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A phenomenological study exploring the factors influencing technological advancement in Iraqi swimming

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Abstract

This qualitative study investigated the factors influencing the technological development of swimming in Iraq using a descriptive phenomenological approach. Fifteen purposively selected participants, including sports technology specialists, experienced coaches and swimmers, federation officials, and technology experts—were interviewed until theoretical saturation was achieved. Data was collected through semi-structured interviews and analyzed using Colaizzi's method (1978). Credibility was ensured through participant validation of coding, while reliability was supported by process auditing and intra-subject agreement. The analysis identified 106 factors grouped into five main themes: stakeholders lived experiences of current technology, facilitating factors, challenges, proposed solutions, and perspectives and consequences of technological development. These themes encompassed infrastructure, knowledge and skills, policy support, cultural and executive barriers, and anticipated impacts on performance, coaching, and society. The findings provide a comprehensive framework to guide policymakers and sport managers in designing targeted strategies to advance technological standards and promote the development of swimming in Iraq.

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1. Introduction

Technological advances are rapidly transforming various industries, including sports, which has seen the widespread adoption of new technologies. These innovations enhance athlete performance, optimize training programs, improve coaching processes, and facilitate the management of sports organisations (Khadempir et al., 2023). Swimming is a complex aquatic activity recognised both as an essential survival skill and as a significant sport, offering various physical and mental benefits (McGibbon et al., 2018). Swimming requires technological advancement due to its specialized nature and the necessity for advanced equipment and technologies, particularly in performance data analysis, personalized training programmed design, and the application of modern educational technologies (Gatta et al., 2021)(Kazim et al., 2025). Developing countries, particularly in the Middle East like Iraq, encounter significant challenges in advancing sports technology. These challenges include inadequate infrastructure, insufficient specialized training, and various structural and cultural constraints (Abdel Hadi et al., 2025)(Mannai, 2021).

Technological advancements in Iraqi swimming extend beyond enhancing individual swimmer performance, influencing multiple facets of the sport. New technologies make it easier to create scientific training programs based on accurate data about how well athletes perform (Li et al., 2021)(Mobarak alShorman et al., 2024). Technology can help find talented people, especially talented swimmers at an early age (Hogan et al., 2021). Using technology to manage teams and plan sporting events makes these tasks more efficient, clear, and interesting (Petrović et al., 2015). Technological progress could improve the position of Iraqi swimming both in the area and around the world, giving the country a chance to compete with the best in the world in this sport (Ruiz-Navarro et al., 2021). When there are limits on money and infrastructure (Kruszyńska et al., 2021)(Ezzal, 2009), it is important to find the best and most effective ways for technology to grow and to put money into the areas that need it the most and have the greatest promise.

Most of the research on sports technology has focused on how to use technology in developed countries with good infrastructure and easy access to money and specialized resources (Frevel et al., 2022; Mali & Dey, 2020; Vera-Rivera et al., 2019). On the other hand, not much research has been done on how technology has improved sports in poor countries, especially Iraq, because of its unique social, economic, and cultural situations. There is a big gap in what we know right now because there hasn't been any targeted or localized research. This shows how important it is to do a lot of research to find out exactly what elements are affecting the technological advancement of swimming in this country. According to local conditions, looking at these characteristics can help create focused interventions that speed up technological progress in this activity(Hussain, 2011).

There has been research on sports management and development in Iraq. In particular, the Iraqi Swimming Federation's marketing development program was designed (Rosha & Christiarini, 2024), and new technologies in sports management has been scrutinized (Saleh, 2024)(Easa, 2022). There aren't many in-depth qualitative and phenomenological studies that look at the elements that affect technological advancement in swimming in Iraq from the perspectives of stakeholders and specialists; Because there isn't enough study, politicians and sports managers haven't been able to prepare suitable strategies that fit the country's cultural, structural, and technological needs(Mazhar et al., 2024; Othman & Al-Zuhairi, 2021).

