

Article

# Innovation, infocommunication and digital transformation in sport policing and certain aspects of sports

Tóth Nikolett Ágnes<sup>1,2</sup>, Mátyás Szabolcs<sup>3</sup>, Bujdosó Zoltán<sup>4</sup>, Dávid Lóránt Dénes<sup>5,6,\*</sup>, Tóth Gergő József<sup>7</sup>, Mátrai Gábor<sup>8,9</sup>

<sup>1</sup> Department of Law Enforcement Theory and Law Enforcement History, Faculty of Law Enforcement, University of Public Service, H-1083 Budapest, Hungary

<sup>2</sup> Department of Sport Law, Economics and Social Science Institute, University of Physical Education, H-1123 Budapest, Hungary

<sup>3</sup> Department of Criminal Tactics, Faculty of Law Enforcement, University of Public Service, H-1083 Budapest, Hungary

<sup>4</sup> Institute of Rural Development and Sustainable Economy, Department of Sustainable Tourism, Hungarian University of Agriculture and Life Sciences (MATE), HU-2100 Gödöllő, Hungary

<sup>5</sup> Department of Tourism and Hospitality, Faculty of Economics and Business, John von Neumann University, HU-6000 Kecskemét, Hungary

<sup>6</sup> Institute of Rural Development and Sustainable Economy, Department of Sustainable Tourism, Hungarian University of Agriculture and Life Sciences (MATE), HU-2100 Gödöllő, Hungary

<sup>7</sup> Institute of Private Law, Department of Civil Law, Faculty of Law University of Miskolc, H-3515 Miskolc, Hungary

<sup>8</sup> Hungarian ICT Association, IVSZ H-1077 Budapest, Wesselényi u. 16, Hungary

<sup>9</sup> DIGITALEUROPE, Association of the European Digital Technology Industry B-1040 Brussels, Rue de la Science 14, Belgium

\* **Corresponding author:** Dávid Lóránt Dénes, [david.lorant.denes@uni-mate.hu](mailto:david.lorant.denes@uni-mate.hu)

## CITATION

Ágnes TK, Szabolcs M, Zoltán B, et al. (2024). Innovation, infocommunication and digital transformation in sport policing and certain aspects of sports. *Journal of Infrastructure, Policy and Development*. 8(3): 2617. <https://doi.org/10.24294/jipd.v8i3.2617>

## ARTICLE INFO

Received: 19 August 2023

Accepted: 8 October 2023

Available online: 15 January 2024

## COPYRIGHT



Copyright © 2024 by author(s).

*Journal of Infrastructure, Policy and Development* is published by EnPress Publisher, LLC. This work is licensed under the Creative Commons Attribution (CC BY) license.

<https://creativecommons.org/licenses/by/4.0/>

**Abstract:** Sport has become a fundamental socio-economic area. Currently, technological progress plays one of the most important roles in the development of sport. In the twenty-first century, innovation, and technology are significantly shaping the world of law enforcement and sports policing, and huge changes are taking place that need to be responded to. The development, spread and completion of info communication, information technology, digital technologies, and digitalization itself at an ever-faster pace than ever before are fundamentally changing all areas of the economy and society. Today there is no question that digitalization is the engine of the economy, which has an impact in all sectors, including sports and law enforcement. In the study, the authors examine the possibility of technical development in the field of sports safety. Among other things, drones, facial recognition systems and predictive analytics will be examined. The methodology used is mainly based on the analysis and examination of previous methods. The authors propose to adapt the innovative tools used at previous sports and mass events in the field of sports safety.

**Keywords:** artificial intelligence; digitalization; info communication; law enforcement; sports; sports policing; sports tourism

## 1. Introduction, materials and methods

Sport became a fundamental socio-economic field at the end of the twentieth century and the beginning of the twenty-first century, and it is no coincidence that it became a national strategic sector in 2010. Sport is an extremely complex phenomenon, it affects physical culture, education policy, health, and its economic and social policy significance is growing (Soto-Fernández et al., 2022). Today we can justifiably speak of a “sports industry”. Sport is gaining increasing importance in domestic and foreign policy and is an important tool for increasing the country’s image. This is especially true of football, which, as the most popular spectator team sport in the world of sports law, also provides many illustrative examples.

