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Adaptation to Smart Sports Technologies: Theoretical Background, Structural Dimensions, and a Proposed Conceptual Model

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ABSTRACT

Digitalization has fundamentally transformed modern sports by reshaping performance analysis, training design, and athlete–technology interaction. Smart sports technologies such as wearable sensors, artificial intelligence–based analytics, and data-driven decision-support systems provide substantial performance and monitoring advantages; however, successful integration depends largely on athletes' and coaches' adaptation processes rather than technical features alone. The purpose of this study is to develop a comprehensive conceptual framework explaining adaptation to smart sports technologies within sports settings. This study adopts a theoretical and conceptual research design. Drawing on an extensive review of the literature, the Technology Acceptance Model (TAM), Task–Technology Fit (TTF), and Innovation Resistance Theory (IRT) are integrated to explain the multidimensional nature of technology adaptation in sports. The proposed framework synthesizes cognitive evaluations, functional alignment, attitudinal processes, and resistance mechanisms into a unified model. The conceptual analysis indicates that perceived usefulness and perceived ease of use constitute the cognitive foundation of adaptation, while task–technology fit determines the functional alignment between technology and sport-specific tasks. Attitude and behavioral intention emerge as key psychological mechanisms linking evaluation to actual usage behavior. Conversely, innovation resistance manifested through cultural, emotional, habitual, and risk-related barriers acts as a suppressive force that weakens acceptance and technology integration. In conclusion, adaptation to smart sports technologies is a multidimensional process shaped by acceptance, functional fit, and resistance factors. The proposed model provides a strong theoretical basis for future empirical studies and for the development of valid and reliable measurement tools in sports technology research.

1. INTRODUCTION

Digitalization is transforming not only performance analysis in sports but also training design, decision making processes, and athlete technology interaction. Smart sports technologies ranging from wearable sensors to data-driven decision-support systems, AI-based performance analysis tools, and intelligent training platforms offer multidimensional benefits for athletes, coaches, and sports organizations [1,2]. This transformation is creating a new paradigm within the traditional structure of sport, enabling training processes to be supported, personalized, and continuously improved through objective data.

Adaptation to sports technologies is not solely determined by the technical properties of the technology itself. Athletes', coaches', and managers' perceptions, expectations, attitudes, and resistance toward these technologies constitute key determinants of the adaptation process. In this regard, the Technology Acceptance Model (TAM), particularly its components of perceived usefulness and perceived ease of use, provides a critical framework for understanding the adoption of sports technologies [3,4]. Belief that smart sports technologies contribute to performance, perceptions that training becomes more efficient, and evaluations that the technology is intuitive and

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easy to use directly enhance athletes' adaptation levels [5].

However, the sports environment is shaped not only by individual perceptions but also by the alignment between the nature of the task and the capabilities of the technology. The Task–Technology Fit (TTF) framework argues that adoption and effective use of technology depend on the degree to which technological functionalities match task requirements (6). When systems such as smartwatches, GPS tracking devices, and sensor-based load monitoring tools are highly aligned with training goals, athletes tend to adapt quickly and integrate the technology into their routines [7].

On the other hand, technological transformation is not always seamless. Some athletes and coaches show varying degrees of innovation resistance toward digital systems. The innovation resistance literature suggests that concerns over inaccurate data, perceived complexity, emotional stress, or beliefs that technology disrupts the "naturalness" of sport may negatively impact usage behavior [8,9]. In sports contexts, common themes include overreliance on technology, disruption of cultural rituals, technology anxiety, and cognitive overload [10].

When these conceptual foundations are combined, it becomes clear that adaptation to sports technologies is a multidimensional structure. Adaptation is shaped not only by positive perceptions but also by resistance, anxiety, and cultural factors. Therefore, measuring adaptation to smart sports technologies is crucial for determining athletes' readiness for technology integration, identifying difficulties they face, and understanding where support and training are needed. However, the literature lacks a comprehensive measurement tool that integrates TAM, TTF, and innovation resistance constructs specifically for sports technologies. This gap creates the need for the conceptual model and item structure proposed in the present study.

2. THEORETICAL FRAMEWORK

A single model is not sufficient to explain the adaptation process to smart sports technologies; therefore, this study integrates technology acceptance, task–technology fit, and innovation resistance approaches into a holistic theoretical framework. In the sports ecosystem, individuals' interactions with technology involve psychosocial, cultural, and behavioral elements beyond mere technical competence, which necessitates a multidimensional approach to adaptation.

