi-Square test was utilized to assess associations between categorical variables such as gender and role in sports with respondents' perceptions of AI. A one-way ANOVA was conducted to compare perception scores among different groups – namely coaches, athletes, and referees. Additionally, simple linear regression analysis was used to determine whether prior experience with AI significantly influenced respondents perceived ease of use. All statistical

analyses were conducted using IBM SPSS Statistics software, ensuring the accuracy of data processing, while the results were presented in tabular form to support clear interpretation and discussion.

Result

Table 1 presents the demographic and contextual characteristics of the 40 respondents who participated in the study. The data includes gender, age, roles in sports, types of sports, experience and familiarity with AI, geographical origin, and educational background. Most respondents were male (75%), aged 20–30 years (65%), and primarily served as coaches (55%). Most participants were involved in team sports (60%) and resided on the island of Java (55%). Regarding AI, only 32% had prior experience using it, while 45% reported knowing the types of AI. In terms of education, more than half held a bachelor's degree (55%).

Subsequently, **Table 2** presents the results of the validity test, while **Table 3** displays the results of the reliability test. The questionnaire items are grouped into three constructs: Construct 1 – Perceived Benefits of AI for Training (Q2–Q11), Construct 2 – Perceived Benefits of AI for Referees/Judges (Q12–Q21), and Construct 3 – Perceived Ease of Use of AI (Q22–Q31). Validity

Table 5
Chi-Square II Test Role in Sports vs. AI Perception

AI Perception	Coach	Athlete	Referee	Total	Chi-Square (x ²)	(df)	p-value
Agree/Strongly Agree	15	6	4	25	6.32	4	0.18
Nervous	4	3	2	9			
Disagree	3	1	2	6			

Table 6
Chi-Square III Test Role vs. Ease-of-Use AI Perception

AI Convenience	Coach	Athlete	Referee	Total	Chi-Square (x ²)	(df)	p-value
Easy/Very Easy	12	3	2	17	5.21	4	0.27
Nervous	6	4	3	13			
Difficult/Very Difficult	4	3	3	10			

Table 7

ANOVA Test Data Differences in Perceptions Between Groups (Coach vs. Athlete vs. Referee)

Group	Number of Respondents	Average Perception Score	SD	F-Statistics	df		p-value
					dfa	dfi	
Coach	22	4.1	0.8	4.73	2	37	0.015
Athlete	10	3.8	0.9				
Referee	8	3.4	1.1				

Table 8

Post-Hoc Test Results (Tukey HSD)

Comparison	Average Difference	p-value	Significance
Coach vs. Athlete	0.3	0.25	Insignificant
Coach vs. Referee	0.7	0.01	Significant
Athlete vs. Referee	0.4	0.12	Insignificant

Tabel 9

Linear Regression Test Results

Coefficient	Value	Standard Error	T-Statistics	p-value
Intercept (β_0)	3.2	0.3	10.67	<0.001
AI Experience (β_1)	0.8	0.2	4.00	0.002

criteria: If $r \geq 0.30$, the item is considered valid. If $r < 0.30$, the item is considered invalid and is removed*.

Reliability criteria: $\alpha \geq 0.70$: accepted for social research and $0.60 \leq \alpha < 0.70$: acceptable for exploratory studies. The results indicate that the research instrument is valid and reliable for further analysis, particularly regarding the construct of perceived benefits of AI for referees/judges. As for the construct on ease of use, although it remains within the acceptable threshold, it is advisable to interpret the results with caution.

The following presents the results of the inferential statistical test (Chi-Square) to explore the relationship between categorical variables (gender, role in sports) and perceptions of AI based on the available data. As shown in Tables 4, 5, and 6, the interpretation of the p-value indicates that $p > 0.05$, thus failing to reject the null hypothesis (H_0). This means that there is no significant relationship between gender and perception of AI.

In Table 7, $p\text{-value} > 0.05$, so that it fails to subtract H_0 . There is no significant relationship between roles in sports and perceptions of AI. And Table 8, $p\text{-value} > 0.05$, thus failing to reject H_0 . There was no significant relationship between the role and perception of the ease of use of AI. The results of this inferential statistical test (Chi-Square) show that demographic factors (gender, role) may not be the main determinant of AI perception in sports in Indonesia. Other factors such as experience using AI, access to technology, or training may be more critical.

See Table 9, $p\text{-value} < 0.05$, so minus H_0 . There is a significant difference in the average perception score between coaches, athletes, and referees.

The conclusion that can be drawn is that coaches are significantly more pro-AI than referees ($p=0.01$). There is no significant difference between coach vs. athlete or athlete vs. referee.

Simple Linear Regression Test Results: AI Experience vs. Ease-of-Use Perception. Respondents who had used AI had an ease-of-use score 0.8 points higher than those who hadn't. Significance: $p=0.002$ ($p < 0.05$), so minus H_0 . Strength of Relationship: The effect is classified as moderate ($R^2=0.29$).

Discussion

Summary of ANOVA statistical test results showed that coaches had a significantly more positive perception of AI compared to referees ($p = 0.01$). In addition, the regression analysis revealed that prior experience with AI significantly increased perceived ease of use ($\beta = 0.8$, $p = 0.002$). This study uncovers unique dynamics in the adoption of Artificial Intelligence (AI) in Indonesian sports, with coaches, athletes, and referees showing varying levels of acceptance. Coaches emerged as the most optimistic group, with an average perception score of 4.1/5, driven by their need for data analysis to enhance athlete performance. In contrast, referees recorded the lowest score (3.4/5), likely due to the limited real-world application of AI in local matches, such as the infrequent use of Video Assistant Referee (VAR). These findings align with studies from Brazil (Da Silva et al., 2021) and Japan (References) (Tanaka et al., 2020), where coaches tend to be early adopters of technology. However, they also highlight Indonesia's specific challenges,

such as infrastructure limitations and a digital literacy gap.

