Scenario Development for the Future of Sports Technologies in Iran: A Ten-Year Horizon

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Abstract

Purpose: The use of sports technologies has become an increasingly significant topic in modern sports. Therefore, the aim of the present research was to develop scenarios for the future of sports technologies in Iran within a ten-year horizon.

Methods: The design of the present research was qualitative, and the statistical population comprised all experts and specialists in the field of technology and sports in Iran. The sampling method was purposive and snowball sampling, which reached theoretical saturation after conducting 15 in-depth interviews. Data collection was performed via semi-structured interviews. In this research, foresight was employed using the scenario writing approach based on Schwartz's Intuitive Logic method, and for designing the scenarios, the Cross-Impact Matrix method was implemented using MICMAC software.

Results: Based on the findings, the analysis of the 21 main factors obtained ultimately led to the generation of two key uncertainties: intelligent governance of sports centered on the perpetual updating of data, and the personalization of sports products and services for each individual and improvement of customer satisfaction.

Conclusion: Finally, based on these factors, four scenarios were derived: the new age, the age of stagnation, the age of confusion, and the age of incongruity. The development and use of sports technology algorithms for the precise analysis of customer data and personalized experiences, the use of intelligent chatbots for handling customer inquiries, and the establishment of an integrated data collection system considering the structural diversity of organizations and institutions related to sports and data in this field are proposed.

Keywords: Sports Technology, Futures Studies, Scenario Development, Intuitive Logic

Introduction

The global sports industry has solidified

its status as a major economic powerhouse, with its complexity making precise measurement challenging yet its significance undeniable (Gammelsæter, 2020). Current estimates underscore its substantial scale, constituting approximately 3% of the gross value added and 3.5% of total employment within the European Union (Frevel, 2022), and representing around 1% of global GDP (Schmidt, 2020). Beyond these direct economic contributions, the industry generates immense value for a wide array of adjacent sectors, including tourism, media, security services, and consumer goods, creating a vast interconnected ecosystem (Kokolakakis & Gratton, 2019; McKinsey, 2020). This multi-faceted growth, sustained over decades, is increasingly propelled by a fundamental force: the rapid and pervasive integration of advanced technologies. In an era of intense competition, the leverage of technology has transitioned from a competitive advantage to an absolute necessity for clubs, athletes, and brands alike (Shajie et al., 2024).

This adoption of sports technologies marks a profound evolution in modern sport. The relationship between athletics and innovation, while long-standing, has undergone a radical transformation in recent years. Sports, like many other fields, have been decisively disrupted and reshaped by digitalization, demanding continuous adaptation (Verhoef et al., 2019). The domain of sports technology now encompasses a broad spectrum of innovations engineered to optimize every facet of the sporting ecosystem. This includes technologies for enhancing athlete training and performance, systems that assist officials in making more accurate decisions, and platforms that fundamentally redefine the consumer experience (Oosthuizen & Hunter, 2024). Historically limited to functional equipment, technology's application has expanded to encompass critical areas such as health and safety protocols, sophisticated athletic performance analytics, and entirely new modalities for sports consumption (Frevel, 2022). The advent of the internet and mobile technology has rendered this deep integration indispensable across all sporting disciplines (Ratten, 2019).

This technological revolution has elevated sport's potential to be more engaging and challenging than ever before, playing a "vital role in being the best on and off the field" (Schmidt, 2020). It has fueled a process of technology-driven internationalization and professionalization, creating seismic shifts in how sport is managed and consumed. Fans now enjoy unprecedented access to live or on-demand coverage of global events through digital platforms and social media at any time (Frevel et al., 2022; Qi et al., 2024). Consequently, the impact extends beyond athletes and consumers to sports managers, who must navigate an increasingly complex and data-driven industry under intensified pressure to adopt market-driven mechanisms (Misener & Misener, 2017). The future promises further transformation, propelled by advancements in AI automation and wearable technologies, aiming to enhance performance, amplify fan engagement, and promote sustainability (Shajie et al., 2024). This is supported by a global sports technology market projected to reach \$40 billion by 2026 (Bradley, 2023).