Today, sport is also considered one of the defining elements of the entertainment and tourism industry (Chang et al., 2022), which, on the one hand, represents an increasing share in the “active” and “passive” spending of leisure time, on the other hand, it popularizes, arouses interest, shapes and shapes public thinking, sets an example for young people, so in addition to ensuring the next generation, it also plays a role in strengthening the physical and mental state of children (Abdullaev and Pardayev, 2020).

Sport is considered an important industry worldwide, and it is also a key strategic sector of the Hungarian national economy. Its importance can be determined in many areas and interfaces, also in terms of business aspects: for example, elite sports, mass and leisure sports, recreation, entertainment (sports broadcasts), tourism (participation in sporting events, conferences) (Szebeni and Salojärvi, 2022).

Sports and digital media have also become deeply intertwined in recent years, transforming the way we consume and engage with sports content. This convergence has had a significant impact on various aspects of the sports industry, including broadcasting, fan engagement, athlete branding, and the overall fan experience.

Sports and tourism are areas that are close to each other. Sports tourism is one of the most dynamically developing areas today. Decades ago, only a few people followed the teams and athletes to another city or country, while nowadays it has become completely natural for tens of thousands to accompany a team to the next match. Team sports, such as football or handball, attract particularly large crowds (Bujdosó and Dávid, 2013).

People have more free time and prosperity, and borders are easier to cross than decades ago. This is especially true for the countries of the European Union. The development of the infrastructure also contributed to the fact that more and more people are traveling (e.g., the development of the road and railway network, the significant reduction of plane ticket prices, the appearance of low-cost airlines) (Herjanto et al., 2022).

Persons who cross national borders and visit a sporting event can also be considered tourists according to the World Tourism Organization a UN Specialized Agency (UNWTO) categorization. Sports tourism is an extremely dynamically developing field, which is a great challenge for law enforcement agencies (Higham, 2021).

The safe travel of a large crowd and the “handling” of a sports event at the venue places an ever-increasing task on the law enforcement agencies of the host countries. Police treatment of sports tourists is multifaceted (Brosnan, 2019). They must be separated from the local fans, secure entry into the stadium must be arranged, they must be prevented from clashing with the other team’s supporters at the end of the match, etc.

Solving all these tasks is now unthinkable without technical tools (e.g., drones, vein scanners, cameras).

Currently, technological development plays one of the most important roles in the development of sport as an industry: not only do data analysis tools help athletes’ performance, but sports broadcasts are also completely transformed, and the technological possibilities of recreational athletes are expanding year by year.

The creation, maintenance and development of order, security, the sense of security of the population and athletes has also become increasingly important in recent years, primarily because top events in spectator team sports, spectacle and individual sports have become mass events, and crowds participate in recreational sports events. Numerous events of elite and grassroots sports mobilize tens of thousands of people not only inside and outside sports facilities, but before, after and after. Sporting events increasingly have showed elements, all of which places new safety requirements (Torres-Ronda et al., 2022).

The safe conduct of sporting events is basically the responsibility of the organisers, but state involvement is also indispensable. In other words, all this can be considered a joint civilian and state law enforcement task.

In sports facilities, the primary duty of action lies with the organiser. According to the law, the police may only participate in supporting match insurance tasks in stadiums classified as public places in contractual form or, if justified by the security risk of the match, as a public task (Tóth, 2019).

The internal protection function results in the obligation to perform law enforcement tasks aimed at ensuring order in the state. Law enforcement tasks aimed at maintaining public order and security in modern states are performed by public administrations. Sports administration is a specific legislative and judicial discipline that is a special part of administrative law, sport-related tasks are carried out by the state through sports administration, so it can be called a kind of policy.

Sports law is fundamentally based on public law, since typically one of the parties is the state itself, and there is a relationship of subordination and superiority between the participants, but of course there is also a civil law aspect of the field, in which legal entities in an autonomous structure are equal, equal and subordinate to each other (Nafziger and Gauthier, 2022).

The civil rights nature of the right to sport also presupposes state tasks, which also means that state bodies and local governments must be given tasks to determine what is mandatory and optional sporting tasks for them, and what they must do to ensure that the human and civil right in sports is effectively enforced. The promotion and provision of sporting activities is therefore, among others, responsibility of the State and thus also a public task, and consequently requires financing from public finance subsystems, primarily from the central budget. In view of all this, the Sports Act has implemented uniform regulations, which defines transparent and clear tasks for state institutions as well (Nafziger and Gauthier, 2022).

