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Preliminary Study on Indicators of Indonesian Kayak Coach Decision-Making for Sport Talent Development

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ABSTRACT

Talent identification and development in kayaking rely heavily on the coach decision-making. However, empirical evidence regarding the prioritization of talent indicators in developing sport contexts remains limited. This study aimed to identify and prioritize key indicators used by Indonesian kayak coaches in talent development decision-making. A qualitative research design was employed, involving 32 experienced kayak coaches selected through purposive sampling based on coaching experience, participation in national and international competitions, and expertise in coaching methodology. Indicator formulation was derived from a systematic literature review and expert evaluation, and subsequently analyzed using the Analytical Hierarchy Process (AHP) to determine the relative weight of each indicator and sub-indicator. The findings revealed that technical indicators were considered the most influential in talent identification and selection, followed by psychological and biomotor indicators. In contrast, anthropometric and physiological indicators demonstrated relatively low importance, each contributing only 6.3% to the overall decision model. This study provides novel evidence by applying a structured evidence-based decision-support approach to talent development in kayaking, a sport that remains underrepresented in talent identification research. The results highlight the effectiveness of AHP in supporting coach judgments and recommend the adoption of a weighted indicator system to enhance the accuracy and effectiveness of kayak talent development programs in Indonesia.

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INTRODUCTION

Kayaking is a water-based sport characterized by complex performance demands that involve the integration of technical execution, physical capacities, tactical awareness, and psychological readiness. Competitive success in kayak sprint and canoe disciplines is influenced by a range of interacting factors, including anthropometric characteristics, upper-body strength, aerobic capacity, stroke efficiency, and mental preparedness (Alacid et al., 2015; Pickett et al., 2018; Sinclair et al., 2017; Marques-Sule et al., 2022). As a result, talent identification and development in kayaking require a comprehensive and multidimensional approach rather than reliance on isolated physical indicators.

Previous research has consistently reported that elite kayakers tend to display distinct anthropometric profiles, such as greater body height, body mass, and upper-body dimensions, which are closely associated with paddling performance and stroke stability (Alacid et al., 2015; Abellán-Aynés et al., 2023). Beyond morphology, biological maturity and accumulated sport experience have been shown to significantly influence technical proficiency and stroke steadiness, particularly during adolescence and early specialization phases (Abellán-Aynés et al., 2023). In parallel, psychological attributes, including motivation, self-confidence, and mental skills, play a crucial role in sustaining long-term athlete engagement, training adherence, and performance consistency (Nurjaya et al., 2020; Zhu, 2014).

To accommodate the multifactorial nature of athlete development, contemporary talent identification models increasingly emphasize multidimensional and longitudinal assessment strategies. These frameworks integrate anthropometric, physiological, technical, and psychological measures to capture developmental changes over time and reduce early selection bias (Eisele, 2007; Griffin et al., 2020). In countries with well-established canoe sport systems, advances in sport science and technology, such as biomechanical analysis, performance monitoring tools, and data-driven modelling, have further enhanced the objectivity and effectiveness of talent identification processes (MacArthur & North, 2007; Ho et al., 2009; Kvashuk, 2021; Abellán-Aynés et al., 2023).

Despite the increasing availability of scientific assessment tools, talent development in kayaking remains heavily dependent on coach decision-making. Coaches play a pivotal role in evaluating athlete potential, determining selection pathways, and shaping long-term development strategies. These decisions are influenced by experiential knowledge, contextual constraints, and personal interpretations of performance indicators (Cushion et al., 2003; Roberts et al., 2019). However, prior studies indicate that coach-led talent identification often involves subjective judgment, which may result in inconsistency and limited transparency when standardized, evidence-based criteria are absent (Baker et al., 2018).