However, this promising trajectory is not without significant challenges. The future of sport, while shaped by exciting possibilities, necessitates careful consideration of ethical implications, privacy concerns, and equity issues (Geisel, 2024). Furthermore, the globalization of sport introduces complex challenges, from environmental impacts to the influence of international media corporations (Frevel et al., 2022). Effectively managing these advancements and drawbacks requires more than just adoption; it demands strategic innovation, evidence-based entrepreneurship (González-Serrano et al., 2017), and crucially, proactive foresight. This is especially true in diverse national contexts like Iran, where local socio-economic structures, policies, and cultural factors uniquely mediate and shape the adoption

and impact of these global technological trends. The necessity of futures studies as a discipline to confront such uncertainty and rapid change is increasingly evident and is a growing focus of scholarly concern globally (Gil-Galvn & Gil-Galvn, 2013). This is particularly relevant within the Iranian academic context, where scholars have emphasized the accelerated, knowledge-oriented movement of the contemporary world obliges decision-makers to actively engage with the future (Ramezani, 2019). The field of futures studies provides the essential toolkit for this, with scenario planning standing out as a critical methodology. This approach allows for the envisioning of multiple plausible futures instead of a single prediction, enabling robust planning for various eventualities (Pādāsh, 2020). Within Iranian sports scholarship, this imperative has been recognized. For instance, research on Iran's sports economy has shown that achieving development requires interpreting its past and present to design a foundational future vision through future literacy and increased social participation in foresight (Aghababaei & Afshari, 2022).

Despite this established need and nascent domestic interest in futures thinking, a critical and specific gap persists. International research has effectively documented the broad impact of technology on athletes, consumers, and managers (Frevel et al., 2022; Ihsan et al., 2025), and its role in validation and knowledge dissemination (Schlegel & Hill, 2020). Similarly, studies have highlighted the transformative potential of AI (Rahmani et al., 2024) and digital technology (Tan et al., 2023), while also noting the risks of a digital divide. However, within Iran, while scattered studies on sports technology exist, no comprehensive, scholarly action has been taken in the specific area of qualitative, scenario-based foresight for sports technology. The main focus of existing research has been solely based on past data or quantitative methods, leaving the high uncertainty of the future largely uninvestigated. Therefore, this study is designed to address this precise and unmet need. It aims to move beyond global generalizations and retrospective analysis to provide a contextualized, strategic roadmap for Iran. The purpose of this research is to develop robust scenarios for the future of sports technologies in Iran within a ten-year horizon. By employing a qualitative foresight approach based on in-depth expert interviews and cross-impact analysis (MICMAC), this research will identify key drivers and uncertainties to construct multiple plausible futures. The outcome will provide an indispensable strategic tool for policymakers, managers, and investors in the Iranian sports industry, enabling them to navigate the complexities of technological integration with greater preparedness, resilience, and insight, ultimately turning future uncertainty into a landscape of opportunity.

Materials and Methods

The objective of the present research is to identify future scenarios of sports technology in Iran. Therefore, this research is an applied developmental study in terms of purpose and employs a qualitative methodology. The research design is based on a prospective approach using scenario planning.

The statistical population of the research consisted of all experts and specialists with scientific and practical expertise in sports technology and the sports industry in Iran. Given the qualitative nature of the study and the need for deep, specialized insights, a non-probabilistic sampling strategy was employed. Sampling began purposively by identifying initial experts who met the criteria of extensive knowledge and experience in the field. Subsequently, the snowball sampling technique was used to identify additional participants, whereby initial participants were asked to introduce other knowledgeable individuals, until theoretical saturation on the research topic was achieved. This resulted in a final sample of 15 experts for in-depth interviews.

Data collection was performed via semi-structured interviews. The interview protocol was developed based on a comprehensive

review of related literature. To ensure the validity of the research instruments, the opinions of 10 experts in sports management and technology were solicited and incorporated. Furthermore, to establish reliability and consistency in the qualitative analysis process, the principles of credibility, transferability, and confirmability were adhered to.