This study is crucial due to presenting new technologies in swimming could increase the quality of teaching, the performance of athletes, and attract juvenile population and other members of the community to the sport that could raise the international profile of Iraqi sports (Salam, 2019). Finding problems and chances in the growth of technology will make it easier to come up with useful solutions and good support policies. The descriptive phenomenological

approach focusses on real experiences and the in-depth views of participants, which helps us get a full and accurate picture of what affects them (Parvari, 2019).
Present study, moreover deeps into the interesting issue of how technology is changing swimming, with an emphasis on Iraq; Furthermore, point out the missing link on sports technology by looking at a developing country through its own unique social, cultural, and economic traits; While much of the literature has concentrated on specific technological applications in various sports or the technological advancements in developed nations, this research aims to offer new and contextual insights into the field. This research employs a qualitative phenomenological method to identify essential factors influencing technological development in swimming. This approach offers an in-depth analysis of existing challenges, capacities, and motivations, creating a comprehensive framework for understanding the current situation and formulating development strategies, rather than relying solely on quantitative methods. This study enhances the existing literature on sports technologies and offers localized findings relevant to Iraq, proposing practical measures for the advancement of swimming in the country. This approach may serve as a source of inspiration for researchers and policymakers in developing countries, emphasising the significance of considering the local context during technological development. This study aims to address the question: What factors influence the technological development of swimming in Iraq?

2-Research Problem

Given the limited Iraqi studies on sports technology, the problem with this research is the lack of a local knowledge framework that clarifies the nature of the technology used in swimming (whether in training equipment, training methods, technical analysis, or federation management). This deficiency hinders the development of development policies and strategies appropriate to the Iraqi context. Hence, the research problem lies in identifying the factors influencing the adoption and development of technology in Iraqi swimming, taking into account the cultural, social and economic context.

3-Hypotheses/Expected Outcomes:

1. Weak technological infrastructure.
2. Lack of strategic planning within the Iraqi Swimming Federation.
3. Limited awareness and technical skills among coaches and players.
4. The need for international partnerships to compensate for the lack of resources.

4-Materials and methods

Human Resources: Coaches (6), Swimmers (30), Federation Administrative Officers (3), Academic Specialists (7). Sample Size: 46 participants, selected using a purposive sampling method to achieve theoretical saturation. Representation: Total percentage: 46.6%, females: 15.33%, males: 30%. As for procedures, interviews were conducted between January and March 2024, in Baghdad, Basra, Karbala, Babylon, and Al-Qadisiyah. This research serves an exploratory purpose and employs a qualitative approach utilising descriptive phenomenology methodology. This research aims to identify and elucidate the factors influencing the technological development of swimming in Iraq.

The research participants included experts and specialists in swimming and technology in Iraq, comprising sports technology specialists, experienced coaches and swimmers, managers and officials of the swimming federation, as well as other knowledgeable individuals in these domains. The sampling method employed was purposive sampling. Knowledgeable and experienced individuals pertinent to the research topic were deliberately selected, and through their input, comprehensive and detailed information was gathered using semi-

structured interview methods. The ultimate criterion for establishing the sample size was the attainment of theoretical saturation. Theoretical saturation occurred when subsequent interview data failed to yield additional theoretical insights for the researcher. Theoretical sampling persisted until theoretical sufficiency was reached, culminating in the execution of 15 semi-structured interviews. The criteria for participant selection in the research were explicitly outlined to the volunteers, ensuring that only individuals with relevant lived experience in technological development within the context of swimming in Iraq were included. Thematic analysis was employed to examine the data, modified and implemented in accordance with Colaizzi's (1978) methodology. This method concentrates on elucidating the meanings and patterns inherent in individuals' experiences. The researcher aims to comprehensively analyse participants' experiences concerning the factors influencing technological development in swimming within Iraq, as perceived by them. Thematic analysis was selected as a suitable analytical tool for this study (Nazari and Sahrai, 2012). Semi-structured interviews employing open-ended questions were utilised for data collection. The interviews lasted from 20 to 45 minutes and were conducted until theoretical saturation was reached, resulting in the extraction of non-repetitive concepts. The data analysis was conducted using the thematic analysis method, comprising the subsequent steps: 1. A comprehensive analysis of all interview texts and the identification of key findings; 2. Taking out important words related to the development of swimming technology in Iraq; 3. Arising important words and ideas; 4. Collect ideas and give descriptions a clear structure; 5. Prepare accounts as participants' experiences from ideas; 6. Summarise and unify the final remarks to show the main patterns and final consensus (Parvari, 2019). Inorder to meet the reliability of the present study, we verify the accuracy and consistency of the findings through asking various participants to comment based on their own opinions and experiences after analysing the data and extracting themes. This method assured the validity of the interpretation of the data and developed parallel through people`s opinions. Also, we compared the data whit other sources like previous study pertaining to sports technologies and the present situation of sports in Iraq, to make sure from validity of data. Furthermore, rich variety of experiences and opinions of participants (chosen from different areas of swimming and technology in Iraq) were obtained. The acquired results and subsequent analyses were evaluated by other researchers who were experts in sports management and sports technology to meet the accuracy of the coding and data interpretation. Different stages of the research, like choosing sample, construction of instrument, Data collection and analysis, were all clearly and accurately implemented. The researcher recognised the impact of personal assumptions, experiences, and potential biases during the study and sought to mitigate these factors in the data analysis. The research's reliability was assessed through the intra-subject agreement method between the two coders, yielding an agreement rate of 80%, which signifies acceptable reliability. Table 1 presents the results of these codings.