Direct experience with AI has proven to be a key factor in shaping user perception. Respondents who had previously used AI reported ease-of-use scores 0.8 points higher ($\beta = 0.8$, $p = 0.002$), supporting the Technology Acceptance Model (TAM), which suggests that practical exposure reduces user anxiety (Davis & Thaut, 1989). However, 68% of respondents admitted to never having tried AI, reflecting a significant gap between technological potential and field realities. This contrasts with many European countries, where AI tools such as motion analysis systems and VAR have become standard. This discussion highlights the importance of training programs that not only introduce technology but also provide hands-on experience, particularly for referees who remain skeptical.

An unexpected finding of this study is the lack of significant perception differences based on gender ($p = 0.65$), which contrasts with a U.S. study (Robinson & Johnson, 2021) that reported gender disparities in technology adoption. This result may be attributed to the relatively homogenous educational backgrounds of the respondents or the still-limited participation of women in coaching and refereeing roles in Indonesia. Nonetheless, the finding opens up avenues for further exploration of the influence of culture and education on technology acceptance.

From a theoretical perspective, this study contributes to the literature by reaffirming the relevance of TAM in developing country contexts, while also emphasizing the importance of contextual factors such as infrastructure availability. Practically, the results serve as a foundation for policy recommendations, including the development of AI applications in the Indonesian language tailored to traditional sports (e.g., Pencak Silat, Sepak Takraw) and simulation-based training for referees. However, research limitations—such as the sample being dominated by respondents from Java (55%) and highly educated individuals (70% holding a bachelor's degree)—suggest that generalizations should be made with caution.

Future research should address several critical questions:

1. How can AI be adapted for traditional sports that reflect Indonesia's cultural identity?
2. Will improved technological access in areas outside of Java reduce the perception gap?
3. How can AI integration with wearable devices enable real-time monitoring of athletes' health?

A mixed-method study combining surveys with in-depth interviews is also needed to understand the underlying reasons behind the skepticism of referees and senior athletes.

This study asserts that AI is not a threat but a strategic partner in advancing Indonesian sports. Collaboration between the government, academia, and the tech industry is essential in developing solutions that meet local needs. With an inclusive approach, AI can become a bridge connecting Indonesia's sporting potential with global standards—without diminishing the human element at the heart of every match and training session.

One of the most compelling takeaways from this research is the opportunity for traditional sports. AI can serve as a preservation tool by recording and analyzing signature movements—such as martial arts forms (jurus) in Pencak Silat—to train future generations. In addition, ethical considerations and humanistic values must be addressed, for instance: does referee decision-making supported by AI diminish the human touch in sports? Moreover, the role of young people—with 65% of respondents aged 20–30—presents an asset for accelerating AI adoption, provided it is matched with policies that ensure equitable access. In other words, the AI revolution in Indonesian sports is not just about technology—it is about how humans harness it to create added value in performance, accuracy, and cultural preservation.

This research serves as a preliminary study aiming to establish an empirical foundation for developing AI technology relevant to the needs of Indonesian sports. Before designing and implementing complex AI systems, it is crucial to understand the perceptions, challenges, and expectations of end-users—namely, coaches, athletes, and referees—as a critical first step. This study also provides a strategic foothold to ensure that AI development in Indonesian sports is not only about following global trends but about addressing real field-level needs. A combination of academic insight and practitioner feedback will help shape AI solutions that are relevant, sustainable, and widely impactful.

Practical implications include prioritizing AI training for referees to reduce perception gaps; organizing hands-on AI demos to enhance user experience, especially for first-time users, and investigating additional factors influencing perceived ease of use (e.g., age, education level).

Conclusions

This study reveals significant differences in the perceptions of coaches, athletes, and referees

regarding the use of Artificial Intelligence (AI) technology in sports in Indonesia. Coaches emerged as the most pro-AI group, driven by the need for data analysis to improve athlete performance. In contrast, referees limited implementation of AI tools, such as the Video Assistant Referee (VAR). These findings highlight the critical role of direct experience with AI—respondents who had used AI reported 0.8 points higher in perceived ease of use, reinforcing the Technology Acceptance Model (TAM). However, 68% of respondents admitted to never having tried AI, reflecting a gap in infrastructure and digital literacy, especially outside of Java. This challenge is exacerbated by the urban-centric distribution of respondents (55% from Java) and the limited technological access in other regions. Amid these constraints, AI's potential in traditional sports offers a unique and untapped opportunity.

To address these challenges, an inclusive strategy involving multisectoral collaboration is needed. The government, academics, and technology industries must design practical training programs for referees and coaches, such as VAR simulations or movement analysis apps in the Indonesian language. AI development should also focus on offline-first solutions or cloud-based systems that require low bandwidth to serve remote areas. Additionally, integrating AI into traditional sports not only supports cultural preservation but also opens up new markets for technological innovation.

This study affirms that successful AI adoption depends not only on technical sophistication but also on approaches that prioritize local context, human resource readiness, and equitable access. Therefore, AI is not merely a tool, but a catalyst that can elevate Indonesian sports to global standards—without neglecting the country's unique identity and domestic needs.

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