To quantitatively assess the coding reliability, a test-retest method was employed. Specifically, three interviews were randomly selected and coded by the researcher on two separate occasions with a 30-day interval. The consistency between the two coding rounds was calculated using Cohen's Kappa coefficient (κ) (McHugh, 2012). The calculated Kappa value of 0.74 indicated substantial agreement, confirming the acceptability and stability of the coding process, as values above 0.60 are generally considered reliable.

For data analysis, the scenario writing approach was adopted. The specific technique utilized was the Intuitive Logics method, as developed by Peter Schwartz (1991) and operationalized through the widely recognized eight-step approach by the Stanford Research Institute International. This method is a creative-narrative technique that leverages the tacit knowledge and intuition of experts to develop plausible futures under conditions of high uncertainty. It focuses on decision-making for an unpredictable future and seeks to develop new strategic narratives (Wilson, 1998). The process involved transcripting and coding the interview content, extracting key factors, and analyzing their interrelationships using a cross-impact matrix in MICMAC software to ultimately identify critical uncertainties and build the scenarios.

Results

The findings of this study are presented in three distinct phases, corresponding to the stages of analysis: (1) Qualitative Analysis and Factor Extraction, (2) Quantitative Analysis using the Cross-Impact Matrix (MICMAC), and (3) Identification of Key Uncertainties and Scenario Development.

3.1. Qualitative Analysis and Factor Extraction

The analysis began with a qualitative examination of the interview data. The content of all interviews was transcribed and coded using a key-point coding method. This involved a line-by-line analysis of the texts to identify primary concepts and themes. Initial coding of expert interviews yielded over 75 unique codes. These codes were subsequently reviewed, discussed, and refined by a panel of several experts. Through an iterative process of combination and categorization, these codes were synthesized into a final set of 21 key factors identified as critical for the future of sports technology in Iran. These factors are listed in Table 1.

3.2. Quantitative Analysis with Cross-Impact Matrix (MICMAC)

The 21 identified factors were subsequently analyzed using the cross-impact analysis method within the MICMAC software environment. A 21x21 matrix was constructed to assess the influence and dependence relationships between each pair of factors. In this matrix, the sum of a factor's row indicates its influence power, while the sum of its column indicates its dependence power. The scores for each factor are presented in Table 1.

Table 1. Scores of Influences and Dependence for Future Factors of Sports Technology in Iran

No.	Factors	Influence	Dependence
1	Implementing new revenue generation models	22	16
2	Using artificial intelligence to optimize athlete performance	13	13
3	Using virtual reality (VR) in training environments	12	14

4	Using Internet of Things for managing sports facilities, improving spectator experience, optimizing operations, increasing productivity, and monitoring athlete performance	27	9
5	Personalizing sports products and services for individuals and improving customer satisfaction	24	19
6	Prevalence of e-sports as one of the global entertainment industries	4	9
7	Injury prediction and prevention through biomechanical and physiological data analysis	1	17
8	Enhancing spectator engagement with virtual and augmented reality technologies	9	13
9	More efficient management of sports events with smart online ticketing and traffic management	16	17
10	Brand strengthening through technology and better audience engagement in clubs and federations	5	18
11	Challenges of security risks and privacy violations	2	30
12	Data collection and analysis to improve game strategies	11	19
13	Fan management through behavioral pattern analysis	14	15
14	Monitoring athletes' physical condition via smart clothing and shoes	14	12
15	Optimizing training and accelerating recovery with advanced sensors	8	15
16	Using blockchain and NFTs (Non-Fungible Tokens) in sports to increase transparency in player contracts and prevent corruption/money laundering	14	5
17	Development of smart stadiums	24	10
18	Smartening talent management processes	4	12
19	Smart governance of sports centered on continuous data updating	33	7
20	Supporting small businesses with virtual/augmented reality technologies	4	19
21	Delivering sports services via phone-based software and developing sports technology startups	6	21

The position of each factor within the influence-dependence map (Figure 1) reveals its systemic role as below:

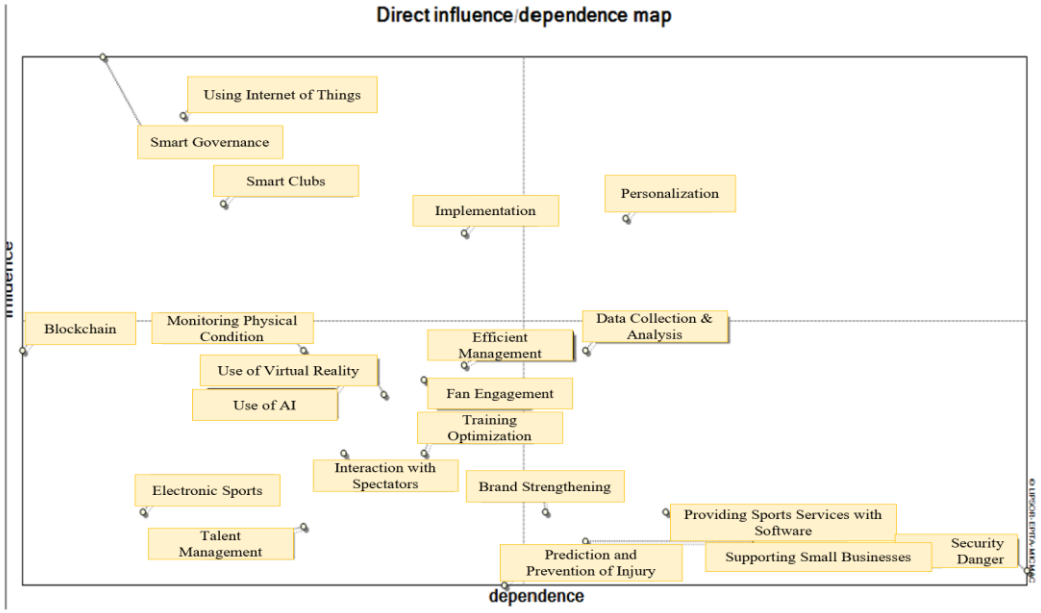

Figure 1. Structural Analysis Matrix Based on Influence and Dependence Levels

Influential Factors (Northwest Sector): Factors with high influence and low dependence. These are key drivers of the system. This quadrant included: Smart governance of sports (Factor 19), Using Internet of Things (Factor 4), Development of smart stadiums (Factor 17), and implementing new revenue models (Factor 1).

Dependent Factors (Southeast Sector): Factors with low influence and high dependence. These are outcome variables. This quadrant included: Challenge of security risks (Factor 11), Delivering sports services via phone-based

software (Factor 21), and Brand strengthening (Factor 10).

Linkage Factors (Northeast Sector): Factors with high influence and high dependence. These are unstable factors that can greatly affect and be affected by the system. The factor of Personalizing sports products and services (Factor 5) was identified here.

Autonomous Factors (Southwest Sector): Factors with low influence and low dependence. These factors are relatively disconnected from the system. This quadrant included factors such as Injury prediction and prevention (Factor 7) and Prevalence of e-sports (Factor 6).