2.1. Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) explains individuals' behavioral intentions and actual use of new technologies [3]. The model focuses on two core cognitive variables: perceived usefulness and perceived ease of use. Perceived usefulness reflects the belief that using a given technology will enhance performance, while perceived ease of use reflects the belief that the technology can be learned and used with minimal effort [4].

In the context of sports and wearable technologies, studies show that smart devices and digital training applications significantly affect athlete performance and training efficiency. Additionally, when these technologies are perceived as "easy to use," adoption rates increase [11]. Therefore, TAM provides a strong theoretical foundation emphasizing user perceptions and cognitive evaluations rather than technical capacity alone.

2.2. Task–Technology Fit (TTF)

The Task–Technology Fit (TTF) theory posits that a technology improves performance and is more likely to be adopted when its capabilities align with the tasks users must perform [6]. In sports, task–technology fit corresponds to the degree to which technological functionalities match the training tasks of athletes and coaches.

Smart sports watches, GPS-based load monitoring systems, accelerometer-based sensors, performance analysis applications, and decision-support algorithms become easier to adopt when their functions directly support the demands of athletic performance [12]. For example, GPS systems that track speed and distance have high task alignment in endurance sports, while force sensors align with explosive power assessments [13,14].

Recent studies increasingly associate technology adoption not with technical features but with functional alignment with sport-specific tasks (15;16). Evidence suggests that when athletes perceive technologies as task-relevant, both adoption and continued usage increase (17). Similarly, alignment between technology and task requirements strengthens the sense of integration into the training routine (18) For this reason, the "task–technology fit" dimension is a theoretically appropriate component of the adaptation scale proposed for smart sports technologies.

2.3. *Innovation Resistance Theory (IRT)*

The Innovation Resistance Theory (IRT) posits that individuals' responses to new technologies are shaped not only by positive cognitive evaluations but also by various cognitive, emotional, and habitual barriers. Ram and Sheth's (1989) seminal model states that innovation resistance consists of two main categories of barriers: functional (rational) and psychological. Functional barriers include cognitive elements such as usage complexity, perceived performance risk, cost, incompatibility, and uncertainty, whereas psychological barriers stem from habits, traditional practices, normative expectations, and emotional reactions toward technology.

In the context of sports technologies, this approach is particularly critical, as digitalization fundamentally reshapes training dynamics. While data-driven decision making has become increasingly common in modern sport, some athletes and coaches express concerns that technology "disrupts naturalness," "weakens intuitive decision making," or "creates excessive dependence on data" [20,21,22]. Such concerns are directly aligned with IRT's dimensions of cultural resistance, habitual resistance, and emotional resistance.

Furthermore, the literature shows that perceived risk toward technological innovation is even more salient in performance driven sports environments [23,24]. Technical risks such as inaccurate sensor readings, miscalculated training loads, or GPS tracking errors can reduce confidence in the technology and decrease willingness to use it [9]. This brings the IRT constructs of the risk barrier and usage barrier into clear focus within sports settings.

Sport is also a domain rich in rituals, cultural norms, and long established training traditions [25]. Therefore, innovation resistance is not merely a cognitive evaluation but a process deeply tied to identity, culture, and relational structures. The traditional nature of coach athlete relationships, along with authority and trust dynamics, may generate an emotional defense against digitalization [26]. In some cases, athletes associate analog training methods with ideas of "purity," "authenticity," or "sporting ethos," reflecting the IRT concept of the tradition barrier.

Overall, IRT demonstrates that understanding adaptation to sports technologies requires more than assessing positive perceptions such as usefulness or ease of use. Resistance, anxiety, habits, and cultural influences also play decisive roles in shaping technology adoption (9; 27). For this reason, incorporating dimensions such as cultural resistance, emotional resistance, habitual resistance, risk perception, and usage barriers into a sports technology adaptation scale is essential for capturing the multidimensional nature of the adaptation process.