One of the most important tasks of the state is to ensure order in the world of sports as well. Using the definitions of law enforcement practitioners, it is possible to arrive at the definition of sports policing, which is a specific part of sports administration. This narrower area can be clearly defined as professional policing, a series of laws regulate everything related to sports policing, supplemented by regulations of sports federations, which, for example, serve as guidelines for keeping sports police records and securing sports events (Tóth, 2019).

Issues related to the provision of sporting events raise social, legal, law enforcement and moral problems. 18 laws, 14 decrees and, mentioning football, the consistent application of the five internal regulations of the Sports Federation, Hungarian Football Federation guarantees the safe conduct of sporting events and

foot-kicking matches. A significant change took place in this area during the amendment of the Sports Act, which entered into force on the first of January 2019. The authors analyze these changes in the article by explaining the reasons.

The authors formulated as a research question whether it would be possible to predict crimes more effectively at sports events without the use of predictive analytics. According to the authors' point of view, the number of police forces can be increased when securing a sports event, but this cannot be solved in all cases, and it also places a significant financial burden on the law enforcement agency.

The theoretical foundations of the study are based on previous international literature. Due to the nature of the topic, the proportion of reports obtained from national and international journals, databases, and news agencies is significant. The methodology used is mainly based on the analysis and examination of previous methods. With regard to digitalization and artificial intelligence, several press articles, analyses, studies and presentations at conferences were also processed, paying special discipline to the latest debates and development trends.

## **2. The impact of innovation on sport**

In the twenty-first century, innovation, technology and technology are significantly shaping the world of sports, and huge changes are taking place, to which we must respond. The word innovation means professional development and innovation, but the concept of innovation itself is constantly evolving and undergoing change, and it also includes organisational innovation. Innovation is the ability to change, which requires courage and the need to be at the forefront of rethinking and redesigning (Tóth, 2020).

So many new innovative solutions are transforming our world and permeating every part of our lives. So why avoid the world of sport with innovation and one of its most dominant manifestations, digital transformation, which means that we redefine and recreate a lot of things in our environment, also in the field of sports?

Without innovative developments, solutions, info communication tools and digitalization, development is unimaginable in all areas and sectors, and all this is now an integral part of the development of the sports industry. The industry is still expecting a huge explosion, the number of companies active in the field is expected to increase significantly in the coming years, and competition between them will intensify. A few decades ago, sports and business were rarely mentioned on the same page, but today we are talking about an industry worth nearly \$90 billion worldwide. Today, data analysis tools help not only competitors but also recreational athletes, while the fan experience is completely transformed—both in front of the TV and in the stadium (Horky, 2021).

In connection with the comparison of the concepts of sport and innovation, the Digital Prosperity Programme states that digital technologies and information technology solutions have fundamentally transformed the field of sport, sport-related activities and operating models in the past few years.

But what is innovation in law? Law preserves, legal traditionalism is always important, but at the same time law responds to the changed economic environment and social life relations. Speed, a new and innovative approach and, of course,

efficiency are increasingly important in legislation, as law adapts to changes in life, and many innovations arise as a result of technical and technological developments.

Order is a fundamental value in every society, those involved in securing sporting events guarantee the safety of all participants (athlete, sports leader, sports professional, spectator) (Perić et al., 2018). Nowadays, innovation has been able to “create” such special situations that nowadays, for example, E-sports events also need to be provided.

Of course, a number of legal instruments have been available for years. One of the most important existing legal innovations was Act CIV of 2011 on the amendment of certain laws necessary to combat the phenomenon of sports hooliganism, the so-called “Hooligans Act”, which simultaneously amended the Police Act, the Criminal Code, the Act on Misdemeanours, the Personal and Property Protection Act and the Sports Act. One of the great novelties of the legislation was the extension of the application of an access control system capable of uniquely identifying participants and the establishment of a sports police register (Tóth, 2019).

Practice has shown that sports hooliganism is not exclusively centred inside the stadium, and therefore the legislator takes the view that disruptors travelling to or leaving sporting events should also be treated as sports hooligans. The relationship between private and misdemeanor sanctions is also unclear, which in extreme cases may result in the offender being punished more than once for the same act.

