A Multi-Level Model of Innovation Capacity Building in a Digital Context to Improve the Venue Utilization and the Reach of Sports Recreation Tourism Spaces

Short Title: A Multi-Level Model for Digital Innovation in Sports Tourism Venues

ABSTRACT

Purpose: This research aims to identify and model structural-interpretive factors affecting innovation capacity in a digital context, aiming to enhance venue utilization and destination reach of recreational sports facilities.

Design/methodology/approach: The study population consisted of academic experts with practical experience, specifically sports management professors who are actively engaged in tourism and sports recreation. Using purposive sampling, 19 experts were selected for Interpretive Structural Modeling (ISM). Initially, a qualitative thematic analysis identified 11 influential factors. Later, these factors informed the development of a pairwise comparison questionnaire aligned with ISM methodology. Structural Interpretive Modeling and MICMAC analysis were used to analyze the collected data, categorizing factors into five hierarchical levels.

Findings: The ISM analysis categorized factors into five interconnected levels. Level five comprises foundational elements: entrepreneurial ecosystem capacities and technological-contextual challenges for innovation in sports tourism. Level four includes building innovation capacity within the industry-market and empowering sports tourism businesses. Level three involves the digital capabilities of business systems and the digital infrastructure of sports tourism destinations. Level two emphasizes optimizing venue utilization, enhancing the technical aspects of recreational spaces, and improving overall space utilization. Finally, level one consists of management capabilities for destination boards and enhancing the capacities of tourism boards in sports tourism. These factors demonstrate a hierarchical interaction, with foundational elements at level five influencing the operational outcomes at level one.

Originality: This study highlights the multi-dimensional and hierarchical nature of innovation capacity driven by digital transformation in sports tourism. The developed ISM framework provides a structured approach for future research and practical planning, emphasizing the importance of integrating innovation and digital technologies to enhance performance management and maximize tourism potential in recreational sports destinations.

Keywords
Destination Reach; Sport Innovation; Sport Tourism, Tourism Technology; Venue Utilization.

Paper type: original research

مدلی چندسطحی برای ظرفیت‌سازی نوآوری در بستر دیجیتال برای بهبود بهره‌برداری از اماکن و گسترش دامنه دسترسی به فضاهای گردشگری ورزشی تفریحی

عنوان کوتاه مقاله: مدل چندسطحی ظرفیت‌سازی نوآوری دیجیتال در گردشگری ورزشی

چکیده

هدف: این تحقیق با هدف شناسایی و مدل‌سازی عوامل ساختاری-تفسیری مؤثر بر ظرفیت نوآوری در زمینه دیجیتال، با هدف افزایش بهره‌برداری از مکان و دسترسی به مقصد از امکانات ورزشی تفریحی انجام شده است.

روش: جامعه مورد مطالعه را کارشناسان دانشگاهی با تجربه عملی، به‌ویژه اساتید مدیریت ورزشی فعال در گردشگری و تفریحات ورزشی تشکیل دادند. برمبنای روش نمونه‌گیری هدفمند، ۱۹ خبره برای مدل‌سازی ساختاری تفسیری (**ISM**) انتخاب شدند. در ابتدا، از طریق یک تحلیل موضوعی کیفی، ۱۱ عامل تأثیرگذار شناسایی شدند. متعاقباً، این عوامل با طراحی یک پرسشنامه مقایسه زوجی همسو با روش **ISM** در اختیار این خبرگان قرا رگرفت. برای تجزیه و تحلیل داده‌های جمع‌آوری‌شده، از مدل‌سازی تفسیری ساختاری و تحلیل **MICMAC** استفاده شد و عوامل در پنج سطح سلسله مراتبی طبقه‌بندی شد.

یافته‌ها: تحلیل **ISM** عوامل را در پنج سطح به هم پیوسته دسته بندی کرد. سطح پنج شامل عناصر اساسی است: ظرفیت‌های اکوسیستم کارآفرینی و چالش‌های تکنولوژیکی - زمینه‌ای برای نوآوری در گردشگری ورزشی. سطح چهار شامل ظرفیت سازی نوآوری در صنعت و بازار و توانمندسازی کسب و کارهای گردشگری ورزشی است. سطح سه شامل قابلیت های دیجیتالی سیستم های تجاری و زیرساخت دیجیتال مقاصد گردشگری ورزشی است. سطح دو بر بهینه سازی استفاده از محل برگزاری، بهبود فنی فضاهای تفریحی و بهبود بهره برداری کلی از فضا تأکید دارد. در نهایت، سطح یک شامل قابلیت‌های مدیریتی برای هیئت‌های مقصد و ارتقای ظرفیت‌های هیئت گردشگری در گردشگری ورزشی است. این عوامل یک تعامل سلسله مراتبی را نشان می دهند، با عناصر بنیادی در سطح پنج که بر نتایج عملیاتی در سطح یک تأثیر می گذارد.

اصالت و ابتکار مقاله: این مطالعه ماهیت چند بعدی و سلسله مراتبی ظرفیت نوآوری ناشی از تحول دیجیتال در گردشگری ورزشی را برجسته می کند. چارچوب توسعه‌یافته **ISM** یک رویکرد ساختاریافته برای تحقیقات آتی و برنامه‌ریزی عملی ارائه می‌کند و بر اهمیت یکپارچه‌سازی فناوری‌های دیجیتال و نوآوری برای بهینه‌سازی مدیریت عملکرد و به حداکثر رساندن پتانسیل گردشگری در مقاصد ورزشی تفریحی تأکید می‌کند.

کلید واژه‌ها

استفاده از محل برگزاری، دسترسی به مقصد، فناوری گردشگری، گردشگری ورزشی، نوآوری ورزشی

1. Introduction

Sports tourism, as a growing industry, plays an important role in the economic, social, and cultural development of countries. Iran, with its diverse natural, historical, and cultural attractions, has significant potential for the development of sports tourism. Given the increasing importance of the sports tourism industry in the global economy and Iran's high potential in this field, optimizing the utilization of sports tourism destinations in Iran is crucial. The main goal of this research is to enhance the capacity of sports tourism destinations and, consequently, increase Iran's share in the global sports tourism market. Despite this potential, sports tourism destinations in Iran face challenges such as a lack of infrastructure, absence of comprehensive planning, and insufficient diversity in tourism products. For instance, some recreational sports facilities may not be structurally suitable for transformation into proper sports places. Additionally, obtaining the necessary permits for changing the use of buildings may be time-consuming and complex. Furthermore, renovating old spaces requires investment (Jahan et al., 2024). Therefore, optimizing the utilization and expanding the reach of sports tourism destinations, which requires the modification and improvement of existing spaces and facilities, should be aimed at better meeting the needs of sports tourists while also contributing to the sustainable development of the region (Ahmady et al., 2024). In the literature, there are several different approaches to optimizing sports and tourism spaces (Đurkin Badurina et al., 2021). One of these approaches is the economic approach, which emphasizes the positive impacts of sports and tourism on economic growth and job creation.