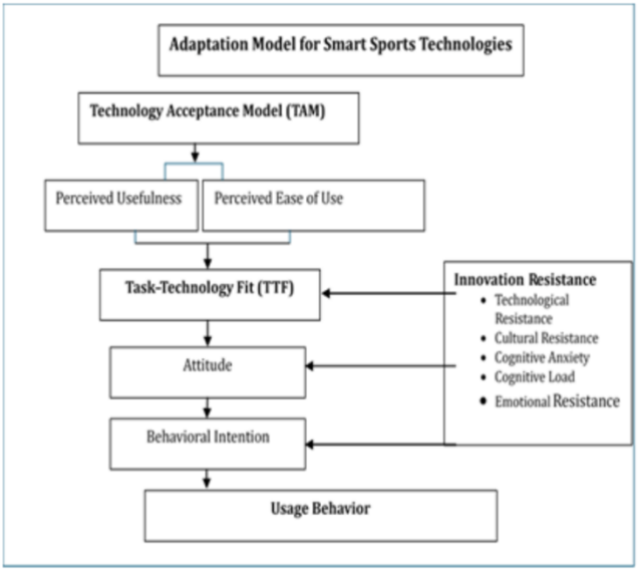

Figure 1. Adaptation model for smart sports technologies

2.4. Adaptation to Smart Sports Technologies

The process of adapting to smart sports technologies can be explained through individuals' cognitive evaluations of the technology, their perceptions of the relationship between the task and the technology, and how these evaluations translate into attitudes and actual usage behavior. In this process, perceived usefulness and perceived ease of use the core cognitive components emphasized by the Technology Acceptance Model (TAM) constitute the initial evaluation stage [3,4]. Beliefs that a technology enhances performance, optimizes training processes, or improves decision-making quality increase perceived usefulness and lead users to evaluate the technology as more compatible with their task requirements. Similarly, technology that is simple, convenient, and low in effort strengthens perceived ease of use, thereby reinforcing task technology alignment and enhancing the degree to which the technology fits the cognitive and operational demands of the user [4].

Task–Technology Fit (TTF) reflects users' evaluations of how well a technology aligns with the functional requirements of the tasks they perform and is a critical determinant of technology use behavior [6]. In sports, high task–technology fit leads athletes and coaches to view the technology as a functional tool that supports their training goals, thereby strengthening positive attitudes toward the

technology. Research consistently shows that TTF has a direct and powerful effect on attitude: technologies perceived as well aligned with tasks generate acceptance, while low fit leads to skepticism, hesitation, and distancing [15,28].

Attitude is one of the strongest psychological determinants leading toward technology usage behavior. Positive attitudes enhance individuals' behavioral intentions, and behavioral intention is considered the strongest predictor of actual usage [4,29]. Thus, as individuals develop favorable evaluations of a technology, their intention to use it increases, and stronger intentions raise the likelihood that this intention will translate into real use. The integration of sports technologies into daily training routines depends heavily on this attitude intention behavior sequence.

However, the model also positions innovation resistance a commonly overlooked but influential factor as central to the adaptation process. Innovation resistance is a multidimensional construct consisting of cognitive and emotional barriers such as usage complexity, performance risk, habit-driven opposition, cultural resistance, and technology-related anxiety [19,9]. As resistance increases, the perceived fit between the task and the technology weakens, leading individuals toward negative evaluations and reduced attitudes. Studies demonstrate that innovation resistance negatively affects not only attitudes but also behavioral intention, sometimes hindering the translation of intention into usage [30,31]. Thus, innovation resistance acts as a suppressive force that can influence the entire technology acceptance process.

In conclusion, the proposed model conceptualizes adaptation to smart sports technologies as a multidimensional process, explaining the sequential relationships among cognitive evaluations (perceived usefulness, perceived ease of use), functional alignment (task–technology fit), attitude, intention, and behavior within a holistic structure. Moreover, by demonstrating the suppressive effect of innovation resistance on task–technology fit, attitudes, and behavioral intentions, the model makes visible the psychosocial barriers that shape technology adaptation. This comprehensive framework provides an analytical and reliable explanation for why technology adoption progresses rapidly and smoothly among some athletes while it slows down for others due to resistance, anxiety, or cultural factors.

3. Conclusion

The rapid digital transformation of contemporary sports has positioned smart sports technologies as indispensable tools for performance optimization, data-driven coaching, and informed decision-making. However, this study demonstrates that the effectiveness of these technologies is not determined solely by their technical sophistication, but by the complex and multidimensional process through which athletes and coaches adapt to them. By integrating the Technology Acceptance Model (TAM), Task–Technology Fit (TTF), and Innovation Resistance Theory (IRT), the proposed conceptual framework offers a comprehensive understanding of the psychological, functional, and cultural mechanisms that shape technology adoption in sports.

