



Developing a Framework for Football Talent Identification Based on Emerging Technologies

Vajiheh Javani* 

Department of Sport Management, Faculty of Physical Education and Sport Sciences, University of Tabriz, Tabriz, Iran.

Kazem Mahmoudi 

Department of Sport Management, Faculty of Physical Education and Sport Sciences, University of Tabriz, Tabriz, Iran.

Mohammad Rasoul Khodadadi 

Department of Sport Management, Faculty of Physical Education and Sport Sciences, University of Tabriz, Tabriz, Iran.

Abstract

Talent identification in modern football increasingly relies on emerging technologies, whereas Iranian football academies predominantly utilize subjective coach-led assessments. This study aimed to develop a technology-based framework for talent identification management in Iranian youth football. The research employed a sequential two-stage mixed-methods design, initially applying the Delphi method to establish expert consensus, followed by the classical DEMATEL method for structural causal analysis. The expert panel comprised 15 male coaches and technical directors with a minimum of five years of experience in youth football talent identification, selected through purposive sampling. In the qualitative phase, twenty preliminary components were extracted from a systematic literature review across international databases (Scopus, PubMed, and Google Scholar) spanning 2020–2025. Through a three-round iterative Delphi procedure, consensus was achieved on 10 final components. Subsequently, these components were analyzed via the DEMATEL method to determine their prominence, causal relationships, and underlying data patterns. The findings revealed that biological maturation status was the most influential causal factor, followed by explosive power and perceptual-motor coverage, both identified as key driving variables. This evidence-based prioritization

* Vajiheh Javani: v.javani@tabrizu.ac.ir

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demonstrates that systematic talent identification requires the sequential assessment of biological foundations prior to technical-tactical capabilities. Such a causal framework provides Iranian football academies with an objective, structured approach to mitigate subjective biases and prevent the oversight of late-maturing talents during early selection stages.

Introduction

Emerging technologies have transformed talent identification across the global sports industry, with football leading the adoption of data-driven assessment systems. Elite international clubs increasingly deploy artificial intelligence (AI), wearable sensors, and advanced performance analytics to identify youth talent, moving far beyond traditional, subjective scout evaluations. Conversely, Iranian football academies face a significant implementation gap, lacking systematic frameworks that integrate technological capabilities with local infrastructural realities. Existing domestic research has focused primarily on macro-organizational structures rather than operational technology applications. This dominance of subjective assessment methods introduces systematic bias toward early-maturing players while frequently overlooking late-developing talents who may possess higher long-term potential. The present study addresses this gap by developing a comprehensive, technology-based framework for football talent identification management specifically adapted to the Iranian youth football ecosystem. The primary objective was to synthesize key technological assessment components from global evidence and map their causal relationships and implementation priorities using an expert consensus methodology.

Methods and Material

This mixed-methods study employed a sequential two-phase design combining the Delphi method for component identification and weighting with the classical DEMATEL technique for causal relationship analysis. The target population consisted of elite coaches and technical managers involved in Iranian youth football talent identification. Through purposive sampling based on strict inclusion criteria (male gender, a minimum of five years of professional team experience, and a demonstrated impact on youth development scouting), a 15-member expert panel was established. This panel size balanced specialist diversity with manageable iteration requirements, as recommended in the Delphi literature.

Initial component extraction utilized a systematic literature review of the Scopus, PubMed, and Google Scholar databases spanning 2020–2025, yielding twenty preliminary components after eliminating conceptual overlaps. Phase one implemented the Delphi method through online questionnaires containing component lists rated on a four-point Likert scale, supplemented by open-ended sections for qualitative feedback. Anonymized responses underwent iterative rounds until a high degree of consensus was achieved (concluding in three rounds) based on predefined criteria: mean ≥ 4 , standard deviation < 1 , agreement percentage $\geq 70\%$. Component weights were calculated using Min-Max normalization. Phase two utilized classical

DEMATEL where experts completed pairwise comparison matrices (0-4 scale) for consensus components. Individual matrices were aggregated into group matrix (Z), normalized to matrix (X), and processed to generate total influence matrix (T) using formula $T=X(I-X)^{-1}$. Row sums (R) and column sums (C) enabled calculation of prominence (R+C) and relationship (R-C) indices for causal classification. Content validity was ensured through expert review of instruments, with clear component definitions provided to minimize interpretation variance.

Results and Discussion

Systematic literature review identified twenty initial components, which Delphi consensus process refined to ten final components through three iterative rounds. Components achieving consensus included: passing accuracy and impact (weight 0.2648), speed splits 10/20m (0.2352), biological maturation status (0.1470), change of direction (0.0883), lower-body explosive power (0.0883), perceptual-sensory coverage (0.0883), emotional stability under sudden game speed changes (0.0587), interpersonal interactions (0.0296), total match distance (0.000), and internal load indices (0.000). DEMATEL analysis revealed hierarchical causal structure with biological maturation demonstrating strongest causal influence (R-C=2.2744, R=3.8228, C=1.5484), meaning it drives other factors while remaining relatively independent of training interventions. Speed splits occupied most central position with highest prominence (R+C=6.5774), functioning as mediating variable influenced by biological and physical factors while affecting technical performance. Analysis identified four distinct quadrants: causal factors (biological maturation, explosive power, perceptual coverage) forming biological-cognitive foundation; mediating factors (speed splits, change of direction) translating capacities into sport-specific movements; effect factors (passing accuracy, interpersonal interactions, internal load, total distance) representing technical-tactical game outcomes; and independent factor (emotional stability) with limited system interaction. Matrix analysis showed biological maturation exerted strongest direct effects on speed (0.4743) and internal load indices (0.4977), approximately double the impact of explosive power on speed, explaining early-maturing players' initial advantages.

Conclusion

This research establishes that football talent identification operates as a hierarchical causal system rather than a collection of independent, weighted traits, with biological maturation and perceptual-sensory capacities serving as the primary structural drivers. This causal framework enables an evidence-based approach to assessment prioritization, suggesting a layered, age-specific evaluation protocol: biological and perceptual assessments during late childhood (ages 8–12), physical capacity evaluations during early adolescence (ages 13–16), and operational, data-driven game performance measurements during late adolescence (ages 16–18). Strategic resource allocation in academies should prioritize the measurement of causal factors using

standardized biological maturation tracking and emerging cognitive technologies. Grouping youth players by biological maturation age rather than chronological age could significantly reduce early-selection bias, thereby preventing the premature exclusion of late-maturing talents. While these findings provide a robust theoretical foundation for Iranian football academies, practical implementation requires empirical validation through longitudinal studies tracking players from initial academy selection to professional senior contracts, while simultaneously addressing infrastructure resource constraints, cultural resistance, and the ethical management of youth biological data.

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Keywords: Sports talent identification; football; emerging technologies