Research indicates that optimizing sports and tourism spaces can help attract investment and foster the development of local businesses, leading to the economic growth of tourist regions. The social approach, on the other hand, focuses on the impacts of optimizing sports and tourism spaces on local communities. This approach examines how tourists interact with the local community, the cultural and social impacts of sports and tourism, and the challenges related to preserving the cultural and social identity of communities (Mahmoudi pati, 2024). Furthermore, the previous studies have revealed that optimizing sports and tourism spaces can help strengthen local identity and increase community participation in tourism processes. On the other hand, the environmental approach in the research literature also focuses on the optimization of tourism spaces (Amore, 2019). This approach examines the effects of tourism on the environment and the challenges related to environmental sustainability (Pourahmad et al., 2022). Research highlights that the optimization of tourism spaces should be carried out in accordance with sustainability principles and environmental protection to reduce the negative impacts of tourism and preserve natural resources. The optimization of venue utilization refers to the process of changing the use or redesigning existing spaces to make the best use of them and address new needs. This concept is particularly relevant in urban planning, architecture, and interior design, and can involve converting old buildings into new spaces, transforming unused areas into public spaces, or repurposing commercial spaces into residential ones (Shamaii et al., 2019).

Optimization of venue utilization refers to repurposing existing buildings or spaces to create new sports facilities and infrastructure. This process can be carried out in various ways, leading to the development of attractive and functional spaces for sports and recreation (Hoxhaj, 2024). Optimization of underutilized venue refers to modifying and improving these areas in a way that best meets the needs of tourists and enhances participant engagement and presence (Ashouri et al., 2024). This process can involve multiple stages and strategies. The first stage of optimization is assessing the current condition of underutilized sports spaces. This assessment includes identifying weaknesses, needs, and the preferences of tourists. Following this, space redesign can be implemented (Roustaei et al., 2021; Zembri-Mary & Engrand-Linder, 2023). Additionally, creating multifunctional spaces that can host sports, cultural, and social events can enhance tourists' engagement with these areas. The third stage is improving access to sports venues. This includes developing public transportation routes, providing adequate parking, and ensuring easy access for individuals with special needs. Tourists should be able to reach these spaces conveniently to have a positive visiting experience, ultimately enhancing their overall tourism satisfaction (Nobahar Ghezeljeh Meydan & Hakimi, 2024). Tourism reach refers to the scope and extent to which a tourist destination can attract and retain visitors. This concept encompasses tourist attractions such as historical, natural, and cultural sites and activities that draw tourists in. Additionally, services and facilities such as hotels, restaurants, and transportation, which influence the quality of customer experience, are other important aspects of tourism reach. Accessibility of the destination, effective marketing and advertising, attention to sustainable development, and positive interaction with local communities are also key factors that can contribute to the success of any destination in attracting tourists. In general, tourism reach refers to a destination's ability to

provide an engaging and lasting experience for tourists, which can be influenced by economic, social, cultural, and environmental factors (Kun, et al., 2025) .

Innovation and technology in the tourism industry encompass concepts, theories, and models that help analyze and understand the role of innovation within this sector. Some related theories have an economic approach, focusing on the impact of innovation and technology on the tourism economy of countries and communities, including job creation, revenue generation, and infrastructure development. Other theories address the social and cultural dimensions and impacts of innovation and technology in tourism, particularly on host communities and travelers, such as cultural exchange and social changes. Other theories take an environmental approach, focusing on the positive and negative impacts of tourism technology on the environment and promoting sustainable tourism. Models have also been developed for the utilization and reach of tourism destinations, such as the Destination Life Cycle Model, which examines the various stages of a destination's development and utilization, including exploration, development, maturity, and decline. Additionally, tourism demand models analyze factors affecting tourism demand, including market factors and customer demographics. Enhancing the theoretical foundations of innovation and technology in this industry can aid in better decision-making regarding sustainable development and effective resource management, making research in this area particularly important (Seifollahi, 2021). Innovation is the practical implementation of ideas that lead to the introduction of new goods or services or improvements in the delivery of existing ones. A common element in definitions is the focus on novelty, improvement, and the expansion of ideas or technologies. Innovation, in fact, is a collective process achieved by involving human and social capital, specifically stakeholders, in organizational creativity and innovation (Seifollahi, 2021). In this regard, tourism innovation and technology can be defined as a set of tools and methods that, by providing digital infrastructure, creative products, and innovative services, can facilitate customer attraction and retention, and make travel for various purposes to recreational and commercial destinations possible in new and engaging ways(Nosratpanah et al., 2024). The capacity building of innovation and technology in tourism businesses refers to a systematic approach with technological and creative capabilities to generate revenue, either through the production or the supply and sale of products and services in the field of leisure and tourism (Barna & Biletska, 2021). In this regard, the experiences of the tourism and sports industries worldwide over the past decade, especially during the crisis caused by the COVID-19 pandemic and its aftermath, have shown that innovation and technology play a crucial role in managing unstable environmental conditions and the competitiveness of businesses (Higgins-Desbiolles, 2020). For instance, the World Travel and Tourism Council (WTTC) reports, during the COVID-19 period from 2019 to 2021, only businesses with digital and creative capabilities were able to demonstrate resilience against the economic downturn caused by the pandemic. In fact, innovation and technology play a crucial role in maintaining tourism reach and the adaptability of destinations and their associated businesses. Moreover, digital transformation and open innovation have become a scientific paradigm and a dynamic business approach in the global tourism industry, serving as one of the key factors for its high competitiveness (Dias et al., 2023).