The findings highlight that perceived usefulness and perceived ease of use form the cognitive foundation of adaptation, influencing initial judgments about whether a technology is worth adopting. Task technology fit further strengthens or weakens this evaluation by determining the extent to which the technology matches sport-specific training demands. Positive evaluations at these stages translate into favorable attitudes, heightened behavioral intentions, and ultimately greater likelihood of actual usage behavior.

Yet, the framework underscores that innovation resistance can significantly suppress this process. Functional barriers (e.g., complexity, performance risk) and psychological barriers (e.g., cultural resistance, emotional discomfort, habitual opposition) hinder the alignment between the task and the technology and diminish both attitude and intention. As a result, even technologies with strong performance potential may fail to be fully integrated into athletic routines if resistance is not adequately addressed.

Taken together, this multidimensional model provides a theoretically robust and practically relevant perspective for understanding why technology adaptation progresses smoothly for some athletes while encountering obstacles for others. The model emphasizes that successful adoption requires not only enhancing perceived benefits and ease of use but also reducing resistance, aligning technologies with sport-specific tasks, and creating culturally and psychologically supportive environments.

Future empirical studies should validate this integrated model, develop reliable measurement tools for each dimension, and explore how adaptation patterns differ across sports, age groups, and performance levels. Such research will contribute to building smarter, more athlete-centered digital ecosystems that balance innovation with human factors, ultimately fostering both performance enhancement and athlete well-being.

Conflict of Interest

No conflict of interest is declared by tehe authors. In addition, no financial support was received.

Author Contributions

Study Design, MK, FSA; Data Collection, MK, FSA; Statistical Analysis, MK, FSA; Data Interpretation, MK, FSA; Manuscript Preparation, MK, FSA; Literature Search, MK, FSA. All authors have read and agreed to the published version of the manuscript.