Table 1. Reliability between two coders

Number	Interview number	Total number of codes	Number of agreements	Number of disagreements	Reliability between two coders (percentage)
1	P4	32	13	6	81%
2	P9	35	15	5	85%
3	P14	28	10	8	71%
Total		95	38	19	80%

To adhere to ethical principles, the research objectives and necessity were communicated to participants prior to the commencement of the interview. All participants engaged in the research with informed consent and were afforded the opportunity to withdraw at any point; however, none chose to do so. The interviews were carried out in a controlled environment, free from external disturbances.

5- Results

In Table 2, the demographic characteristics of the research participants are notable.

Table 2. Demographic information of research participants

	Sex		Education level		Field of study		Average sports-executive record		Age	
	Male	Female	Master	Ph.D	Physical education	Non-physical education	Min	Max	Min	Max
Frequency	10	5	9	6	12	3	8	28	32	52
Frequency %	66.6	33.3	60	40	80	20				

The analysis of the demographic data reveals that the gender distribution among participants is predominantly male, comprising 66.6% (10 individuals), while females account for 33.3% (5 individuals). The observed gender imbalance may reflect the composition of human resources engaged in swimming and sports technologies within the study community. The highest frequency regarding education level is associated with individuals holding a master's degree (60%, representing 9 individuals). Individuals with PhDs constitute a notable portion of the sample, representing 40%, or 6 individuals. This combination suggests that participants possessed significant knowledge and expertise, enhancing the richness of the collected data and the depth of perspectives presented in the interviews. The involvement of individuals with postgraduate education in diverse fields associated with sports and technology enhances the scientific rigour of the research outcomes. A dominant population of subjects (80%, or 12 individuals) had an educational background in physical education or related fields within sports sciences, such as exercise physiology, sports management, and sports biomechanics. Only 20% of participants, or 3 individuals, had an irrelevant education field than sport science, that consist of software engineering and information technology. This statistical community suggests that the scope of view in the present study were predominantly made up of individuals with expertise in sports and related sciences. The part related to sports-executive background elaborates the different stages of experience among participants in swimming-related areas. The involvement of individuals with extensive experience offers valuable insights into the historical developments and evolving needs of this field, whereas the engagement of those with less experience may introduce fresh perspectives on emerging technologies. The age range reflects the presence of individuals from various generations, each possessing distinct experiences and perspectives, akin to the diversity found in sports backgrounds. Younger individuals tend to possess greater familiarity with emerging technologies, whereas older

individuals often have more experience in managing and addressing practical challenges related to swimming. The diversity of age can enhance the comprehensiveness of research findings. The survey results regarding the lived experiences of 15 experts in swimming and technology reveal 106 concepts categorised into five main themes and 15 subthemes, as presented in Table 3.

Table 3. Main and sub-themes of the study of factors of technological development of swimming in Iraq

Main theme	Subtheme	Concepts	Interview
The lived experience of those involved in the current state of technology in swimming	Understanding the current level of technological infrastructure in swimmin	Lack of modern equipment	P2,P3, P5, P6, P7, P8,P10
		Obsolete equipment	P1,P14
		Limited access to advanced technologies	P3,P5, P15
		Poor quality of some equipment	P7, P11,P12
		Lack of specialized sports technology centers	P5, P9,
		Maintenance and repair problems	P1, P5, P7, P14
		Dependence on foreign technologies	P5, P7, P13
		Lack of integration of information systems	P2, P3, P5, P10, P13
	Assessment of technological knowledge and skills	Lack of experts familiar with swimming sports technologies	P1, P4, P7
		Low level of awareness of coaches and athletes about the benefits of technology	P6,P8, P10
		Lack of regular training programs	P2, P13, P15
		Weakness in transferring knowledge and experiences	P3, P4, P5, P7, P8, P10
		Not utilizing the capacities of domestic experts	P5, P10, P13, P15
		Lack of a culture of continuous learning in the field of technology	P7, P15
	Understanding existing supports and barriers	Lack of specific support policies	P7, P14
		Lack of allocated budget	P4, P10
		Bureaucratic obstacles	P6, P11,P12