### **Sports police register—The result of innovation**

Persons subject to restraining orders are recorded in a register kept by the National Police Headquarters. From the data file, the police for the purposes of public order and security, the prevention of violence and disturbance, the fulfilment of international police cooperation obligations and the protection of the rights of others to the foreign police force, as well as for the purpose of protecting the security of events, the refusal to attend sports events and the sale of tickets to the organiser or, if an organiser is employed, ticket sales on behalf of the organiser transfer data to the person performing the data (Dell’Aquila, 2020).

It can be said that parallel to the introduction of the use of the camera system, the use of the access control system and the consistent application of legal institutions such as exclusion, banning and disqualification also played a role in reducing the number of infringements committed in stadiums.

The European Football Championship was to be held in 2020, where the country and its new top facility (Puskás stadium) would have played a prominent role. Of course, next year we hope that the plan can be implemented.

The European Commission will pose a serious security challenge to the countries organising and organising the sporting event. The cultured and safe organisation of matches and related events can only be achieved through the coordinated professional work of all actors and professional areas involved in the organisation and with wide-ranging international cooperation based on partnership. This is also based on mutual acceptance, mutual respect and willingness to cooperate. Based on the experience of previous world competitions, it can be safely stated that

dialogue and information exchange are basic conditions for making good and balanced decisions, and the key to solving security issues. The use of new information technologies will be essential for the successful conduct of the event (Houben et al., 2022).

### **3. Technical and technological innovation**

Law enforcement agencies have a wide range of infocommunication tools and software available. Among others, radio technology, RoboCop program, Activity Management System, Mobile framework, body camera, surveillance systems, devices used in electronic surveillance, Veda Road Intelligent Camera Network. However, focusing on the safe conduct of sporting events, I would like to highlight the latest technical tools that are essential for the safe organisation of an international sporting event (The Evolution and Future of Infocommunication Tools in Law Enforcement, 2019).

#### **3.1. Application of drones**

According to Act XCVII of 1995 on Air Transport, an unmanned aircraft is a civil aircraft designed and operated in such a way that it is not piloted by a person on board.

The illegal use of drones came into focus years ago when a drone pilot broke out a mass brawl with a provocative flag during a European Championship qualifier between Serbia and Albania. The biggest risk in drone development is when technology falls into the wrong hands (Asatryan and Kalpakian, 2021). In extreme cases, it can even become an instrument of terrorism (Ayamga et al., 2021). There is a growing demand for procedures and solutions that can be used to detect drones.

The risk is always real, that after all, a development or new invention will be used for good or harm. Therefore, if Technik falls into unauthorized hands, there may be a significant risk that we have to reckon with. Drone technology makes it incredibly difficult to pinpoint their exact location, but there is already a device that alerts you if you're hovering nearby. The Drone Laboratory was originally set up to develop agricultural drones, but in the meantime, they realized that there was a huge need to facilitate the detection of drones (Ayamga et al., 2021). They produce detectors that alert when a drone for advertising or even entertainment purposes is detected. This includes voice and radio wave drone identification.

In Hungary, an info communication solution will be able to find and identify the signal source of the drone user in Puskás Arena. There will be an airspace closure during matches, so according to current plans, media representatives will not be able to use drones. Protection against drones is prescribed by Union of European Football Associations (UEFA), and the organisation has formulated a detailed set of requirements in connection with this within the framework of its tasks of organising the European Championship, of which this area is a pivotal point.

#### **3.2. Facial recognition system**

Security threats are a growing concern both internationally and nationally, as well as in commercial organisations and activities. As threats to international borders

intensify, governments are introducing new measures at airports, seaports and public transport hubs. One of the main tasks of law enforcement agencies is to identify persons wanted by the public and to filter and highlight them as quickly as possible. In addition, security companies and facility managers must fear unauthorized access to or stay in their premises and offices by known unwanted or unknown persons, and they must also identify highlighted, possibly VIPs, who return to a facility legally and authorized (Tóth, 2020).

The human face plays an important role in our social interaction, conveying people's identities. Using the human face as the "key to security", biometric facial recognition technology has received significant and particular attention in identification in recent years, as it has many applications both in law enforcement and in other areas of civilian life.