The review of the research literature includes two sections: domestic and international studies. The studies conducted in other countries: (King et al., 2015) demonstrated in their study on the decline of the attractiveness of sports tourism destinations that changing the image of a destination for sports tourists, especially after participating in sports events, requires the redesign of sports spaces and event programs. (De Martini Ugolotti, 2017) examined the role of urban space redevelopment in enhancing street sports programs in Turin, Italy. (Henderson, 2017) investigated the development and renovation of event venues to promote sports tourism in the UAE and Qatar. (Wise & Perić, 2017) explored the reconstruction of sports tourism spaces and their social impacts in Croatia. (Ladu et al., 2019) studied the role of sports venues in urban optimization in Cagliari, Italy, with a focus on sustainable development. (Kim & Bramwell, 2019), in their study on urban optimization policy for tourism development, reported that the main challenge lies in the boundaries of regions and spaces, and the key strategy in this field should focus on facilitating the integration of spatial boundaries. (Davis, 2019) examined the foresight of urban redevelopment for the urban heritage of the London Olympic Games during the period from 2008 to 2018. (González et al., 2019), in a study titled "Digital Marketing as an Advertising Strategy for Recreational Services in Ecuador", stated that digital tools ensure the enhancement and optimization of search processes, tourist convenience, and the reduction of time and costs. In their study on the relationship between digital marketing and the recreational services industry in Vietnam, (Cuomo et al., 2021) evidenced that the core capacities of the recreational services industry in Vietnam and aspects of digital marketing have the greatest impact on this sector. (Duxbury et al., 2020) explored models for developing regenerative tourism towards sustainable and creative tourism. (Davis, 2019)

examined the role of urban sports center redevelopment in enhancing the social functions of sports. In an applied study, (Broshi-Chen & Mansfeld, 2021) discussed the call for innovation in the management of tourism crisis and the impact of creative and unnecessary innovation. Investigating the strategic management of innovation development in tourism businesses with a multi-systematic approach, (Barna & Biletska, 2021) showed that innovation in the business supply chain plays a crucial role in overcoming crises. (Đurkin Badurina et al., 2021) reported on the optimization capacities of rural areas for sports events through local participation. (Ahmad et al., 2022) examined the role of innovation in the sustainability of tourism and reported that environmentally friendly tourism is dependent on innovation and entrepreneurship. (Dias et al., 2023) considered the development of sustainable tourism businesses to be dependent on acquiring local knowledge and the entrepreneurship of tourism lifestyles through updated business models. (Park et al., 2023) in their critical review of service innovation in the tourism industry highlighted the necessity of focusing on innovation and technology-based services in current studies and future research programs. presence (Bellato et al., 2023) presented a conceptual framework for redesigning tourism spaces to revive tourism. (Rocha & Cao, 2023) probed the impact of urban regeneration on small businesses' readiness for hosting the 2022 Beijing Winter Olympics. (Zembri-Mary & Engrand-Linder, 2023) explored the optimization of urban spaces for hosting the Olympics (Paris 2024, London 2012, and Athens 2004). (Elshaer & Marzouk, 2024) reported the significant role of innovations and technologies in tourism businesses and smart technologies in hospitality on tourists' experiences. (Wang et al., 2024) found that the influencing factors and processes of innovation in cultural tourism destinations are dependent on the capacity and cultural heritage of the region. (Hoxhaj, 2024) examined the role of sports infrastructure reconstruction in optimizing contemporary cities and showed that the optimization of urban sports spaces leads to an improvement in urban livability.

The studies conducted in Iran: (Pourahmad & Hosseini, 2015)reported on the optimization of dilapidated urban spaces with an emphasis on leisure spaces in the urban areas of Tehran. (Mahmoudi-Safid-Kuhi, 2018) examined the spatial optimization of urban neighborhoods with a focus on social sustainability in Babolsar. (Alavi et al., 2018) analyzed the distribution pattern of sports centers and their spatial organization in District 10 of Tehran. (SHAMAII et al., 2019) investigated the role of optimizing the old urban space of Ardakan in the development of urban tourism. (balali oskoi & dehghan, 2020) observed a significant relationship between the redesign of historical-cultural spaces and the development of the urban tourism industry. (Taghizadeh Salman, 2020)assessed the prioritization of effective tourism development strategies for optimizing the northern area of Naqsh-e Jahan Square in Isfahan. (Roustaei et al., 2021) examined mixed-use applications in deteriorated spaces with low utilization in District 18 of Tehran. (Pirbabaei & Bahaloo, 2023)examined the optimization of culture-based historical spaces with an emphasis on attracting tourists in Tabriz. (Rasoolnazi et al., 2022)investigated the role of community and local capacities in optimizing underutilized urban spaces in Urmia. (Pourahmad et al., 2022) conducted a review and qualitative content analysis of the theoretical foundations of urban optimization. (Alizad Gohari et al., 2023)evaluated the spatial components influencing tourist presence in the commercial spaces of Naqsh-e Jahan Square, Isfahan, based on informal relationships. (Ahmady et al., 2024) explored the optimization components of underutilized urban spaces based on the morphological dimensions of Ahvaz. (Nobahar Ghezeljeh Meydan & Hakimi, 2024) examined the role of transit-oriented development in optimizing urban land use (Tabriz Metro Station). (Jahan et al., 2024) provided a framework for sports tourism destination planning with a focus on enhancing tourist loyalty in Ardabil. (Mahmoudi pati, 2024) presented an integrated process model for evaluating tourism as a tool for urban optimization. (Ashouri et al., 2024) reported on the analysis of venue utilization in Sari from the perspective of the creative city strategy.

A review of the research highlights a significant gap in knowledge and studies regarding capacity-building and the integration of innovation and digitalization to optimize the use of recreational sports spaces for maximizing tourism impact. This gap underscores the need for interdisciplinary research in this field. In domestic studies, one of the most notable shortcomings is the absence of comprehensive and systematic exploratory research. Most existing studies have focused on specific aspects of the topic rather than providing a holistic and in-depth analysis. In addition, the lack of specialized conceptual models is another significant gap. This shortcoming can hinder the precise identification and analysis of tourists' needs and preferences. Furthermore, many existing studies do not address the impact of innovation and digital technology on optimizing sports spaces for tourism, leaving this as an unexplored research gap. Globally, although some countries have conducted research on optimizing sports spaces, there is still a need for further studies in this area. In particular, the impact of innovation and technology on the utilization of these spaces and their influence on the tourism sector has not yet been fully explored. This research adopts an exploratory theoretical approach and aims to propose a multi-level conceptual framework for analyzing and examining

the chain of determining factors in the process of capacity-building for innovation based on digital platforms. The goal is to enhance the venue utilization and broaden tourism impact in large-scale sports and recreational spaces across the country. Research benefits various groups, including researchers, industries and businesses, governments and policymakers, communities and individuals, educational institutions, environmental and social initiatives, sports organizations, urban managers and municipalities, and sports tourists. Researchers utilize it to expand their knowledge, while businesses leverage findings for innovation and growth. Governments and policymakers make informed decisions based on research data, and communities benefit from advancements in healthcare, technology, and education. Educational institutions use research for academic development, while environmental and social projects aim for sustainability and social progress. Sports organizations apply research to enhance athletes' performance and improve sports policies, urban managers and municipalities use research data for better city planning, and sports tourists can gain better experiences through specialized studies.

