

The effect of technological developments on athletic performance

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Abstract

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In contemporary society, technological development is widely acknowledged to facilitate human life and contribute to advancements across numerous domains. The most fundamental factor in the development of technology is human beings, who are the most affected by this development. In the contemporary era, technological advances are occurring at an unprecedented rate. These rapid changes have profound implications for social structures and living conditions. Since the 20th century, technological development has been a significant catalyst for rapid advancements and innovations in the construction industry, facilitating the dissemination of novel concepts and methodologies with unprecedented efficiency. This transformation has been further enabled by the emergence of mass communication devices, which have played a crucial role in disseminating information and fostering collaboration across different sectors. These developments have had a significant impact on numerous aspects of the sporting realm. The utilization of technology is of paramount importance in optimizing the utilization of sports facilities and equipment. The advent of technologically advanced sporting products, novel sporting activities and unprecedented records has led to a paradigm shift in the sporting realm. The increasing technological developments in sports products are being utilized by coaches and athletes in exercises and training. Technology is utilized in numerous domains to enhance individual and team performances.

Introduction

In contemporary society, technological development has been identified as a facilitator of human life and a contributor to developments in numerous fields. The primary objective of technological development is to serve the human race, and it is the human race that is most impacted by this development (Karaçam & Aydın, 2014). Technology is defined as an applied science that makes rapid progress in tools and equipment with the development of science (Baygül, 2020).

The concept of technology is a multifaceted one, with numerous meanings. However, it is generally defined as the development and more effective use of tools and equipment, machines and related methods to solve people's problems (Kaya, 2006).

The utilization of technological advancements within the domain of sports sciences and the sports industry represents a pivotal area of application. The utilization of technological resources is of paramount importance when seeking to derive maximum benefit from sports

facilities and equipment. The advent of new sporting activities and the establishment of new records have been precipitated by the development of sporting products through technological innovation. This phenomenon has been identified as a contributing factor to the enhancement in athletic performance, as evidenced by the research conducted by Atasoy & Kuter (2005) and Haake (2009).

In examining the contemporary relationship between sports and technology, the significance of internet-controlled objects, cyber systems, cloud technologies, augmented reality, autonomous and robotic systems, and 3D printer systems cannot be overstated (Tekin & Karakuş, 2018). As Banger (2017) and Tekin & Karakuş (2018) have demonstrated, the most prevalent technology in the domain of sports is internet technology.

The integration of technology within the domain of sports science has been demonstrated to have a significant impact on enhancing the performance of athletes to the highest levels. The integration of

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technology in sports has been proven to facilitate rapid development across a wide range of sports disciplines (Haake, 2009).

Sport performance

In the context of general definition, performance may be considered as a short-term, limited aspect of behaviour. Performance can be defined as the action of carrying out a specific task (Tiryaki, 1991). In another definition, performance is understood to mean the physiological, biomechanical and psychological efficiency demanded by a physical activity (Kuter & Öztürk, 1997).

Within the domain of sports sciences, studies aimed at enhancing performance are commonly conducted. The objective of these studies is to achieve superior outcomes by accomplishing tasks with reduced energy expenditure, diminished error rates, and enhanced efficiency (Thompson et al., 2008). Athletes are in constant search of ways to enhance their performance, to increase their strength, speed and equipment. It is evident that technological advancements in equipment, namely tools and apparatus, in conjunction with the evolution of physical training methodologies, have been demonstrated to be efficacious in enhancing performance (Strack et al., 2011).

Athletic performance can be defined as the mental and physical performance of athletes in any sporting activity (Ulucan, 2016). An examination of extant studies reveals that the rates of genetic relationships in performance development are 30-80% for muscle strength, 40-70% for maximum oxygen uptake ($VO_2\text{max}$), and 30-90% for anaerobic power and capacity (Hughes 2015; Williams et al., 2005). The remaining percentages are coach support, family support, appropriate training methods, nutrition, equipment, motivation, sleep, genetic factors and external factors (Sercan et al., 2019).

Technology

Technological influences are now very important in shaping the social environment. Technology makes human life easier, improves living conditions, and enables us to use time more efficiently. The concept of technology is often associated with digital machines, mechanical hardware or devices. However, in the present day, the term 'technology' is understood to include not only mechanical equipment or digital machines, but also an institutional dimension. In general, the subjects of technology include science,

machinery, technical requirements and operations, organization, culture and social issues (İşman, 2014).

Technology is defined as the application of proven, observation-based knowledge to achieve specific goals and solve problems (Demirel, 1993). It is generally defined as the state of creating the necessary functions to dominate nature, together with acquired skills (Alkan, 1998).

It is also defined as the systematic application of scientific or technical knowledge to practical areas (Koç, 2004).

The most recognized and prominent types of technology are:

- Computer technology
- Information and communication technology
- Mobile technology
- Medical technology
- Energy technology
- Agriculture technology
- Transportation technology
- Industrial technology
- Artificial intelligence technology (Gezgin, 2023).

Technology and sport

Technological changes are very rapid today. These changes affect social structures and living conditions. Technology, which has developed significantly since the 20th century, has been instrumental in bringing developments and innovations to the world of construction in the fastest way possible through the development of mass communication devices. All of these developments have impacted many areas of sport (Argan & Katırcı, 2002). Technology has contributed to the development of sports and enabled new sports to emerge (Jenny et al., 2016).