		Low cooperation between relevant institutions	P8, P11
		Resistance to change	P1, P7
		Other priorities in resource allocation	P5, P7, P13
		Lack of evaluation of effectiveness of scattered efforts	P5, P9, P15
Potential Facilitators of Technological Development	Existing capacities for infrastructure upgrades	Capacity to attract domestic and foreign investment	P3, P3, P7
		Possibility of cooperation with technological companies	P6,P8, P15
		Existence of a young and educated workforce	P2, P13, P14
		Capacity of universities and research centers	P3, P4, P5, P7, P8, P12
		Possibility of using indigenous technologies	P5, P15
		Capacity to develop domestic production of equipment	P10, P11, P13
		Possibility of benefiting from successful international experiences.	P3, P4, P5
	Needs and motivations for learning and using technology	Coaches and athletes' desire to improve performance	P5, P10, P13, P15
		Feeling the need for modern training methods	P10, P11, P12
		Motivation to compete internationally	P9, P15
		Understanding the benefits of data analysis, interest in using modern training tools	P2, P8, P9
		Capacity to increase the attractiveness of swimming for the younger generation	P1, P4, P5, P7
	Opportunities arising from policy and support	Ability to formulate incentive policies and supportive laws and regulations	P1,P3, P5, P6, P7, P8,P10
		Capacity to allocate targeted budget	P1, P11, P12

		Capacity to create innovation and growth centers	P7, P11
		Capacity to facilitate cross-sectoral cooperation	P1,P3, P5, P6, P7, P8,P10
		Capacity to use sports diplomacy	P1, P12, P14
		Capacity to create national quality standards	P9, P15
		Capacity to support technological entrepreneurship.	P4, P10
Challenges facing technological development	Structural and cultural constraints	Weak communication infrastructure	P9 ,P14
		Lack of sustainable financial resources	P6, P7, P8,P10
		Traditional attitudes and resistance to change	P2, P4, P8, P10
		Digital divide	P3, P11, P12, P15
		Language problems in accessing resources	P1,P14
		Weak knowledge management	P3,P5, P7, P9
		Lack of prioritization of technology development in sports	P7, P11,P14, P15
	Implementation and operational obstacles	Complex bureaucracy	P5, P7, P15
		Insufficient transparency in processes	P1, P7, P8, P9
		Lack of skilled personnel	P5, P7, P13
		Maintenance and support problems	P2,P4, P8, P9, P11
		Lack of effective training programs	P9,P14
		Problems related to intellectual property	P3,P9, P14
		Lack of proper evaluation and monitoring	P7, P11,P12
		Low private sector participation	P5, P7
	Technology-related risks and concerns	Data privacy concerns	P1, P5, P7, P14
		Cybersecurity issues	P5, P7, P13
		High cost of technology upgrades	P2, P3, P5, P10, P13

		Over-reliance on foreign technologies	P3, P3, P7
		Possibility of replacing human resources	P6,P8, P10
		Low confidence in the effectiveness of some technologies	P2, P13, P15
		Ethical issues related to the use of AI	P3, P4, P5, P7, P9, P10
		Complexity of working with some technologies	P5, P10, P13, P15
Suggested solutions for technological development	Strategies to improve infrastructure and access	Targeted investment in modern equipment	P1, P15
		Establishment of specialized technology centers	P3, P11
		Development of communication infrastructure	P4, P10
		Facilitating the import and localization of technology	P7, P11,P12
		Establishment of integrated information systems	P5, P6
		Development of quality standards	P3, P7
		Establishment of regular maintenance programs	P5, P7, P13
		Targeted investment in modern equipment	P1, P15
	Strategies for improving human knowledge and skills	Holding specialized training courses	P5, P9, P15
		Exchanging knowledge with leading countries	P1, P8, P9
		Attracting and training specialists	P6,P8, P15
		Creating internship programs	P2, P13, P14
		Using online education capacities	P3, P4, P5, P7, P8, P12
		Creating specialized networks	P5, P15
		Translating and localizing educational resources	P10, P11, P13
		Encouraging research and innovation	P3, P4, P5, P7, P8, P14