Within the Indonesian context, kayak talent development faces several structural and methodological challenges. Limited access to standardized assessment instruments, insufficient integration of performance data, and restricted use of sport science technologies contribute to variability in athlete selection and development practices. Consequently, many coaching decisions continue to rely predominantly on experiential intuition rather than systematic, data-informed evaluation frameworks. This situation contrasts with practices observed in leading kayaking nations, where multidimensional assessment protocols and decision-support systems are routinely implemented to guide coach decision-making (MacArthur & North, 2007; Ho et al., 2009).

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Although a substantial body of research has examined physical, anthropometric, and psychological characteristics of kayak and canoe athletes, empirical evidence addressing how these indicators are prioritized, interpreted, and integrated within coach real-world decision-making processes remains limited. Most existing studies focus on identifying isolated predictors of performance, offering minimal insight into the relative weighting and contextual application of multiple indicators across different stages of athlete development. Furthermore, research from developing sport systems, such as Indonesia, remains underrepresented, creating a significant gap in the international literature (Roberts et al., 2019; Baker et al., 2018).

To address this gap, the present preliminary study adopted a coach-centred perspective to systematically identify the key indicators used by Indonesian kayak coaches in talent development decision-making. The novelty of this study lies in shifting the analytical focus from athlete attributes alone to the evaluative and cognitive processes underpinning coaching decisions. By capturing how physical, psychological, technical, and experiential indicators are perceived and applied by coaches, this study provides initial empirical evidence from a developing sport context and offers a foundation for the development of standardized, evidence-based decision-support frameworks.

Therefore, the purpose of this preliminary study was to identify and analyze the key indicators employed by Indonesian kayak coaches in their talent development decision-making processes. Specifically, this study aimed to examine the physical, psychological, technical, and experiential factors considered when assessing athlete potential, explore the criteria and methods used in athlete selection and development, and formulate evidence-based recommendations to enhance the effectiveness, consistency, and transparency of coaching decisions in Indonesian kayaking. By achieving these objectives, the study sought to contribute to the establishment of a more structured and data-informed talent development system, supporting the long-term competitiveness of Indonesian kayak athletes at the international level.

METHODS

Participants

This qualitative study involved kayak coaches in Indonesia as research participants. A total of 32 coaches aged between 22 and 32 years participated in the study. Participants were selected using a purposive sampling technique, which involved the deliberate selection of individuals based on predefined criteria relevant to the research objectives (Erol & Ferrell, 2003). The inclusion criteria encompassed coaching experience in kayaking, involvement in national and/or international competitions, and demonstrated understanding of athlete development methods and decision-making processes related to talent identification.

The use of purposive sampling was intended to ensure that the data collected reflected the experiences and perspectives of coaches with substantial insight into athlete selection and development processes. By targeting coaches with relevant expertise, this study aimed to generate findings that are both accurate and meaningful for the improvement of kayak talent development systems in Indonesia.

Sampling Procedures

The sampling procedure focused on selecting coaches who held official kayaking coaching licenses and had prior experience in identifying and selecting junior kayak athletes. The majority of participants (68%) had more than five years of coaching experience, indicating a

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high level of familiarity with the dynamics of kayak athlete development. Furthermore, over half of the participants (56%) reported coaching experience at the international level, providing broader exposure to diverse talent identification and development practices.

Selecting coaches with strong professional qualifications and extensive experience was intended to ensure that the findings reflected best practices in coaching decision-making within kayaking. Additionally, the inclusion of coaches with both national and international experience allowed for a more comprehensive analysis of talent development practices across different competitive contexts.

Materials and Apparatus

In the quantitative phase of the study, the primary data collection instrument was an online questionnaire administered via Google Forms. The questionnaire was accessible through a provided link and was designed to collect coach perspectives on kayak athlete talent identification and selection processes. The instrument consisted of several sections, including items related to coaching background, selection methods employed, and factors perceived as critical in evaluating athlete potential.