Compared to other biometric systems using fingerprints/palmprints and iris diagnostics, facial recognition has particular advantages as it is a 'physical' contactless process. Facial images can be captured remotely without knowing the person to be identified, and identification does not require interaction with a person. In addition, facial recognition serves the purpose of 'detering' crimes, as a recorded and archived facial image can later help identify a person with high accuracy (Hutchins and Andrejevic, 2021).

Facial recognition technologies can generally be implemented as functionally independent applications, but can be seamlessly integrated into new or existing biometric security solutions through system integrators and solution providers (Hutchins and Andrejevic, 2021).

In Hungary, the operation of the Mobile Facial Recognition System and the Portrait Facial Recognition System also belong to the bodies of the Ministry of Interior. Obviously, at a sporting event, mobile facial image analysis can be used to screen out various suspicious persons, while the stationary facial image analysis system helps in subsequent detection in case of a criminal offence. The photographs in the register with which the requested person can be compared are laid down in the law, as are the bodies entitled to use them, indicating the purpose.

As an innovative legal measure, the Sports Act allows the registration of images in the sports police system from the first of January 2019. This provides the legal basis for the inclusion of facial images in the sports police register in the database with which the facial recognition system will work.

In 2015, the creation of two pieces of legislation could be considered as legal innovations: Act CLXXXVIII of 2015 on the Facial Image Analysis Register and the Facial Image Analysis System, and Act No. 78/2015 (XII. 23.) BM Decree on the detailed rules for the operation of the facial image analysis system.

#### **4. Digitalisation in sport**

The development, spread and completion of infocommunication, information technology, digital technologies and digitalization itself at an ever faster pace than ever before fundamentally change all areas of the economy and society, and beyond their direct value-creating role, catalyze the transformation of other industries through their multiplier effect, and fundamentally determine the adaptability and

competitiveness of enterprises, the state is simpler, more transparent, cheaper, more efficient operation (Hutchins and Andrejevic, 2021). Digital transformation driven by information technology and the info communication sector is a decisive driver and engine of economic growth, innovation and social development, and a decisive element of increasing digital wealth.

There is no longer any question that digitalization is the engine of the economy, affecting all sectors. Previously immature technologies are becoming widespread, 5G, Internet of things (IoT), big data, artificial intelligence (AI) are fundamentally transforming entire sectors, from agriculture, health industry, sport and education, to transport and tourism. Thanks to digitalization and digital transformation, efficiency improves, prosperity increases, productivity increases, competitiveness improves.

Europe is building its future on its long history of technology, research, innovation and creativity, as well as on vigorously defending rights and fundamental values. New policies and frameworks will help Europe adopt cutting-edge digital technologies and strengthen its cybersecurity capacities. Europe will continue to maintain an open, democratic and sustainable society, and digital tools can be a powerful underpinning of these principles. Europe will find and pursue its own path to become a globally competitive, value-based and inclusive digital economy and society, preserving its open but rules-based market and continuing to work closely with its international partners. Digital technologies have fundamentally transformed sport-related activities, operating models and the entire ecosystem of sport over the past few years. The availability of big data, sensors, digital services and digital channels and communities are completely transforming the sports system; The widespread use of virtual and augmented reality devices is also gaining momentum (European Union, 2020).

Consequently, digitalisation, the virtual world and the information society must also be addressed in the field of sport.

#### **4.1. Digital applications and tools**

The aim is to build on the successes, traditions, intellectual resources and innovation activities of Hungarian sport to develop new digital applications, solutions and products in Hungary that can be globally competitive. Cloud-based systems and data analytics software have brought tremendous momentum to various sports, so it's no surprise that sports analytics and sports informatics have grown into independent industries within IT and the following applications play a major role in revolutionizing the sports industry (Tóth, 2021b):

- Sports analytics systems (real-time data analysis, statistics).
- Sensors, wearable technology.
- Cloud-based solutions.
- Mobile technology.
- Virtual reality.
- Drones.

These technologies, individually or in different combinations, have now appeared in almost every sport. It would be important to equip youth education bases and sports academies with state-of-the-art digital equipment, along the lines of

setting up a unified procurement concept and proposal in advance. The goal should be to integrate digital technologies widely in all areas of the sports sector, especially in youth education, spectator team sports, as well as priority sports and prominent associations (Woods et al., 2021).