2. Methodology

This study employs a structural-interpretive modeling approach with an applied objective. The research population includes experts and analysts in the research subject, including professors, researchers, and university lecturers with a Ph.D. in sports management, as well as professionals active in the sports tourism industry (members of sports tourism associations and provincial committees, employees of municipal sports organizations, managers of recreational sports facilities, and others). Participants were selected using a purposive sampling method, based on their expertise in the subject matter. The sample size was estimated based on the adequacy criteria for the structural-interpretive method (between 10 to 20 experts), with a total of 19 participants. The sample consisted of 13 men and 6 women, with an average work experience of 16.31 years. The research tool was a pairwise comparison questionnaire for 11 variables identified in the qualitative phase. The questionnaire was structured within the ISM matrix framework and was distributed to the sample members (5 received printed copies, and 14 received electronic copies). The pairwise comparison questionnaire is used to determine the mutual effects of factors on each other. Since the structural-interpretive framework is a standard matrix and all possible relationships are examined within the matrix, it ensures content validity. Additionally, as the respondents are experts, the reliability is ensured due to sufficient stability.

The data analysis was conducted using the Structural-Interpretive Modeling (ISM) method and MICMAC analysis, based on which an ISM graph was designed. The ISM analysis was performed in five stages: 1. Determining the relationships between factors and forming the self-interaction matrix; 2. Creating the initial reachability matrix; 3. Forming the final reachability matrix; 4. Plotting the coordinates of influence power and dependence; 5. Determining the level of indicators; 6. Drawing the interpretive structural model. The structural-interpretive analysis was performed using the MICMAC software.

For each questionnaire, the matrix was derived according to Table 1, and by aggregating all the questionnaires based on the mode (modal), the self-interaction matrix was created, which is the first step of the Structural-Interpretive Modeling (ISM) method. After forming the self-interaction matrix, the numbers 0 and 1 are replaced with the response symbols according to the following relationships, and the initial reachability matrix is obtained. Then, the secondary relationships between the factors must be checked. To achieve this, the initial reachability matrix is raised to the power of K+1 using a command in MATLAB until a stable state is reached: $M^k = M^{k+1}$. The final reachability matrix then displays the column of influence power, which is derived from the row sum of each factor, and the row of dependency, which is obtained from the column sum of each factor. Based on the column of influence power and the row of dependency, a coordinate system is drawn, consisting of four regions: autonomous, dependent, driving, and linking. The boundary points between the regions must be defined in such a way that they effectively distinguish the different factors into the desired clusters, ensuring that no factor is located in two regions simultaneously. Additionally, based on the final reachability matrix, the level of each factor is determined. For this purpose, the reachable set (the set in which the rows of the final reachability matrix appear as 1 and 1*), the antecedent set (the set in which the columns appear as 1 and 1*), and the common set (the intersection of the reachable and antecedent sets) are defined for each factor to determine its level. A factor where the common set matches the reachable set is assigned to the first level. After removing this factor, the process is repeated for the remaining factors to determine the subsequent levels. Finally, once the interrelationships and levels of each factor are determined, the structural interpretive model of the study is represented in a diagram.

3. Results

Initially, the research variables, which include a set of determining factors for building innovation capacity in a digital platform to enhance the utilization and tourism potential of recreational sports spaces, were identified and defined. These factors were extracted from the qualitative section of the doctoral dissertation using thematic content analysis of 18 interviews. These 11 factors were derived from the third coding process, consisting of 29 sub-themes and 135 initial conceptual codes.

Table 1: The characteristics of the participants in the study.

Indicator	Position	Education	Academic Field	Executive Field
P2	University Faculty Member	PhD in Sports Management	*	*
P1	University Faculty Member	PhD in Computer Science & Artificial Intelligence	*	*
P3	University Faculty Member	PhD in Sports Management	*	*
P4	University Faculty Member	PhD in Sports Management	*	*
P5	University Faculty Member	PhD in Sports Management	*	*
P6	University Faculty Member	PhD in Sports Physiology		*
P7	Postdoctoral Researcher in AI in Sports & University Lecturer	PhD in Sports Management	*	
P8	University Lecturer	PhD in Sports Management	*	*
P9	University Lecturer	PhD in Sports Management	*	*
P10	Entrepreneur & University Lecturer	PhD in Entrepreneurship	*	*
P11	Entrepreneur	Master's in Mathematics & Image Processing, AI Researcher	*	
P12	Entrepreneur	Master's in Sports Management	*	
P13	University Faculty Member	PhD in Computer Science & AI Specialist		*
P14	University Faculty Member	PhD in Entrepreneurship	*	
P15	University Faculty Member	PhD in Sports Management		*
P16	University Faculty Member	PhD in Sports Management	*	*
P17	University Faculty Member	PhD in Sports Management	*	
P18	University Faculty Member	PhD in Computer Science & Artificial Intelligence	*	*
P19	University Faculty Member	PhD in Sports Management	*	*

Table 2. Definition of factors for structural-interpretive modeling.

	Factors	Definition
F1	Capacity of the Entrepreneurship and Technology Ecosystem for Sports Tourism	It encompasses the internal drivers of business in sports tourism destinations and the requirements at the industry and market of sports tourism.
F2	Contextual Challenges of Innovation and Digitalization in Sports Tourism	It includes geographic and ecosystem limitations, technical and systemic barriers of centers, and economic and commercial issues of sports tourism.
F3	Innovation capacity building at the industry and market of sports tourism	It includes optimizing the innovation support system in tourism and sports and fostering innovation networking within the sports tourism industry.
F4	Empowering sports tourism businesses in innovation	It includes enhancing the capabilities of process innovation and product and service innovation in sports tourism businesses.
F5	Digital capacity of sports tourism business systems	It includes the management capacity, financial capacity of businesses, marketing and communications of businesses, and the capability of human capital and members of sports tourism businesses, all of which must undergo digital transformation.
F6	Digital infrastructure of sports tourism destinations	It includes the digital capability of center systems, digitalization of services, and the smartization of sports tourism facilities and venues.
F7	Improvement of the utilization capacity of sports tourism spaces	It includes the development of space utilization and the modernization of the utilization of sports tourism spaces.
F8	Optimization of the utilization of sports tourism spaces	It includes the standardization of space usage, the combination of various space types, and the distribution of usage across sports tourism spaces.
F9	Technical enhancement of the utilization of recreational sports facilities	It includes the technical and engineering regulations of the facilities, the structural suitability of the venues, and the sustainability standards for recreational sports facilities.
F10	The capability to manage the reach of sports tourism destinations	It includes the capability to manage the reach of sports tourism destinations and enhance the capacity of these destinations.
F11	Enhancing the capacity of the reach of sports tourism destinations	It includes improving the tourism reach capacity of destinations and enhancing the assessment of the tourism reach of recreational sports destinations.