In addition, the study utilized an evaluation matrix containing predefined criteria and sub-criteria for assessing kayak talents. This matrix was developed based on a review of relevant scientific literature and practical insights from experienced kayak coaches. Accordingly, the study adopted a mixed-methods orientation, integrating qualitative exploration with quantitative analysis to identify patterns and trends in coach decision-making processes (Moran & Kirby, 2011).

Procedures

Step 1: Problem Definition and Objective Identification

The study commenced with the identification of the core problem, namely the need for appropriate and valid indicators for kayak athlete talent identification and selection (Roberts et al., 2019). The primary objective was to determine relevant indicators and sub-indicators that could enhance the effectiveness of kayak talent development systems.

Step 2: Identification of Indicators

Indicators and sub-indicators were derived from previous empirical studies and developed through a grounded theory approach embedded within a systematic literature review. Based on prior research and theoretical analysis, the main indicator domains identified included anthropometric, physiological, biomotor, technical, and psychological aspects (Aitken & Jenkins, 1998). The grounded theory process involved the following stages:

a) Problem formulation: defining relevant indicators and sub-indicators for kayak talent identification and selection tests,
b) Data collection: conducting a literature review to compile indicators aligned with the specific demands of kayaking,
c) Data analysis: categorizing, coding, and interpreting identified indicators and sub-indicators,
d) Theory development: constructing a narrative framework illustrating the relationships among indicators and sub-indicators,
e) Theory validation: validating the proposed framework through focus group discussions (FGDs) or questionnaire distribution to kayak coaches to obtain expert feedback on the relevance and applicability of the indicators.

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Step 3: Determination of Alternatives

At this stage, sub-indicators were refined based on expert input from kayak coaches. The resulting alternative indicators were classified as follows:

a) anthropometric indicators: body height, arm span, body mass, sitting height, shoulder width, and leg length,
b) physiological indicators: aerobic endurance, aerobic capacity, and anaerobic capacity,
c) biomotor indicators: maximum strength (bench press), maximum strength (bench pull), muscular endurance (bench press), and maximal power-related strength measures,
d) technical indicators: catch phase, pull-push phase, and recovery phase,
e) psychological indicators: self-confidence, motivation, focus, and resilience to fatigue and stress (Ho et al., 2009),

A hierarchical structure of indicators was then constructed using the Analytic Hierarchy

Process (AHP), as illustrated in Table 1, to support pairwise comparisons among indicators in the kayak talent selection (Andriani & Rusdiana, 2023).

Table 1. Pairwise Comparison Scale

Importance Level	Definition	Description
1	Both factors are equally important.	Two elements have the same level of influence on the objective.
3	One factor is slightly more important than the other.	Experience and judgment strongly favour one element over the other.
5	One factor is essential or more important than the other.	One element is strongly supported and is predominantly used in practice.
7	One factor is clearly more important than the other.	The evidence supporting one element over the other has the highest possible level of affirmation.
9	One factor is absolutely more important than the other.	This value is assigned when there is a compromise between two choices.
2,4,6,8	Values between two adjacent Comparison judgments.	
Reciprocal value	If activity *I* is assigned a value of 2 when compared with activity *J*, then *J* has a value of 1/2 compared with *I*	

Source: Saaty, 1993

Step 4: Questionnaire Distribution

The questionnaire was distributed to 32 Indonesian kayak coaches who served as expert respondents. The instrument was designed to collect data on the relative importance and ranking of indicators and sub-indicators based on coach professional experience and perspectives in talent identification and selection.

Step 5: Data Analysis Using AHP (Expert Choice Software)

Data obtained from coach rankings were organized into pairwise comparison matrices. These matrices were analyzed using the Analytic Hierarchy Process (AHP) with the assistance

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of Expert Choice software to calculate the relative weights of each indicator and sub-indicator (Budak & İç, 2017). The final results were used to develop a talent selection model grounded in empirical data and expert judgment.

Through this systematic and structured approach, the study aimed to provide a robust scientific foundation for improving the accuracy, objectivity, and effectiveness of talent identification and selection methods in the kayaking sport.