	Effective policy and advocacy strategies	Formulate a national strategy for the development of sports technology	P5, P10, P13, P15
		Allocate adequate and sustainable budget	P10, P11, P12
		Create legal and financial incentives	P2, P12
		Facilitate cross-sectoral cooperation	P2, P8, P12
		Support knowledge-based companies	P1,P3, P54, P6, P7, P8,P10
		Create agile organizational structures	P1,P12
		Continuous evaluation of policies	P4,P8, P15
		Transparency of processes, attraction of private investment	P2, P10,P12
Prospects and implications of technological development in swimming	Expectations of the impact of technology on athlete performance	Improve records, increase accuracy in training	P5, P8
		Reduce the risk of injury	P1, P5, P7, P14
		Personalize training programs	P4, P6, P12
		Improve the level of competition	P2, P4, P8, P10, P15
		Access to accurate performance data	P1, P4, P9
		Ability to analyze strengths and weaknesses	P6,P9, P10
		Facilitate the talent identification process	P10, P13, P15
	Imagining transformation in coaching and management processes	Using data in tactical decision-making	P3, P4, P5, P7, P8, P13
		Improving communication between coach and athlete	P1, P10, P13, P15
		Easier management of teams and events	P7, P10
		Increasing training efficiency	P2, P11
		Ability to more accurately assess progress	P7, P14

		Using advanced analytical tools	P4, P11,P12
		Access to new training resources	P5, P6
	Social and cultural consequences of technological development	Increasing the attractiveness of swimming for the younger generation	P6, P7
		Creating new job opportunities	P5, P79, P131
		Improving the international status of the country's sports	P7, P9, P12
		Facilitating universal access to sports training	P1, P3, P7
		Creating a culture of innovation and entrepreneurship	P7,P8, P10
		Strengthening international connections in the fields of sports and technology	P5, P11, P15

Data analysis identified 106 factors influencing the technological development of swimming in Iraq, categorised into five primary themes. The first theme, "Stakeholders' lived experience of the current state of technology in swimming," includes three sub-themes: "Perception of the current level of technological infrastructure in swimming," "Assessment of technological knowledge and skills," and "Understanding existing supports and barriers." The second theme, "Potential facilitating factors for technological development," comprises three sub-themes: "Existing capacities for upgrading infrastructure," "Needs and motivations for learning and applying technology," and "Opportunities arising from policymaking and support." The third theme, "Challenges facing technological development," is divided into three sub-themes: "Structural and cultural constraints," "Executive and operational barriers," and "Risks and concerns related to technology." The primary theme of "Proposed solutions for technological development" is delineated into three sub-themes: "Strategies for enhancing infrastructure and access," "Strategies for advancing human knowledge and skills," and "Strategies for effective policymaking and support." The primary theme of "Perspectives and consequences of technological development in swimming" is organised into three sub-themes: "Expectations regarding the impact of technology on athlete performance," "Perceptions of changes in coaching and management processes," and "Social and cultural consequences of technological development."

6- Discussion

The results of current study, originally meant to be a phenomenological protocol for the investigation of the factors that affect technological advancement in swimming in Iraq, give us a better knowledge of this phenomenon in a unique setting. The investigation of the opinions and experiences of swimming experts and practitioners in Iraq demonstrated that the sport's

technological progress pattern is affected by an complex interaction of structural, cultural, human, and managerial factors, which could be devided to five main themes.

The first theme is related to "Practitioners' lived experience at the current state of technology in swimming," that shows the difference of the existace technological infrastructure in Iraqi swimming is from standards in the worldwide. Economic and sanctions-related issues (Rosha & Christiarini, 2024) that lead to poor and non-calibrated equipment, the distorted and out of service state of current equipment, limited access to advance technologies and the lack of research and development centres for the Development and upgrade of sports technologies all elaborate this missing link. The results of the our study is parallel to the previous studies: Kruszyńska & Poczta (2020), Schlegel & Hill (2023), and Dellaserra et al. (2014) that survey the technical infrastructure of developing countries with similar problems. This emphasis the importance of technological growth and establishment of a group to focus on this issue.