The following presents the findings obtained from the Structural-Interpretive Modeling method.

Structural Interaction Matrix: The identified factors were distributed in the form of a pairwise comparison questionnaire among the experts. Based on the responses, and according to Table 3, a separate matrix was created for each questionnaire. Then, by aggregating the questionnaires based on the mode (modal), the structural interaction matrix for the study was formed. Table 2 shows the structural interaction matrix of the research.

Table 3. Structural interaction matrix.

Variable	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11
1. Capacity of the Entrepreneurship and Technology Ecosystem for Sports Tourism	X	X	V	O	O	V	V	V	V	V	V
2. Contextual Challenges of Innovation and Digitalization in Sports Tourism		X	V	V	V	V	O	V	V	V	O
3. Innovation capacity building at the industry and market of sports tourism			X	X	X	X	V	V	V	V	V
4. Empowering sports tourism businesses in innovation				X	X	X	V	O	V	V	V
5. Digital capacity of sports tourism business systems					X	X	V	O	V	V	V
6. Digital infrastructure of sports tourism destinations						X	V	X	V	V	V
7. Improvement of the utilization capacity of sports tourism spaces							X	X	X	V	V
8. Optimization of the utilization of sports tourism spaces								X	X	V	O
9. Technical enhancement of the utilization of recreational sports facilities									X	V	V
10. The capability to manage the reach of sports tourism destinations										X	V
11. Enhancing the capacity of the reach of sports tourism destinations											X

Initial Reachability Matrix: After obtaining the structural interaction matrix, the initial reachability matrix is formed by replacing the symbols with 0s and 1s. Table 3 shows the initial reachability matrix of the research.

Table 4. Initial reachability matrix.

Factors	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11
1. Capacity of the Entrepreneurship and Technology Ecosystem for Sports Tourism	1	1	1	1	1	1	1	1	1	1	1
2. Contextual Challenges of Innovation and Digitalization in Sports Tourism	0	1	1	1	0	0	1	1	1	1	1
3. Innovation capacity building at the industry and market of sports tourism	0	1	1	1	1	1	1	0	1	1	1

Factors											
4. Empowering sports tourism businesses in innovation	0	0	0	1	1	1	1	1	1	1	1
5. Digital capacity of sports tourism business systems	0	0	0	1	1	1	1	1	0	1	1
6. Digital infrastructure of sports tourism destinations	0	0	0	1	1	1	1	1	0	1	1
7. Improvement of the utilization capacity of sports tourism spaces	0	0	0	1	1	1	1	1	1	1	1
8. Optimization of the utilization of sports tourism spaces	0	0	0	0	0	0	0	1	1	1	1
9. Technical enhancement of the utilization of recreational sports facilities	0	0	0	0	0	0	0	1	1	1	1
10. The capability to manage the reach of sports tourism destinations	0	0	0	0	0	0	0	1	1	1	1
11. Enhancing the capacity of the reach of sports tourism destinations	0	0	0	0	0	0	0	0	0	0	1

Final Reachability Matrix: After obtaining the initial reachability matrix, the secondary relationships between the factors must be examined. To do this, the initial matrix needs to be raised to the power of K+1 until stability is achieved: $M^k = M^{k+1}$ (Mirfakhredini et al., 2013). After achieving stability, the final reachability matrix is obtained. In the final reachability matrix, some zero elements are converted to 1, and these are indicated as 1*. Table 4 shows the final reachability matrix of the study.

Table 5. Final reachability matrix.

Factors	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	Power Influence
1. Capacity of the Entrepreneurship and Technology Ecosystem for Sports Tourism	0	1	1	1	*1	*1	1	1	1	1	1	14
Contextual Challenges of Innovation and Digitalization in Sports Tourism	0	1	1	1	1	1	1	*1	1	1	1	14
3. Innovation capacity building at the industry and market of sports tourism	0	0	0	1	1	1	1	1	1	1	1	12
4. Empowering sports tourism businesses in innovation	0	0	0	1	1	1	1	1	*1	1	1	12
5. Digital capacity of sports tourism business systems	0	0	0	1	1	1	1	1	*1	1	1	12
6. Digital infrastructure of sports tourism destinations	0	0	0	1	1	1	1	1	1	1	1	12
7. Improvement of the utilization capacity of sports tourism spaces	0	0	0	0	0	0	0	1	1	1	1	8
8. Optimization of the utilization of sports tourism spaces	0	0	0	0	0	0	0	1	1	1	1	8
9. Technical enhancement of the utilization of recreational sports facilities	0	0	0	0	0	0	0	1	1	1	1	8

Factor	1	2	3	4	5	6	7	8	9	10	11	
10. The capability to manage the reach of sports tourism destinations	0	0	0	0	0	0	0	0	0	0	1	5
11. Enhancing the capacity of the reach of sports tourism destinations	0	0	0	0	0	0	0	0	0	0	0	4
Degree of dependence	1	3	3	7	7	7	7	10	10	10	11	

Power and Dependency Coordinate System (MICMAC Analysis): Based on the power column and the dependency row in the final reachability matrix, the MICMAC analysis of the factors within a system can be conducted. MICMAC analysis is derived from the power column and dependency row in the final reachability matrix. The power and dependency coordinate system, obtained from the final reachability matrix of the study, is shown in the figure below.

Figure 1 shows that factors 1, 2, 3, and 5 are located in the Driver region, factors 4, 6, and 8 are in the Linkage region, factors 7, 9, and 10 are in the Dependency region, and factor 11 is in the Autonomous region.
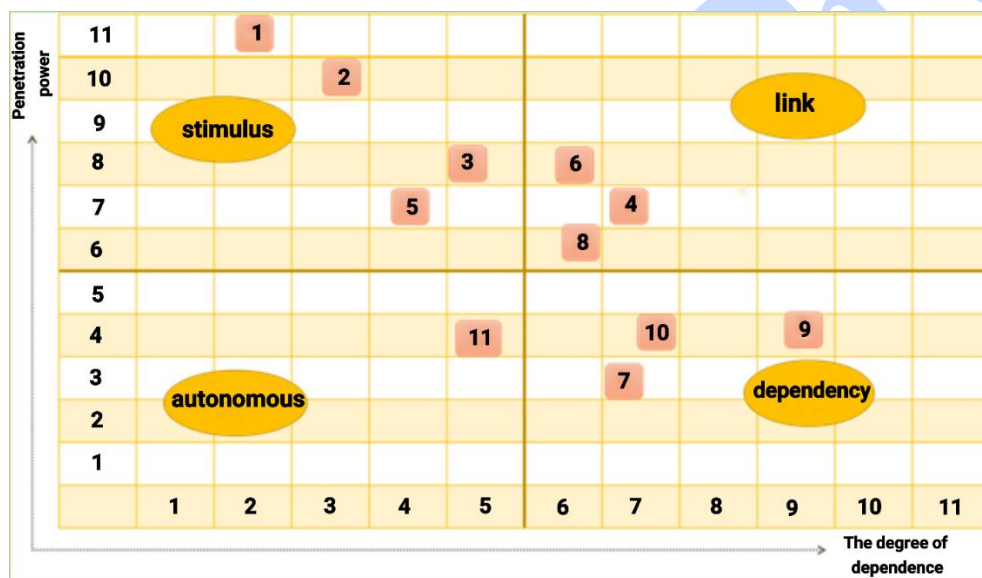

Figure 1. Power Influence and dependency matrix.