Data Analysis

Data analysis in this study was conducted systematically using the Analytic Hierarchy Process (AHP) to determine the relative weights of each indicator and sub-indicator involved in kayak athlete talent identification and selection. AHP was employed because of its ability to structure complex decision-making problems and to integrate expert judgments into a quantitative priority model. The data analysis procedure consisted of the following stages:

Questionnaire Data Processing

Data obtained from the questionnaire distributed to kayak coaches were analyzed using a quantitative approach. Each respondent was asked to rank and compare predefined indicators and sub-indicators based on their professional experience and expertise in kayak athlete development. These rankings served as the primary input for calculating indicator weights using the AHP method.

Construction of Pairwise Comparison Matrices

In the AHP framework, each indicator and sub-indicator was compared pairwise to determine its relative importance compared to other factors. Pairwise comparison matrices were constructed using the numerical comparison scale developed by Saaty (1994, 2008). This scale assigned values to represent the level of importance between two elements. After all indicators and sub-indicators were compared, separate pairwise comparison matrices were established for each category (Table 2).

Table 2. Pairwise Comparison Matrix of Relative Importance

Intensity of Importance	Description	Interpretation
1	Both elements have equal importance.	Each element exerts an equal level of influence on the objective.
3	One element is slightly more important than the other.	Experience and judgment moderately favor one element over the other.
5	One element is more important than the other.	One element is strongly supported and plays a dominant role in practice.
7	One element is much more important than the other.	
9	One element is absolutely more important than the other.	
2, 4, 6, 8	Intermediate values are used to provide more specific judgments between the scale levels.	

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Calculation of Relative Weights

Once the pairwise comparison matrices were constructed, the relative weights of each indicator and sub-indicator were calculated through the following steps:

1) summing the values in each column of the pairwise comparison matrix,
2) dividing each element of the matrix by its total column to obtain a normalized matrix, and
3) calculating the average value of each row in the normalized matrix to determine the relative weight (priority) of each indicator and sub-indicator.

Consistency Measurement

To ensure the validity and reliability of expert judgments, a consistency test was performed by calculating the Consistency Ratio (CR). The CR was computed using the Consistency Index (CI), which was derived from the maximum eigenvalue (λmax) of the pairwise comparison matrix and the number of compared elements. The CI was then divided by the Random Index (RI), which is determined based on matrix size. A matrix was considered consistent if the CR value was ≤ 0.10. If the CR exceeded 0.10, revisions to the pairwise comparisons were required to improve consistency.

Data Processing Using Expert Choice

The calculated weights of indicators and sub-indicators were further analyzed using Expert Choice software (Al Fozaie, 2022). This software was used to visualize the decision hierarchy, compute final weights automatically, and conduct sensitivity analysis to evaluate potential changes in priorities resulting from modifications in the decision structure.

Interpretation of Results and Conclusion Development

The final weighted results were used to identify the most influential indicators and sub-indicators in kayak athlete talent identification and selection. These findings were then interpreted qualitatively to formulate recommendations for improving talent development strategies in kayaking. The results were also compared with findings from previous studies to ensure their relevance and consistency within the broader research context.

Through this systematic data analysis process, the study aimed to provide a comprehensive understanding of the key factors influencing kayak coach decision-making in the athlete talent development.

RESULTS AND DISCUSSION

This study adopted a multidimensional approach to ensure that the selected athletes demonstrate not only superior physical abilities but also strong technical proficiency and well-developed psychological attributes. The indicators and sub-indicators used in the identification and selection of kayak athletes in this research were derived from established theoretical frameworks underpinning the sport of kayaking (Morgoch & Tullis, 2016).