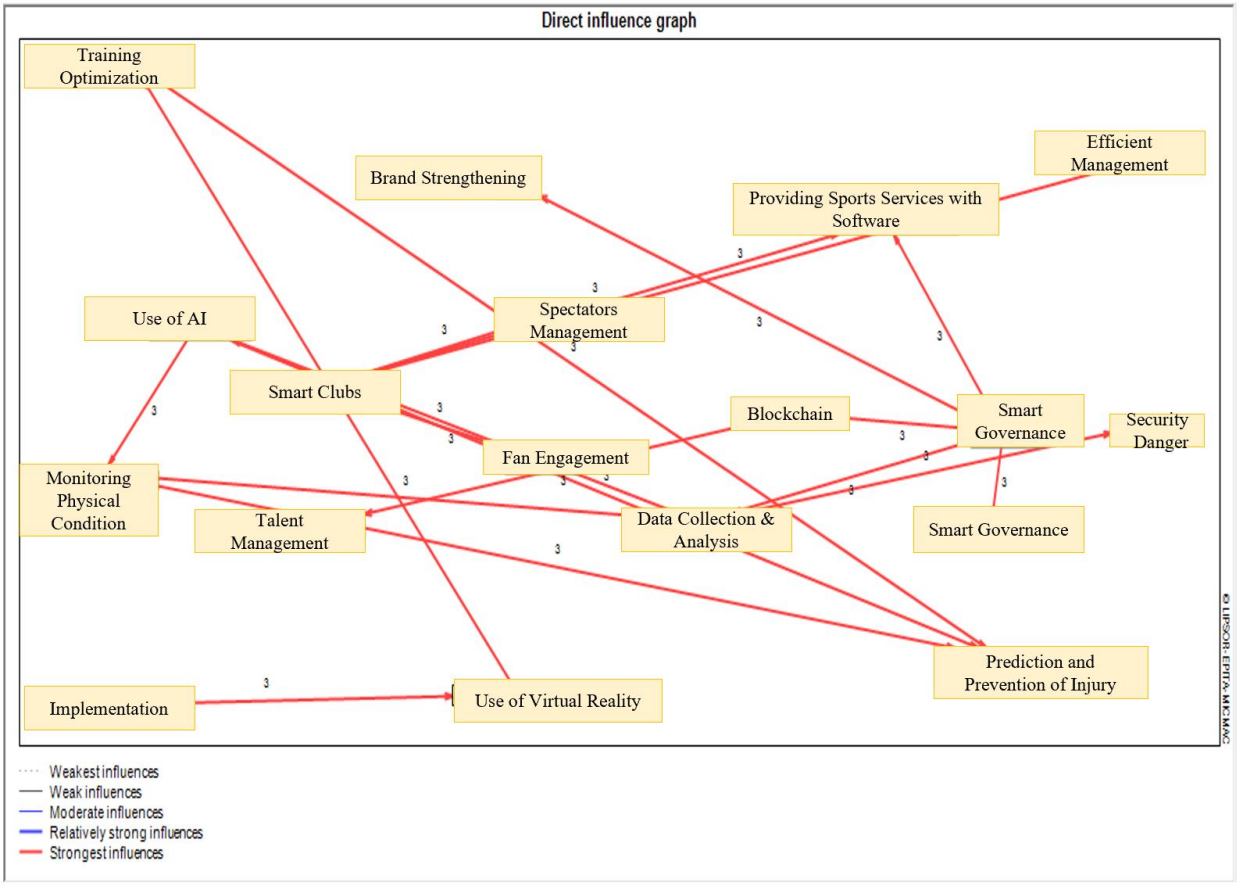

Figure 2. Direct Relationships Between Factors

Figure 2 illustrates the dense web of direct relationships and influences between these factors, confirming the complex and interconnected nature of the sports technology ecosystem in Iran.

3.3. Identification of Uncertainties and Scenario Development

Following the structural analysis, a questionnaire was developed to assess the 21 factors based on their importance and their degree of uncertainty. Experts were asked to score each factor, leading to the identification of the most critical uncertainties.

The factors with the highest uncertainty scores were: (1) Personalizing sports products and services (Factor 5), (2) Addressing the challenge of security risks and privacy violations (Factor 11), and (3) Smart governance of sports centered on continuous data updating (Factor 19). From these, the two most uncertain and influential factors were selected as the axes for scenario building:

1. Axis 1: Smart Governance of Sports (modern vs. traditional)
2. Axis 2: Delivery of Sports Products and Services (personalized vs. generic)

The combination of these two axes, each with two possible states, defines a classic scenario matrix and yields four distinct plausible futures for sports technology in Iran over a ten-year

horizon (Figure 3):
1. The New Age Scenario: Modern governance & Personalized delivery.
2. The Age of Stagnation Scenario: Traditional governance & Generic delivery.
3. The Age of Confusion Scenario: Modern governance & Generic delivery.
4. The Age of Incongruity Scenario: Traditional governance & Personalized delivery.

Discussion

This study aimed to develop strategic scenarios for the future of sports technology in Iran, identifying key uncertainties through a rigorous qualitative and cross-impact analysis. The findings provide a structured framework for navigating the complex and evolving technological landscape in Iranian sports. The core of our analysis rests on two pivotal uncertainties derived from the expert data: the model of smart governance of sports (centered on continuous data updating) and the approach to personalizing sports products and services.