Determining the Levels of Indicators: After obtaining the final accessibility matrix, the reachable set, antecedent set, and their common set were identified to determine the level of each factor. The reachable set for each factor is a set where the rows in the final accessibility matrix are shown as 1 or *1, while the antecedent set is represented by the columns marked with 1 or *1. The intersection of these two sets forms the common set. An element whose common set and reachable set are identical is identified as a level-one factor. By removing this factor and repeating the process for the remaining elements, the subsequent levels of the factors are determined. Table 5 shows the reachable set, antecedent set, common set, and the levels of each factor.

Table 6. Reachable set, antecedent set, common set, and levels of each factor.

Level	Common	Antecedent	Reachable	Factors
Fifth	1,2	1	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11	Capacity of the Entrepreneurship and Technology Ecosystem for Sports Tourism
Fifth	1, 2	1, 2	2, 3, 4, 5, 6, 7, 8, 9, 10, 11	Contextual Challenges of Innovation and Digitalization in Sports Tourism
Fourth	3, 4	1, 2, 3, 4	3, 4, 5, 6, 7, 8, 9, 10, 11	Innovation capacity building at the industry and market of sports tourism
Fourth	3, 4	1, 2, 3, 4	4, 5, 6, 7, 8, 9, 10, 11	Empowering sports tourism businesses in innovation
Third	5, 6, 7	1, 2, 3, 4, 5, 6	5, 6, 7, 8, 9, 10, 11	Digital capacity of sports tourism business systems
Third	5, 6, 7	1, 2, 3, 4, 5, 6	6, 7, 8, 9, 10, 11	Digital infrastructure of sports tourism destinations

Second	5, 6. 7	1, 2, 3, 4, 5, 6, 7, 8, 9	7, 8, 9, 10, 11	Improvement of the utilization capacity of sports tourism spaces
Second	8, 9	1, 2, 3, 4, 5, 6, 7, 8, 9	8, 9, 10, 11	Optimization of the utilization of sports tourism spaces
Second	8, 9	1, 2, 3, 4, 5, 6, 7, 8, 9	9, 10, 11	Technical enhancement of the utilization of recreational sports facilities
First	10, 11	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	10, 11	The capability to manage the reach of sports tourism destinations
First	10, 11	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	11	Enhancing the capacity of the reach of sports tourism destinations

Table 5 shows that 14 factors are ranked from levels 1 to 6: Factors 1 and 2 are at level 5, factors 3 and 4 are at level 4, factors 5 and 6 are at level 3, factors 7, 8, and 9 are at level 2, and factors 10 and 11 are at level 1:

- Level 5 includes two factors: entrepreneurial ecosystem capacities and technology for sports tourism, and the contextual challenges of innovation and digitalization in sports tourism.

- Level 4 includes two factors: innovation capacity building at the sports tourism industry and market level, and empowering sports tourism businesses in innovation.

- Level 3 includes two factors: the digital capacity of sports tourism businesses' systems and the digital infrastructure of sports tourism destinations.

- Level 2 includes three factors: improving the utilization capacity of sports tourism spaces, optimizing the use of sports tourism spaces, and enhancing the technical utilization of recreational sports facilities.

- Level 1 includes three factors: the capability of managing the reach of sports tourism destinations and enhancing the reach capacity of sports tourism destinations.

- Interpretive Structural Modeling (ISM) is used to illustrate the relationships between the factors. After determining the levels of each factor, the final step in the ISM process is to draw the model. Figure 2 presents the structural interpretive model of the study. According to the principles of the ISM method, the chain of influence and causality flows from level five toward level one.
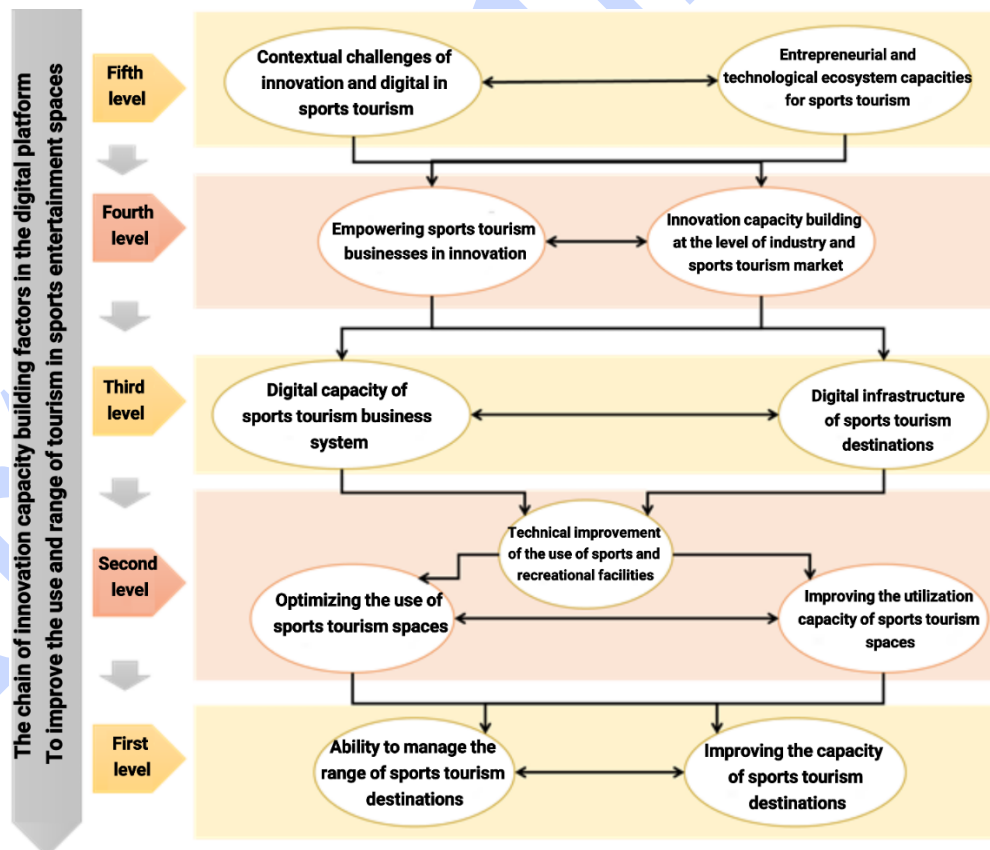

Figure 2. Interpretive structural model.