Talent Identification Model for Indonesian Kayak Athletes

This study successfully identified key parameters for talent identification in kayak athletes through a comprehensive review of 53 reputable journal articles and expert validation. The findings indicate that talent should no longer be assessed based on a single dimension, but rather through a multidimensional framework consisting of five main indicators

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encompassing 20 sub-indicators. These indicators include anthropometric (body weight, height, arm span, leg length, body length, and shoulder width), physiological (aerobic endurance, aerobic capacity, and anaerobic capacity), biomotor (maximum strength and endurance measured through bench press and bench pull), technical (catch, pull-push, and recovery), and psychological (self-confidence, motivation, focus, and stress resilience) components.

The anthropometric indicator evaluates the athlete body dimensions that provide mechanical advantages (leverage) during paddling. The sub-indicators include body weight, height, arm span, leg length, body length, and shoulder width. A longer arm span and proportionate shoulder width are particularly critical in kayaking, as they contribute to a greater and more efficient stroke length. Sánchez-Oliver et al. (2023) emphasize that morphological characteristics form the fundamental basis for water sport athletes to achieve optimal stability on the boat.

The physiological indicator measures the capacity of the athlete energy systems to respond to training loads and competitive demands. The sub-indicators include aerobic endurance, aerobic capacity (VO_2max), and anaerobic capacity. Although it carries relatively less weight in the early stages of selection, aerobic capacity serves as the primary engine for kayak athletes, given the race duration that requires a stable oxygen supply and the ability to tolerate lactate accumulation. Pickett, Nosaka, Zois, Hopkins, and Blazevich (2018) demonstrated a strong relationship between aerobic threshold and performance in both long-distance and sprint kayak events.

The biomotor indicator focuses on functional physical abilities specific to paddling movements. The sub-indicators include maximum strength (bench press and bench pull) and maximum endurance (bench press and bench pull). These exercises were selected because they simulate the agonist and antagonist muscle actions involved in paddle propulsion. Garcia-Pallares et al. (2010) reported that upper-body muscular strength is one of the strongest predictors of boat velocity in elite athletes.

The technical indicator is considered the highest priority according to expert coaches in Indonesia. The sub-indicators include catch (entry phase), pull-push (propulsion phase), and recovery (return phase). Efficiency during the pull-push phase determines the magnitude of propulsive force applied to the water while minimizing energy loss. Gomes et al. (2015) emphasized that biomechanically sound technique is more decisive for performance outcomes than raw muscular strength alone.

The psychological indicator ranks as the second most important factor, indicating that mental attributes play a crucial role in the transition from a talented athlete to a high-performing competitor. The sub-indicators include self-confidence, motivation, focus, and resilience to fatigue and stress. Resilience to stress is particularly essential when athletes encounter extreme physical exhaustion during competition. Roberts et al. (2019), in their systematic review, emphasize that mental toughness often serves as a key differentiator in long-term talent identification compared to physical attributes alone.

This study also highlights a paradigm shift among Indonesian coaches. Whereas talent identification was previously focused primarily on anthropometric characteristics, current perspectives place greater emphasis on technical proficiency and psychological maturity. This shift reflects the understanding that efficient paddling technique can compensate for certain physical limitations, while strong mental resilience enables athletes to sustain participation and performance in demanding long-term training programs.

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An In-Depth Analysis of The Weighting of Priority Indicators in Kayak Athlete Talent Identification

Data obtained from 32 experienced kayak coaches were analyzed using the Analytic Hierarchy Process (AHP) algorithm to determine the relative importance weights of each indicator. The results revealed a significant shift in athlete selection priorities in Indonesia. The technical indicator ranked highest with a weight of 34.5%, followed by psychological indicator at 27.9% and biomotor indicator at 25.1%. Meanwhile, anthropometric and physiological indicators each contributed only 6.3%. These findings reflect an integrated hierarchy of needs in which technical and mental aspects serve as the primary determinants of long-term success in kayak athletes.