Today, sports are highly successful in utilizing technology. Technology, in the form of products, services and organizations, helps many sports in many categories and is very beneficial for the development of sports. It provides convenience for professional and amateur athletes, as well as their supporters (Ateş, 2016).

New technological developments and universalization create a competitive environment today. In order to compete internationally, it has become necessary to increase the power of technological innovation. Technological innovation is widely recognized as one of the most important factors in rapid production and income growth, as well as in the ability to compete

internationally (Ansal, 2004). Recent technological developments are transforming sports. Many countries are developing systems that produce sports technology by applying technology to sports. These technologies have had an impact not only on sports products, but also on the materials used by sports referees, such as flags, whistles and headphones. Satellite and internet broadcasts, as well as fibre systems that enable sports organizations to reach a wide audience, are also examples of this. Sports organizations' facilities have been transformed into smart fields with technological innovations; the camera systems used have become new technological systems and scoreboards. The training of future athletes is being conducted in laboratories, utilizing technological devices for training sciences, with virtual analyses providing support. The integration of technological advancements within the domain of sports has been instrumental in catalyzing innovations and the emergence of a significant new industry (Devecioğlu & Altungül, 2011).

The relationship between technological developments and athletic performance

The increasing technological developments in sports products are being utilized by coaches and athletes in exercise and training. Technology is utilized in numerous domains to enhance individual and team performance (Akçalı, 2016). The advent of technological developments has precipitated a paradigm shift in the manner in which exercise is conducted. EMS (Electro Muscle Stimulation) represents a new generation of exercise systems and offers a divergent sporting experience. This system, which stimulates muscles with electrical currents, functions in a manner analogous to the human body's operating principle. The occurrence of activities is contingent upon the transmission of signals from the brain to the muscles, thereby inducing muscular movement. EMS technology involves the generation of strong and powerful contractions in the muscles due to the current that is sent to them. The integration of this technology with sporting activities, physical exercises and training regimens has the potential to yield substantial gains in a relatively brief period. The content and intensity of this system will be adapted according to the individual's training history and physical capacity. In the contemporary era, prominent figures such as Tiger Woods, Usain Bolt, and Kobe Bryant, along with distinguished sporting teams including Bayern Munich, have adopted this system (Rothenberg, 2016).

The monitoring of athletes' performance, the examination of their performance status, and the maintenance of information about their overall physical condition are all important elements in the evaluation and improvement of performance (Ünlü et al., 2018). In addition, it has been documented that the continuous monitoring of athletes through the utilization of computer technology can facilitate the prediction of their energy status and the demands of their muscles, thereby preventing muscle damage resulting from performance (Can et al., 2011; Ünlü et al., 2018). Furthermore, the implementation of this programme is expected to prevent injuries and mitigate time losses due to such occurrences. The utilization of Global Positioning System (GPS) technology in sporting contexts empowers the aggregation of data pertaining to athletes' performance across various positions, thereby enabling the scientific analysis of their training and competitive performance (Venter et al., 2011).

The advantages that technology will confer on athletes will initially manifest in the form of technological equipment, the selection of which will be at the discretion of the individual or team. It is evident that professional athletes place a significant emphasis on attire and equipment, with a notable prevalence of items supported by nanotechnology. The materials' durability, lightness, flexibility, and strength make them ideal for use in a variety of sports and recreational activities, including soccer, basketball, volleyball, athletics, skiing, and swimming. They are also employed in the manufacture of sportswear and sporting equipment, such as rackets used in tennis and badminton. As Türkmen & Mutlutürk (2014) demonstrate in their study, sports equipment and materials are categorized as follows: balls (football, basketball, volleyball, tennis, badminton, bowling, etc.), bats (baseball, hockey, golf, etc.), helmets (American football, motor sports, cycling, etc.), and materials used in most sports. It is also possible to mention wearable technology products that have the capacity to provide training plans, assist in the tracking of exercises, record and analyse health and performance data, and provide feedback for the purpose of monitoring and improving performance by the individual or their coach. Such products include those that can determine resting heart rate, exercise intensity level, number of steps taken; sleep quality, and basal metabolic rate (Kim & Chiu, 2019; Lee et al., 2016; Swan, 2012).

Conclusion

Technological developments continue to advance rapidly in today's world. At the same time, it is evident that technological developments have made people's lives easier. It is possible to say that the world of sports has also benefited greatly from these technological developments. There are many reasons why individuals are interested in sports, such as leading a healthy lifestyle, socializing, gaining a sense of belonging and taking part in recreational activities. This interest has increased the importance of all products and equipment in the world of sports (Akçalı, 2016). Many things, such as training athletes, organizing sports events, training athletes, and broadcasting competitions to the whole world, have become easier thanks to technological developments. State-of-the-art products also have a significant impact on improving athletes' performance. Many factors, such as sports shoes, training equipment, clothing, technological devices, and training areas, have made it much easier to improve athletic performance in the world of sports thanks to technological developments. Haake's 2009 study stated that technological developments play an important role in the development of both professional and amateur sports. It is known that athletes use many technological systems to ensure a safe training environment, to develop themselves to the best of their ability, and to achieve the best performance.

In conclusion, considering all these factors, we must ensure that technological developments support the sports world in a harmonious way in terms of improving athlete performance.

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