4. Discussion and conclusion

The fifth level encompasses two key factors: the capacities of the entrepreneurial and technological ecosystem for sports tourism and the underlying challenges of innovation and digitalization in this field. Previous research also highlights the importance of continuously identifying capacities and environmental challenges to mitigate negative impacts and maximize the positive effects of the sports tourism industry in light of innovation and technological advancements (Kim & Bramwell, 2019). Managerial issues and lack of coordination between various institutions can also lead to the inefficient use of these spaces and a decline in tourist attendance. Additionally, a shortage of appropriate facilities and services for tourists is evident in many sports venues. This shortage may include the absence of restaurants, shops, sanitation services, and recreational amenities. Cultural and social limitations may also negatively impact tourist attendance and pose challenges for certain sports venues. Moreover, a lack of awareness and sufficient education regarding the importance of optimizing sports spaces and their impact on tourism can lead to neglect of this issue. Another challenge is competition with other tourist attractions, as Iran offers a diverse range of attractions, which may prevent sports venues from securing a strong position in this competitive landscape (Alavi et al., 2018). The country's economic and political conditions can also impact investment and the development of sports venues, creating further challenges. Given these challenges, there is a clear need for precise and strategic planning to optimize sports spaces and increase tourist attendance in Iran. This can contribute to improving the quality of life and promoting sustainable development in the country. Understanding the underlying factors can serve as a foundation for future planning and managerial decisions regarding capacity building for innovation and digital transformation in sports and tourism. The capacities of the entrepreneurial and technological ecosystem for sports tourism focus on the drivers of domestic business in sports tourism destinations and the requirements of the sports tourism industry and market. The fundamental challenges of innovation and digitalization in sports tourism include geographical and ecosystem limitations, technical and systemic barriers in facilities, and economic and commercial difficulties in the sports tourism sector. Understanding these underlying factors enables recreational sports venues to leverage innovation and digital platforms to function as major tourist attractions. Identifying and utilizing the capacities and opportunities that enhance tourist attraction to these venues can contribute to diversifying tourism offerings in Iran and provide new experiences for visitors. Additionally, recognizing and analyzing the existing challenges and limitations in this field can help identify threats and weaknesses in utilizing sports and recreational complexes from the perspective of innovation and technological capabilities. This environmental information can assist managers and planners of sports tourism destinations in enhancing the utilization of sports and recreational services and facilities, expanding their tourism appeal, and better understanding and meeting the real needs of sports tourists. This research aligns with the studies conducted by Abbass Farahmand Mehr (2022), Rasool Norouzi Seyed Hossini (2024), and Ruiyi Zhao (2024)

The fourth level comprises two key factors: enhancing innovation capacity within the sports tourism industry and market, and empowering sports tourism businesses in innovation. Recent studies also highlight that the innovation chain is crucial for upgrading services and applications of sports facilities, enabling them to achieve sustainable development and commercial growth (Shamaii et al., 2019). Innovation in the processes and services of recreational sports facilities acts as an added value for recreational and sports activities, playing a crucial role in enhancing service quality and customer satisfaction. By improving the utilization of these spaces, innovation not only provides better amenities and services for tourists but also for local residents, contributing to the expansion of tourism in these areas. Recreational sports spaces can serve as creative tourism destinations for a region, helping optimize the use of these spaces by creating a network of innovation in tourism. This goal is achieved through capacity building at various levels of the industry and business. Therefore, capacity building for innovation in the sports tourism industry and market involves simplifying the innovation support system in tourism and sports, as well as promoting network innovation in the sports tourism industry. Empowering sports tourism businesses in innovation includes improving the ability to innovate processes, products, and services within sports tourism businesses. Given the rapid growth of market demand and the sports tourism industry, as well as the increasing competition between different recreational-sports destinations, the need for innovation and new approaches to attract more tourists and provide unique experiences is of great importance. With the increase in innovation and technology capacity, recreational sports facilities can serve as significant destinations and attractions in this area, as improving their utilization can contribute to the growth in the number of tourists and expand tourism reach. Therefore, promoting innovation and its application in the sports tourism industry must occur both at the general industry level and specifically within businesses and recreational-sports complexes to ensure sustainability and

effectiveness. This research aligns with the studies conducted by Shafagh Abolghasemi Atany (2025), Georgios Tsekouropoulos (2022), and Christopher D. Silbernagel (2024).

The third level includes two factors: the digital capacity of the sports tourism businesses' systems and the digital infrastructure of sports tourism destinations. As previous research has emphasized, identifying and examining the dimensions of digitalization in sports tourism businesses is essential to ensure tourist engagement, attract investment, and enhance the supply chain capabilities within recreational-sports complexes (Amore, 2019). Digital infrastructure in the sports tourism industry and the digital capabilities of businesses at its destinations can significantly enhance the venue utilization and improve service quality, thereby increasing tourist presence and expanding tourism reach within recreational-sports complexes. Therefore, on one hand, the digital capacity of the sports tourism business system is crucial for achieving tourism usage and access, as digital transformation must occur across all dimensions of management capacity, financial capabilities, marketing, and communication. This transformation requires the use of the digital infrastructure of sports tourism destinations, including the digital capabilities of the central system, the digitalization of services, and the smart integration of sports tourism facilities and venues. Therefore, it can be mentioned that the digitalization of recreational and sports complexes is a multi-dimensional and multi-stage process that must be implemented in a coordinated and appropriate manner to achieve optimal utilization. This research aligns with the studies conducted by Jose de la Maza (2025) and Xu Wang (2024).