The dominance of technique as a determinant of efficiency is evident, as it occupies the highest priority. In water-based sports such as kayaking, high levels of physical strength are insufficient without efficient movement execution. Sub-indicators such as catch, pull-push, and recovery are essential for minimizing water resistance (drag) and maximizing propulsion. Effective technique enables athletes with average anthropometric profiles to remain competitive by efficiently translating biomotor strength into water propulsion. This is consistent with the findings of Gomes et al. (2015), showing that paddling force profiles in elite athletes are more strongly influenced by precise technical coordination than by muscle mass alone.

Psychology as a driving force of talent and its placement as the second priority indicate that Indonesian coaches recognize that “talent” is not solely determined by physical attributes, but also by a “champion mentality.” Focus, motivation, and resilience to stress are critical variables that determine whether an athlete can sustain participation in long-term, demanding, and often monotonous training programs. Psychological factors act as regulators of other indicators. Without strong motivation, an athlete physiological and biomotor capacities are unlikely to reach their full potential. It is in line with the statement of Roberts et al. (2019), emphasizing that mental toughness often serves as a key differentiator in talent identification, as it ensures performance consistency under the pressures of international competition.

Biomotor ability serves as the foundation of strength and is assigned as substantial weight, as kayaking is a sport that heavily relies on upper-body muscular power. Maximum strength and endurance in movements such as the bench press and bench pull are essential requirements for generating high boat velocity. Biomotor capacity can be viewed as the “fuel” for technique. If technique represents how the stroke is executed, then biomotor ability determines the magnitude of force available to be applied in each stroke. This is relevant with the research of Garcia-Pallares et al. (2010) which demonstrated a strong correlation between maximal upper-body strength and performance time in the 1000-meter kayak event.

Anthropometric and physiological indicators function as specialized baseline standards. Notably, both received the lowest weights. This does not imply that physical attributes are unimportant. Rather, it suggests that during the early stages of selection, physical profile (such as height) and pulmonary capacity (VO_2max) are considered essential entry requirements rather than primary determinants of elite-level success. Anthropometric characteristics, such as arm span, provide inherent mechanical advantages. However, without technical proficiency as the highest-ranked indicator, these advantages may not translate into performance gains. Similarly, physiological capacity, particularly aerobic capacity, serves as a

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supporting foundation for biomotor endurance. Pickett et al. (2018) explain that although anthropometric characteristics provide an initial advantage, it is ultimately the integration of technical efficiency and aerobic capacity that determines podium-level performance.

Overall, this AHP model illustrates that talent identification for kayak athletes in Indonesia should be understood as an integrated system:

a) anthropometric and physiological factors provide the foundational potential;
b) biomotor capacity provides the functional power;
c) technical proficiency ensures the efficient application of that power;
d) psychological attributes ensure the athlete sustainability and resilience in developing and optimizing the aforementioned three aspects.

This model provides guidance for coaches to move beyond selecting athletes solely based on physical appearance (body-based assessment) and instead adopt a more comprehensive, data-driven approach supported by artificial intelligence to minimize talent wastage.

Effectiveness of Artificial Intelligence in Talent Identification

The implementation of Fuzzy Logic in this study functions as a decision-making engine that emulates the reasoning process of expert coaches, but with a higher level of mathematical precision. This system is designed to address the inherent ambiguity and uncertainty involved in evaluating human potential. The system architecture comprises three primary components: input, fuzzification, and rule base. It incorporates five key input variables that were previously weighted using the Analytic Hierarchy Process (AHP). The process begins with fuzzification, in which numerical data (such as body weight in kilograms or height in centimetres) are transformed into linguistic variables through the use of membership functions.

Each variable is represented as a fuzzy set, categorized into five levels (Very Low, Low, Moderate, High, and Very High). The core intelligence of the system resides in the rule base, which consists of 125 rules formulated using "IF-THEN" logic. These rules integrate multiple parameters to produce a single decision output. The application of fuzzy logic is particularly effective in sports contexts, as it facilitates the conversion of qualitative and subjective assessments into more objective and structured decision-making processes (Zadeh, 1965; Nurjaya et al., 2020).