REFERENCES

1. Huang, M., & Yongquan, T. (**2025**). Tech-driven excellence: A quantitative analysis of cutting-edge technology impact on professional sports training. *Journal of Computer Assisted Learning,* 41(1), e13082. [CrossRef]
2. Hammes, F., Hagg, A., Asteroth, A., & Link, D. (**2022**). Artificial intelligence in elite sports a narrative review of success stories and challenges. *Frontiers In Sports and Active Living*, 4, 861466. [CrossRef] [PubMed]
3. Davis, F. D. (**1989**). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 319-340. [CrossRef]
4. Venkatesh, V., & Davis, F. D. (**2000**). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management science,* 46(2), 186-204. [CrossRef]
5. Kim, T., & Chiu, W. (**2019**). Consumer acceptance of sports wearable technology: the role of technology readiness. *International Journal of Sports Marketing and Sponsorship,* 20(1), 109-126. [CrossRef]
6. Goodhue, D. L., & Thompson, R. L. (**1995**). Task-technology fit and individual performance. *MIS Quarterly*, 213-236. [CrossRef]
7. Nath, S. C., Das, A., Nath, D., Bhutia, R. O., & Choudhury, R. D. (**2024**). Technology integration in sports coaching*: Innovations and challenges. Int. J. Multidiscip. Res. Dev*, 11, 38-42.
8. Ram, S., & Sheth, J. N. (**1989**). Consumer resistance to innovations: the marketing problem and its solutions. *Journal of Consumer Marketing*, 6(2), 5-14. [CrossRef]
9. Claudy, M. C., Garcia, R., & O'Driscoll, A. (**2015**). Consumer resistance to innovation a behavioral reasoning perspective. *Journal of the Academy of Marketing Science*, 43(4), 528-544. [CrossRef]
10. Canini, D., & Tjønndal, A. (**2025**). The impact of culture on sport innovations. In Handbook on Sport and Culture (pp. 64-76). Edward Elgar Publishing. [CrossRef]
11. McCallum, C., Rooksby, J., & Gray, C. M. (**2018**). Evaluating the impact of physical activity apps and wearables: interdisciplinary review. *JMIR mHealth and Health*, 6(3), e9054. [CrossRef] [PubMed]
12. Liu, H. (**2025**). Technology-based sports performance enhancement: A conference review. *Intelligent Sports and Health*, 1(2), 98-102. [CrossRef]
13. Akenhead, R., & Nassis, G. P. (**2016**). Training load and player monitoring in high-level football: current practice and perceptions. *International Journal of Sports Physiology and Performance, 11(5), 587-593.* [CrossRef] [PubMed]
14. Malone, J. J., Lovell, R., Varley, M. C., & Coutts, A. J. (**2017**). Unpacking the black box: applications and considerations for using GPS devices in sport. *International Journal of Sports Physiology and Performance*, 12(s2), S2-18. [CrossRef] [PubMed]
15. El-Masri, M., Al-Yafi, K., & Kamal, M. M. (**2023**). A task-technology-identity fit model of smartwatch utilisation and user satisfaction: A hybrid SEM-neural network approach. *Information Systems Frontiers*, 25(2), 835-852. [CrossRef] [PubMed]
16. Ali, Y., Umair, M., Mahmood, A., & Noor, A. (**2025**). *Effect of wearable fitness technology trust on sports injury prevention awareness and cross-sport athletic performance in pentathletes*. Paper presented at the 14th International Scientific Conference "Science and Higher Education in Function of Sustainable Development – SED 2025"
17. Seçkin, A. Ç., Ateş, B., & Seçkin, M. (**2023**). Review on Wearable Technology in sports: Concepts, Challenges and opportunities. *Applied sciences*, 13(18), 10399. [CrossRef]
18. Suyudi, I. (**2023**). The Digital Revolution in Sports: Analyzing the Impact of Information Technology on Athlete Training and Management. *Golden Ratio of Mapping Idea and Literature Format,* 3(2), 140-155. [CrossRef]
19. Ram, S., & Sheth, J. N. (**1989**). Consumer resistance to innovations: the marketing problem and its solutions. *Journal of consumer marketing*, 6(2), 5-14. [CrossRef]
20. Dyer, B. (**2015**). The controversy of sports technology: a systematic review. *SpringerPlus*, 4(1), 524. [CrossRef]
21. Lopez Frias, F. J. (**2019**). Unnatural Technology in a "Natural" Practice? Human Nature and Performance-Enhancing Technology in Sport. *Philosophies*, 4(3), 35. [CrossRef]
22. Postma, D., Reidsma, D., van Delden, R., & Karahanoğlu, A. (**2024**). From metrics to experiences: investigating how sport data shapes the social context, self-determination and motivation of athletes. Interacting with computers, iwae012. [CrossRef]
23. Pope, N., Brown, M., & Forrest, E. (**1999**). Risk, innovativeness, gender, and involvement factors affecting the intention to purchase sport product online. *Sport Marketing Quarterly*, 8(2), 25-34. [CrossRef]
24. Qi, Y., Sajadi, S. M., Baghaei, S., Rezaei, R., & Li, W. (**2024**). Digital technologies in sports: Opportunities, challenges, and strategies for safeguarding athlete wellbeing and competitive integrity in the digital era. *Technology in Society*, 77, 102496. [CrossRef]

25. Broch, T. B. (**2022**). The cultural sociology of sport: a study of sports for sociology?. *American Journal of Cultural Sociology*, 10(4), 535-542. [CrossRef]
26. Ratten, V., & Jones, P. (**2020**). New challenges in sport entrepreneurship for value creation. International *Entrepreneurship and Management Journal*, 16(3), 961-980. [CrossRef]
27. Omoregie, P. O. (**2016**). The impact of technology on sport performance. Paper presented at the 14th International Scientific Conference Science and Higher Education in Function of Sustainable Development (INCEDI August 29–31, 2016), Accra, Ghana. ISBN: 978-9988-2-3994-7.
28. Dishaw, M. T., & Strong, D. M. (**1999**). Extending the technology acceptance model with task–technology fit constructs. *Information & Management*, 36(1), 9–21. [CrossRef]
29. Ajzen, I. (**1991**). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179–211. [CrossRef]
30. Agarwal, R., & Karahanna, E. (**2000**). Time flies when you're having fun: Cognitive absorption and beliefs about information technology usage. MIS quarterly, 665-694. [CrossRef]
31. Yu, C. S., & Chantatub, W. (**2016**). Consumers'resıstance to Usıng Mobıle Bankıng: Evıdence From Thaıland and Taıwan. *International Journal of Electronic Commerce Studies,* 7(1), 21-38. [CrossRef]