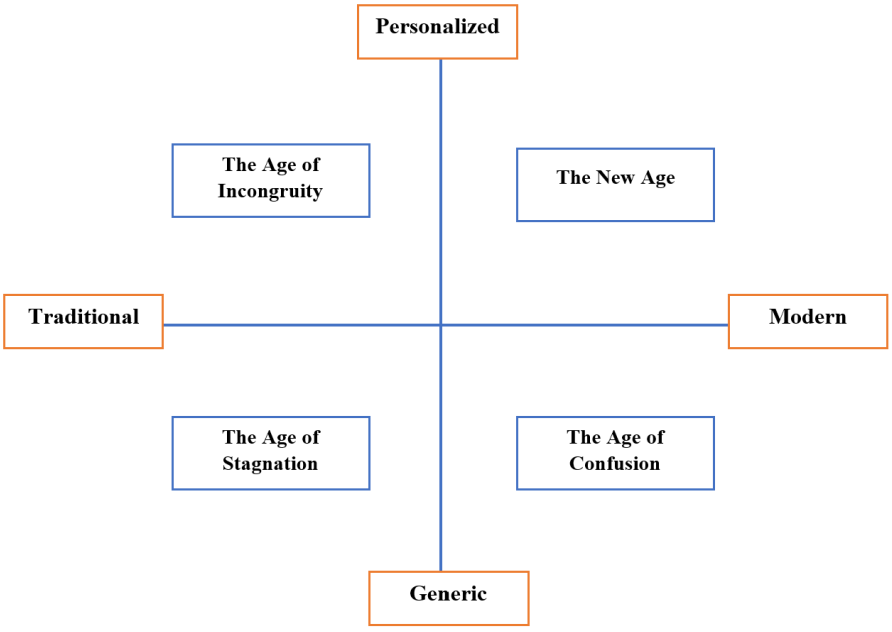

Figure 3. Scenario Planning for the Future of Sports Technologies in Iran over a Ten-Year Horizon

The cross-impact analysis (MICMAC) revealed the fundamental drivers of this system. The most influential factors, in order, were: (1) smart governance of sports, (2) using Internet of Things for facility management and experience enhancement, and (3) personalizing sports products and services. These factors, characterized by their high influence and low dependence, act as critical leverage points; strategic interventions here can drive widespread change throughout the entire sports technology ecosystem in Iran. Furthermore, expert scoring of uncertainty identified these same factors—particularly smart governance and personalization—as the most unpredictable and critical for shaping the future. It is the interplay between these two highly influential yet uncertain dimensions that forms the logical basis for our scenario matrix, generating four distinct plausible futures: The New Age, The Age of Stagnation, The Age of Confusion, and The Age of Incongruity.

The New Age Scenario, characterized by modern data-centric governance and personalized service delivery, represents the optimal future. This scenario aligns with global research indicating that artificial intelligence and data analytics are paramount in creating personalized customer experiences and enhancing business performance in digital sports marketing (Pashaei et al., 2024; Tung, 2024). The findings of Rane et al. (2023) further corroborate this, showing that AI-driven personalization significantly increases customer

satisfaction and loyalty. This scenario envisions a future where the Iranian sports industry successfully leverages technology to build deep, resonant relationships with its audience.

Conversely, The Age of Stagnation Scenario depicts a future of traditional governance and generic services. This scenario underscores the risk of technological backwardness and diminished competitiveness when institutions fail to embrace data-driven decision-making and modernize their engagement strategies. The absence of smart governance can facilitate arbitrary and subjective decisions, a challenge that currently hinders scientific policy formulation in Iranian sports. This finding emphasizes the critical role of strategic, evidence-based leadership, as highlighted in broader sports management literature (Schmidt, 2020).

The Age of Confusion Scenario emerges from a mismatch between modern governance systems and a generic service approach. This scenario illustrates a critical insight: adopting technology infrastructure is insufficient without a concurrent strategic focus on the end-user experience. Organizations may invest in data collection systems but lack the strategy or capability to translate that data into personalized, value-added services for customers and fans. This can lead to cognitive confusion and wasted resources, as the potential of the technological infrastructure remains unrealized.