The second level consists of three factors: improving the usability capacity of sports tourism spaces, optimizing the use of sports tourism spaces, and enhancing the technical utilization of recreational sports facilities. To explain the factors of this level, it should be mentioned that the success of optimization projects requires precise planning, active community participation, the use of modern knowledge and technologies, and attention to social, economic, cultural, and environmental aspects (Pourahmad & Hosseini, 2015). In essence, by utilizing existing spaces, energy wastage is prevented, and optimization typically involves fewer costs compared to constructing new sports tourism spaces. From another perspective, it can also be argued that in many cases, optimization supports innovation and the use of technology to maintain the quality of destinations and recreational-sports spaces. Research indicates that optimized recreational-sports spaces are generally more attractive, efficient, and aligned with the daily needs of both locals and tourists, helping to improve service quality in the market (Yan, 2020). In addition, for the development of usage, various recreational-sports facilities can be created in one location to meet the needs of different individuals. Moreover, new sports spaces can also function as tourism centers and contribute to the growth of the sports tourism industry. Studies have shown that with continuous improvement, sports and recreational spaces gain access to attractive facilities, and even require lower maintenance costs (Davis, 2019; Gratton et al., 2020). Hence, sports tourism spaces can be improved through the expansion of their usage and the modernization of the utilization of recreational-sports spaces. Additionally, optimizing the use of sports tourism spaces requires standardization of the spaces, the use of various types of spaces, and the effective utilization of recreational-sports facilities. To improve performance and optimize usage, the necessary steps for enhancing the technical functionality of recreational-sports venues must be provided. This should be determined through technical regulations, the structural compatibility of the venues, and the sustainability standards of recreational-sports facilities. In explaining this conceptual topic and its interconnected themes, it can be stated that since optimizing the use of recreational-sports spaces is recognized as a strategy for sustainable urban development, it may contribute to improving service quality and satisfaction, increasing the efficiency of existing space utilization, and reducing environmental impact. This research aligns with the studies conducted by D Xiong (2025), Hanying Wen (2023), and Shengping Peng (2022).

The first level contains three factors: the management capability of sports tourism destinations and the enhancement of the capacity of sports tourism destinations. In explaining the importance of this topic and its components, it can be said that since the development of tourism capacities reflects the potential of recreational-sports spaces for tourism, increases access to sports facilities, and enhances the willingness of tourists and customers, it requires assessment, estimation, management, and intervention across all economic, geographical, and social dimensions. From a social perspective, tourism accessibility must monitor the needs and desires of tourists by analyzing their behaviors, interests, and expectations of sports and recreational spaces. According to previous research, this information can be gathered through surveys, interviews, and focus groups (Ladu et al., 2019). The scope of tourism also reflects the status and reach of tourism attractions, the acceptance of services, events, and recreational-sports programs. A significant part of tourism accessibility is achieved through the involvement of the local community in the supply chain of recreational-sports spaces. From an economic and commercial perspective, it can be highlighted that market data and visitor information, as well as satisfaction surveys, assist managers in analyzing the economic impacts of

sports tourism destinations by identifying the strengths and weaknesses of the spaces and the reach of services and tourism (Davis, 2019). Therefore, by transforming the use of spaces and guiding tourists' preferences and needs, innovation and technology enable sports spaces to function in a way that tourism destinations can largely meet these needs and expand their tourism scope. In fact, expanding the tourism scope of these destinations requires two capabilities: managing access to sports tourism destinations and enhancing the capacity of these destinations. The ability to manage access to sports tourism destinations leads to the enhancement of the destinations' capacity and improves the evaluation of the tourism range of recreational-sports destinations. Additionally, enhancing the capacity of sports tourism destinations must be achieved in all dimensions, including commercial and economic reach, population growth and community involvement, as well as the expansion of the physical and environmental scope of sports tourism destinations. This research aligns with the studies conducted by Giovanni Raso (2023) and Yanhong Liu (2020).

According to the ISM method principles, the influence and susceptibility chain of factors moves from the fifth level towards the first level. Based on the findings, the application of innovation based on digital transformation to enhance the usage and scope of sports tourism destinations in the country is a multi-level and multi-dimensional process that results from the combined effect of the eleven factors in the chain. From general perspective, capacity-building for innovation based on a digital platform to enhance the usage and scope of sports leisure tourism spaces, is a systematic process and cycle. From internal perspective, this network of concepts reflects the flow of relationships and the chain of factors: environmental drivers of digital transformation in sports tourism services, the system capacity for innovation in sports tourism, the digitalization of the business system in sports tourism destinations, the enhancement of the usage of leisure sports spaces, and the development of the tourism scope of leisure sports spaces. This conceptual framework aligns with previous specialized models in terms of thematic content and reference theories, such as the theory of open innovation, dynamic capabilities theory, and absorptive capacity theory. Therefore, it can contribute to enriching the academic literature in this area. Additionally, findings from previous studies, such as those by (Rocha & Cao, 2023), and (Alizad Gohari et al., 2023), confirm the themes of this conceptual framework.

Like all research, this study suffers from some limitations that the research team tried to mitigate by using appropriate strategies and methods. The three main limitations and the team's innovative approaches to mitigate them are as follows: 1. Lack of collaboration from some experts and organizations (Mitigation strategy: Use of additional scholarly resources); 2. Lack of documented environmental information regarding the research topic (Mitigation strategy: Use of examples and event-based evidence); 3. Critical perspectives and differing viewpoints on certain aspects of the research topic (Mitigation strategy: Involvement of at least two experts for each related specialization).

In conclusion, based on the analytical capabilities of the proposed conceptual framework, some practical implications are recommended. Through this framework, successful models of innovation and digitalization of recreational sports spaces, as well as the optimization of their use and accessibility for tourism, can be examined across different regions of the world, along with an analysis of the factors contributing to their success. Additionally, given the theoretical nature of this research, it is recommended that empirical data be collected and analyzed regarding the impact of innovation and digital transformation on the tourism reach of recreational sports spaces. Based on the general and contextual concepts discussed, this research can serve as a framework and scientific guide for researchers, urban planners, and managers of recreational and sports spaces in exploring and applying innovation and technology to improve the usage and accessibility of tourism. Therefore, it can be utilized as a framework for evaluation, analysis, decision-making, and planning, contributing to enhancing innovation capacity and addressing challenges in today's unstable conditions for sports tourism businesses. Understanding these factors and the relationships between them helps managers and tourism centers adjust, guide, or control their impacts effectively. Given the lack of reliable information and analytical frameworks with practical examples in the management and development of the sports tourism industry, this study offers new insights into business management in the current economic context of the country, leveraging innovation capacity and a digital platform. Additionally, new frameworks and insights, such as the one presented in this research, assist analysts and decision-makers by simplifying and integrating the innovation and digitization system in the sports tourism sector, making it easier to understand. It appears that if business managers and the sports tourism industry in the country are aware of the conditions, factors, mechanisms, functions, and necessities of capacity building and innovation in the current context, they will be more inclined to benefit from it.

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