These technologies not only provide new training tools for professional and hobby athletes, but also lay the foundation for new sports and business models. The spread of digital solutions is particularly important in the field of youth education and talent management.

Currently, there are few digital solutions in the field of sport in Hungary, the systematic and extensive use of digital technologies, and there are few professionals who know sport well but also have adequate digital knowledge who could handle the most modern IT systems and apply digital analysis methods at a skill level and with sufficient efficiency.

The spread and introduction of digital technologies, applications and solutions should be encouraged in the fields of elite sports, competitive sports, school sports, youth education and mass sports (Woods et al., 2021). The aim is to build on the successes, traditions, intellectual resources and innovation activities of Hungarian sport to develop new digital applications, solutions and products in Hungary that can be globally competitive. Cloud-based systems and data analytics software have brought tremendous momentum to various sports.

Social media has given athletes a tool to build a fan base of millions and nurture them professionally. According to recent statistics, 2.2 billion people actively use Facebook, 1 billion use Instagram, 1.3 billion use Messenger. Online social media has become one of the main tools for athlete branding. Players often post live streams, photos, videos. The peculiarity of this is that the main characters themselves share the recordings, thus accompanying the followers behind the scenes, which gives a special experience to the viewer as well (Digital Prosperity Programme 2.0, 2017)

Chatbots, that is, interlocutors who act and respond like robots, have also begun to work in sports. In a simplified application, fans only need to tick which club and player they like and the chatbot will automatically send them a message with the current video summary of their favorites' last match. Clubs can also use AI-based chatbots to replace customer services: they can provide immediate answers to simple questions, such as how fans can get to the stadium, where to buy tickets or how to sign up for the club's platforms. Thus, chatbots can also be of enormous importance in the field of sports policing, and in Hungary they can also help the work of contributors included in the Sports Act.

Digitalization can also bring about the latest revolution in enhancing sports performance.

Smartwatches measure activity, performance, health app is available. It can be used by amateur, professional and recreational athletes. These devices measure and record their activity, store health analyzes.

The demand for digital tools and services has also had an impact on online gaming, leading to a sharp increase in interest in e-sports. Our lives take place in an online space controlled by us. Innovation is present in all areas of life today; it is essential to use innovative tools without the use of development.

Technological changes and artificial intelligence (AI) have had a significant impact

on the generation and analysis of reports on sports. It has revolutionized the way sports data is collected, processed, and presented, making reports more informative, accessible, and insightful. AI-driven sports reports are also becoming increasingly sophisticated and valuable for sports enthusiasts, journalists, analysts, and sports organisations. They provide a wealth of information and insights that enhance the understanding and enjoyment of sports, and they continue to evolve as AI technology advances.

For example regarding the concept of automated journalism, although there is a wide terminological variety to designate the generation of journalistic content from algorithms such as robot journalism, algorithmic journalism, or computational journalism, among others, this term is the most used in approaches close to the sociology of communication (Murcia et al., 2022).

In recent years, the presence of artificial intelligence programs in journalistic newsrooms has become normalized and it has also become characteristic of the sports reports with the same quality standards as the chronicles made by journalists (Murcia et al., 2022).

The form of e-sports as we know it today began to develop at the end of the 90s, with the spread of video games that can be played through the World Wide Web, in South Korea, where the state was the first in the world to recognize the importance of a purely entertaining activity that captured the interest of many young people. The Ministries of Culture, Sports and Tourism established the Korean E-sports Association, whose primary task has been to regulate and promote e-sports ever since. Esports are currently officially recognized in more than 60 countries, including China, the USA and South Korea.

Already in 2000, players were able to compete in ten tournaments, and the popularity of e-sports is evidenced by the fact that by 2010 the number of tournaments had grown to 260 per year, in South Korea alone. E-sports is an abbreviation for electronic sports, in fact it is a special combination of intellectual and technical sports, so this topic raises a number of technological legal questions (Tóth, 2020).

E-sports is a collective term for competitive (competition, racing) video games, where professional players and competitors compete with each other online or offline, at traditional events and organised competitions, usually for some kind of prize. Actually, the game is the competition. Video gaming at home as a hobby is by no means an e-sport (Kóhidi, 2018).