Finally, The Age of Incongruity Scenario reveals the frustrations of a demand for personalized experiences without the enabling governance and data infrastructure. Here, downstream entities (e.g., clubs, startups) may strive to meet modern expectations for customization, but are stifled by the lack of a supportive, integrated, and updated national data ecosystem. This misalignment creates a gap between market desires and operational capabilities, preventing the establishment of a coherent and effective technological environment. This scenario stresses that personalization is not merely a marketing tactic but is fundamentally dependent on robust upstream data governance.

The emphasis on smart governance aligns with global calls for data-driven approaches in sports development. Deng et al. (2022) noted that sports digitalization plays a significant role in progress, while Kaiser (2024) describes smart governance as a new progressive approach that prioritizes information and maintains high standards of public management. For Iran, establishing an integrated national data collection system, considering the structural diversity of its sports organizations, is not merely a recommendation but a prerequisite for escaping stagnation and incongruity and moving toward a prosperous "New Age."

Furthermore, the factor concerning the use of Internet of Things (IoT) for managing facilities and enhancing spectator experience was also among the most influential. This supports international findings on the transformative role of IoT in creating intelligent environments, improving operational efficiency, and revolutionizing fan engagement (Li, 2023; Qi et al., 2024). The underdevelopment of sports venues in some regions may indeed stem from neglecting critical technological domains like IoT. Therefore, alongside governance and personalization, strategic investment in IoT infrastructure is a key recommendation for optimizing operations and creating more engaging and efficient stadiums, as discussed by Zha (2023) and Du et al. (2023).

In conclusion, this study demonstrates that the future of sports technology in Iran is not predetermined but will be shaped by critical choices in governance and customer engagement. The proposed scenarios offer a strategic tool for policymakers to visualize the consequences of these choices. To navigate towards the most desirable future (The New Age), practical steps include developing algorithms for data analysis, utilizing AI for personalization, establishing integrated data systems, and fostering public-private partnerships to drive innovation. This research expands the discourse on sports technology by providing a contextualized, foresight-based framework specifically for Iran, highlighting the inseparable link between technological adoption and strategic governance.

Conclusion

This research has undertaken a systematic and rigorous exploration of the future landscape of sports technology in Iran, employing a sophisticated scenario-based foresight methodology grounded in the Intuitive Logics approach. The primary objective was to move beyond simplistic predictions and instead construct a set of plausible, challenging, and relevant narratives that can serve as a strategic compass for policymakers, managers, and investors within the Iranian sports industry. Over a ten-year horizon, the study successfully identified the critical forces and uncertainties that will shape this dynamic ecosystem, culminating in a framework of four distinct scenarios. The analysis reveals that the future is not a single, predetermined path but a spectrum of possibilities defined primarily by the interplay of two pivotal uncertainties: the approach to smart governance of sports, centered on the perpetual updating and strategic utilization of data, and the degree of personalization in sports products and services offered to individuals. The intersection of these two axes creates a matrix that defines the four potential futures: the New Age (modern governance, personalized services), the Age of Stagnation (traditional governance, generic services), the Age of Confusion (modern governance, generic services), and the Age of Incongruity (traditional governance, personalized services).

The findings of this study underscore that the most desirable and optimal future, encapsulated in the "New Age" scenario, is contingent upon a synchronized and deliberate strategic shift across multiple fronts. It requires not only the adoption of advanced technologies but, more importantly, a fundamental transformation in institutional mindset and operational paradigms. This scenario envisions a future where a data-driven governance model is seamlessly integrated with a deep, organizational commitment to delivering hyper-personalized user experiences. This alignment is paramount. The research demonstrates that technology alone is an insufficient catalyst for transformation; its ultimate success and impact are intrinsically linked to visionary, evidence-based leadership and a genuinely customer-centric philosophy. This conclusion finds strong support in the global literature. For instance, the work of Pashaei et al. (2024) and Tung (2024) demonstrates that artificial intelligence technologies are revolutionizing digital sports marketing by enabling unprecedented levels of personalization and customer interaction through the analysis of consumer data and the creation of detailed profiles. Similarly, Rane et al. (2023) confirm that AI-driven strategies significantly enhance customer satisfaction, foster loyalty, and ultimately improve business performance in acquisition and retention. Therefore, a central strategic imperative arising from this study is the critical need to develop and deploy sophisticated sports technology algorithms capable of conducting precise analysis of customer data to enable these personalized experiences. Furthermore, the utilization of intelligent chatbots for handling customer inquiries and providing relevant recommendations is put forward as a practical application of this principle.