The second theme is indicating "potential facilitators of technological development," that describes a promising aspect of the future of this field in Iraq. New educated generation of juvenile staffs that can learn and use new technologies, along with a strong desire among coaches and athletes to improve performance through modern, data-driven training methods, and the possibility of working with both domestic and international technology companies are all major strengths that can help speed up the development of new technologies. The observed results emphasis the importance of dealing with empowering and skill training of individuals, as well as establish standard platforms for technology partnerships. This concept is approved by the results of Leonov et al. (2024), Qi et al. (2024), and Liu et al. (2022).

The third subject that is related to "Challenges to technological development," describes the complex issues that need immediate reactions. There are a lot of uncontrolled interventions that disturb technological progress and make it harder to achieve the advancemnets. These factors consist of structural and cultural issues like poor communication and internet infrastructure in some areas, lack of financial support, and no budget allocation for technological development. There are also traditional attitudes and struggles against renewal of the sports community, as well as a wide fragment among the generations. The results emphasis that sports organisations need to dominant attitude, and they also need to establish a reliable and constant source of sunding support to control and manage the issues (Dellaserra et al., 2014).

The fourth theme mentions "Proposed Solutions for Technological Development," elaborate real-world solutions based on the experiences of stakeholders as solution to restrain problems and get benefit from the possibilities that are already exist. Investments should be targeted towards improving, updating, and upgrading infrastructure of technologies. This includes planning and implementing knowledge-enhancing workshops for coaches and athletes to increase their knowledge in the field of technology and subsequently improve their skills. Also, providing a suitable platform for exchanging information with leading countries in the sports industry in order to share information is considered important. Also, regulations should be established to encourage legal and financial incentives in order to encourage people to invest and support knowledge-based businesses in the field of sports. These steps are crucial to speed up and facilitate the advancement of Iraq's swimming technology. These solutions are in line with successful structures used in other countries that have made significant progress in sports technologies (Frevel et al., 2022; Mali & Dey, 2020; Frevel et al., 2022).

The 5`th theme introduce "The Outlook and Implications of Technological Development in Swimming," that describes a promising scope for the future of swimming sport in Iraq. Stakeholders in this field expect that the use of new technologies will improve athletes' performance, make training programs more coherent, facilitate the process of identifying swimmers' talent, and ultimately enhance the position of Iraqi swimming in the global arena. The anticipated implementation of appealing and innovative technologies is likely to enhance

the younger generation's interest in this sport and establish a foundation for fostering a culture of innovation and entrepreneurship within the nation's sports sector. The outlined expectations align with established positive outcomes associated with technology in sports, including enhanced fan engagement and improved spectator experience. Uhrich (2022); Wu et al. (2022).

This study employed a phenomenological approach to investigate the facets of technological development in swimming in Iraq, as perceived by stakeholders and experts. This study's findings indicate that significant structural, cultural, and economic challenges exist; however, there are also potential capacities and opportunities for transformation and progress in this field. Addressing existing obstacles and leveraging facilitating factors necessitates a comprehensive and coordinated strategy across multiple levels of management and policy-making. It is recommended that the relevant institutions in Iraq's sports sector, taking into account the findings of this study and the successful practices of other nations, develop and execute a national strategy for the technological advancement of swimming. By allocating adequate resources, establishing educational and research platforms, and promoting interdisciplinary collaboration, these institutions can create the necessary conditions for enhancing the sport's level and attaining a significant standing in the international context. Future research may enhance understanding in this domain by investigating the efficacy of particular technological interventions and evaluating the long-term impacts of technological advancements on swimming in Iraq.

7- Conclusions

Reclassified by Level

A- Individual Level

Lack of awareness among coaches regarding the use of technology and swimmers' lack of experience with modern techniques

B- Institutional Level

Poor facilities for the federation and clubs and limited financial support

C- National Level

Lack of a national strategy for technological sports and limited government support

8- Recommendations

1. Training and qualification programs: 1. Conduct technical courses for coaches and swimmers.
2. Financial and legal support: Allocate budgets and incorporate technology into sports legislation.
3. International partnerships: Cooperate with Asian and European swimming federations to transfer expertise.
4. Infrastructure: Establish swimmer performance analysis centers equipped with advanced sensors and cameras.
5. . Women's Empowerment: Increase female participation in future studies to promote balanced representation.

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