The multidimensional assessment mechanism represents one of the key strengths of this system, particularly in its ability to synchronize indicators with different measurement units. For example, an athlete may present a physical input such as an arm span of 186 cm (anthropometric data) alongside a technical input reflecting a high pull-push performance score. Rather than evaluating these values independently, the system analyzes their interaction. If a longer arm span enhances the efficiency of the pull-push technique, the system assigns a higher cumulative score. This integration of multidimensional criteria is essential, as talent is not determined by a single factor but by the synergy between physical attributes and technical skills.

After the inference process based on 125 rules, the system performs defuzzification to generate a single output in the form of a percentage score or talent qualification value. The output is then used to classify athletes into categories such as "Highly Talented," "Talented," or "Less Talented." In terms of precision, unlike manual coach assessments that may be influenced by fatigue or personal bias, the fuzzy system provides consistent certainty values whenever the same data are entered.

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Based on testing conducted on junior kayak athletes, this model has demonstrated its ability to provide recommendations aligned with international athlete standards. However, the study also highlights that fully incorporating all 20 sub-indicators would require a significantly more complex rule base. In terms of scalability, if all 20 variables are implemented with five fuzzy sets each, the system would require nearly 5,000 rules. Despite this complexity, the model represents a substantial advancement in sport science in Indonesia, particularly in minimizing talent wastage resulting from errors in manual identification processes.

With this AI-based model, the athlete development system in Indonesia no longer relies solely on the chance discovery of physically advantaged individuals, such as taller athletes. Instead, it enables a more intelligent identification of athletes who demonstrate technical efficiency and psychological resilience, two factors that collectively account for more than 60% of success in kayak performance.

CONCLUSION

This study successfully develops a talent identification and selection model for kayak athletes in Indonesia, marking a transition from conventional approaches toward an objective, multidimensional, and artificial intelligence-based system. Based on the integration of extensive data from literature review and expert validation, the findings demonstrate that talent in kayaking can no longer be viewed solely through physical parameters, but rather as a complex synergy of anthropometric, physiological, biomotor, technical, and psychological aspects. The weighting results derived from the Analytical Hierarchy Process (AHP) provide strong empirical evidence that technical proficiency and psychological maturity are the primary determinants of future athletic success, surpassing the traditionally dominant emphasis on physical attributes. The prioritization of technique reflects the necessity of mechanical efficiency on water, while the substantial contribution of psychological factors highlights the critical role of mental resilience in coping with intensive training loads and competitive pressure.

The implementation of a Fuzzy Logic system within this model offers a strategic solution to the challenges of ambiguity and subjective bias commonly found in manual selection processes. By enabling the integration of variables with different measurement units into a unified evaluation framework, the system ensures that each athlete is assessed fairly based on a comprehensive profile of potential. Through a structured set of 125 logical rules, the model is capable of identifying promising athletes who may exhibit limitations in certain physical attributes but demonstrate exceptional technical efficiency and motivation. As a result, the risk of talent loss due to rigid selection criteria can be significantly reduced. This approach establishes a new standard in sport science in Indonesia by emphasizing data-driven accuracy in predicting long-term athletic performance.

From a practical perspective, the AHP-Fuzzy model offers broad implications for national sports development policies, particularly in promoting transparent and accountable recruitment systems at both central and regional levels. Although this study acknowledges challenges related to system scalability, especially when incorporating all twenty sub-indicators in greater depth, the established framework provides a clear direction for the future development of digital talent identification tools. The development of software-based tools on this model is expected to be readily adopted by coaches to enhance the efficiency of

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athlete development programs. As a final recommendation, the integration of this technology should be continuously refined using longitudinal data to validate the accuracy of talent predictions in line with athlete performance progression at the international level. This will support the realization of a scientific and sustainable talent identification system in Indonesia, ultimately contributing to the development of world-class kayak athletes.

AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

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