A fundamental enabler of this envisioned future is the establishment of a robust, integrated national data collection system. This system must be designed with a keen awareness of the structural diversity and often fragmented nature of organizations and institutions related to sports in Iran. The current research indicates that the absence of such a cohesive system facilitates arbitrary and subjective decision-making, a significant challenge that presently impedes scientific policy formulation and strategic development in Iranian sports. This study argues that smart governance, as conceptualized by Kaiser (2024), represents a new, progressive, and data-driven approach that prioritizes information in operations and maintains exceptional standards of public management. It is a paradigm that contributes directly to development across various domains, including sports. The implementation of such governance requires the active use of technologies to deploy digital initiatives aimed at creating a new model for sports service delivery. The essential prerequisite for this is the capability to integrate diverse environments within a unified, data-driven smart governance framework, a challenge that this research highlights as both critical and

urgent for Iran.

Beyond the core uncertainties, the cross-impact analysis (MICMAC) highlighted other influential factors that demand strategic attention. The use of Internet of Things (IoT) for managing sports facilities, optimizing operations, and significantly enhancing the spectator experience emerged as a major driver of change. Emerging technologies like IoT are bringing about fundamental transformations in training methods, competitive environments, and social interactions within sports. These tools provide athletes, coaches, and managers with precise and personalized data that can be leveraged to enhance performance, prevent injuries, and create deeply interactive and immersive experiences for fans and spectators. The research of Li (2023) on IoT-based smart stadium systems and the findings of Qi et al. (2024) on digital technologies in sports provide robust external validation for this finding, indicating that IoT-supported systems can intelligently control facilities, improve operational performance, and have a markedly positive impact on the overall experience. Consequently, strategic investment in this enabling infrastructure is a key recommendation for optimizing operations and creating more engaging, efficient, and safe stadiums and training centers. However, fully realizing the potential of IoT and similar technologies in the Iranian context requires establishing appropriate infrastructure and securing supportive investment. This includes investment in research and development, the creation of global standards, and careful attention to the social and ethical dimensions of technological adoption.

In a broader sense, this research concludes that sports, as a unique social phenomenon, have become inextricably intertwined with modern technology. The productivity and efficiency of professional sports programs in the future will be deeply dependent on the awareness and application of technology, as noted by scholars like Dhankhar and Sharma (2023). Therefore, businesses, sports organizations, and recreational entities must align their communications, programs, services, and human resources with this technological reality to succeed in their activities. The integration of technology and data in sports brings significant consequences across all aspects of the industry, transforming how sports organizations interact with fans, optimize their operations, and develop successful strategies. Personalized fan experiences become a tangible reality as data analytics enable sports entities to tailor interactions, marketing campaigns, and content to individual preferences. This personalization not only increases fan satisfaction but also enhances loyalty and boosts revenue through targeted merchandise and ticket sales. On the operational front, data analysis empowers organizations to streamline stadium operations, reduce wait times, and improve resource allocation, leading to cost savings and safer events.

Ultimately, this study provides a structured, contextually grounded framework for navigating the complexities of the future. It argues that the future of sports technology in Iran is not a matter of fate but a landscape of agency, shaped directly by the strategic choices made today in governance, investment, and customer engagement. The presented scenarios are not mere abstractions but tools for building resilience and fostering proactive strategy development. The path to the prosperous "New Age" scenario requires a deliberate, coordinated, and sustained commitment to data-centricity, personalization, and strategic infrastructure investment. By embracing this framework, policymakers and managers can move from passive adaptation to proactive transformation, turning the present uncertainty into a horizon of opportunity and shaping a competitive, inclusive, and technologically-enabled sports ecosystem for Iran in the coming decade.

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