Artificial intelligence is already being used in esports (Tóth, 2021a). At the end of 2018, the world's first AI-based gaming coaching system was introduced. It aims to provide effective assistance to amateur e-athletes and help them improve their performance. The development is registered by a Hungarian startup. This system is nothing more than an artificial intelligence-based personal coach that develops the player by analyzing the videos recorded during gameplay. In addition to traditional statistics, the system provides tips and even practice exercises, thus contextualizing the player's performance and effectively helping to understand mistakes.

For example, a sporting goods company has developed self-lacing shoes that automatically fit the shape of the foot and will be able to control the tension of the shoelaces with a smartphone. This is the latest futuristic shoe from the manufacturer. According to the company, this innovative solution will improve the performance of basketball players in particular, because it will no longer be necessary to loosen corsets

to improve blood circulation in the feet. In addition, smart jerseys, smart vests, smart clothes, motion analysis systems, clothing with sensors and electronic sensors built into the material are constantly being developed, which record data.

Leicester City, one of only three Premier League teams, are working with futuristic technological innovation, artificial intelligence, among others, to process data about them and their opponents during the season. The three current podium finishers, Liverpool, Manchester City and Leicester City, are the most advanced in Europe, and perhaps the world, in integrating artificial intelligence into everyday processes.

The club uses IBM's artificial intelligence, Watson, which provides completely new ways to prepare a team. One of the most spectacular of these solutions is to place all the team's games in virtual reality, and with the help of a controller and glasses, any scene can be analyzed standing on the pitch between the players. This gives a new perspective to the coaching and analytical staff and, through them, to the players. From here, with a single click, they can get a new perspective: the track can be examined in 3D (with rudimentary graphics) in a top view, as if it were a giant terrain table. Behind him on the wall is the image of the original TV broadcast in sync so that they can analyse what happened on the track (Index, 2020).

The program uses GPS data recorded about the players, is able to expand its own knowledge base about players and teams.

Interestingly, this platform also found the answer to exactly where the attacks come from, analysing data from the 2017–18 Premier League season, and found that 20% of shots on goal started from throw-ins. As it turned out that throw-ins were a priority, Liverpool, which pays close attention to data analysis, signed a separate throw-in coach.

They are currently working on a virtual reality system in which players will be able to walk onto the pitch themselves with glasses on their heads and be able to position themselves anywhere.

An interesting fact is that there is already a team game developed by artificial intelligence called "speed gate", in which two teams of six play on a field with three gates, and players have to hit each other with a ball by bypassing the middle gate—the American soccer ball can be passed to each other with hands and feet.

While there is no substitute for talent and expertise in football and other sports with IT, leading sports clubs around the world are also striving to modernize. Because what used to require many years of experience or special observation skills is now also known by technology. The use of certain technologies is also becoming more and more widespread in football: for example, goal-line technology to determine goals, camera systems and video applications to help refereeing decisions and check their regularity.

## **4.2. Predictive analytics**

As mentioned above, sports today cannot do without artificial intelligence. For major sporting events, only predictive software is rarely used to predict crimes. However, it is increasingly common in everyday police practice. Predictive software was first used in Hungary to predict crimes, and then it spread to many countries around the world. Predictive software is seldom used at global international sports events, and the related results and experiences are not available to researchers. However, a Hungarian example

can be used. Hungarian software called Böbe was used to predict crimes at the Sziget Festival in Budapest in the 2000s. Based on the police data, the number of crimes decreased as a result of the software (Mátyás, 2017), so the forecast can also be used successfully in the case of a mass event. However, the police did not achieve the most remarkable result within the event, but near the event (Sziget Festival). In some years, not a single crime occurred in the surrounding streets during the festival (source). In the case of sporting events, this may be the most important thing so that no crime occurs near the sporting event. Several studies have established that it is practically impossible to enter the area of a sports event to commit a crime due to strict control. Crimes committed during sports events take place in the vicinity of sports venues, where there is less police presence and no control (Mátyás et al., 2022).

Several software already exist today (e.g., Hunchlab, Crime Anticipation System) into which you can enter the dates of sporting events, and it will give you a forecast based on this. according to the authors, the future will move in this direction; that is, software based on mathematical statistics and artificial intelligence can greatly help forecasting. Based on certain methods of committing (modus operandi), certain software can even name the perpetrator by name, so facial recognition cameras can easily filter him out during entry. However, it can be a problem the ethnic profiling, predictive software is being restricted in more and more places due to attacks by legal defenders (see: PredPol software in Los Angeles). Another problem with using predictive software is that current software cannot predict improbable human behaviour. This can be, for example, a terrorist attack, an attack by a lonely perpetrator or an attack by a mentally ill perpetrator (Mátyás et al., 2020).

We should also mention geographic profiling, which is close to predictive policing in its operating principle. This can primarily be used at sporting events when a series of crimes have already occurred, and to prevent the next crime, they want to find the place of residence of the perpetrator. In the case of a longer sports event (at least 1–2 weeks), it is possible to create a geographical profile. The modus operandi is of great help to the investigators in this case as well. However, in the case of crimes committed at the site of the sports event, the offender's movement, the buffer zone, etc., must be interpreted differently. We can assume that the perpetrator is not a local resident but may even be a foreigner. It is important to emphasize that profiling can be used primarily in the case of crimes that involve multiple crimes. There are also attempts to detect the perpetrators of individual, small number of crimes, but they only work with less efficiency.

Crime mapping is also closely related to predictive policing and geographic profiling. Today, of course, we should think of something other than paper-based maps, but of GIS. Several predictions can be made by marking the number and type of these crimes. There are many software (e.g., Crimestat) that perform correlation and regression operations (e.g., Pearson's correlation coefficient, Moran's I index). Based on this, it is possible to find between some indicators of crime and geographic location. In other words, what facilitates the occurrence of crimes. In particular, autocorrelation tests are the ones that can be of great help in delineating hot spots (e.g., in a fan zone). They can be used to optimize the area where the largest number of police forces will participate in the insurance. If the demarcated area is too large, it is uneconomical for the law enforcement agency (more people and more

equipment are needed). And if the demarcated area is too small, it causes problems again, as a large number of crimes will occur outside the controlled area. The possible places of crime and danger zones depicted on the map can greatly help the work of law enforcement agencies. It will be clear to everyone involved in the insurance where they have to provide service and which are the places where a significant event should be expected (e.g., by displaying previously committed crimes).

Finally, let's mention the role of criminal geography, which is related to each of the above areas. Examining the social and natural environment of an area is essential. Knowing these factors, the factors that may appear as risk factors in a specific area and location can be specified. Predictive software can primarily interpret these factors as risks. Knowing this, it is only possible to develop the appropriate law enforcement strategy in connection with securing a sports event.

In relation to the geography of crime, we should mention that most authors (Zeitner and Clages, 2016) mean crime mapping or environmental criminology by criminal geography. The author of this article emphasized in his many studies that the field of criminal geography is much broader than this (Mátyás, 2020). In connection with a sporting event, it is necessary to analyze the social conditions of the immediate environment (in some cases, even the natural conditions), e.g., what kind of social status people live within a few kilometres of the sports hall. Several factors can be examined in this regard, such as GDP per capita, unemployment, the population's age structure, occupational structure, and the proportion of people with a criminal record. Knowing these, it is possible to create a location-based policing strategy for the sports event.

## **5. Summation**

In the twenty-first century, innovation and technology will completely transform the world of sport. The emergence and spread of new innovative solutions and digital technologies have fundamentally transformed sport-related activities, operating models and the entire ecosystem of sport in the last few years. The availability of large amounts of data, sensors, digital services and digital channels and communities are completely transforming the sports system; The widespread use of virtual and augmented reality devices is also gaining momentum.

Unfortunately, in Hungary there are currently few digital solutions in the field of sport, the systematic and extensive use of digital technologies (both vertically and horizontally), and there are few professionals who know sport well but also have adequate digital knowledge, who can handle state-of-the-art IT systems and apply digital analysis methods at a skill level and with sufficient efficiency.

Regarding the research question, it was established that, according to our current knowledge, the use of predictive software can predict the place and time of crimes with the greatest efficiency. Each software gives the future event with different accuracy; as a result of technical and scientific development, the accuracy of the forecast is expected to increase. We can state that predictive tools can provide an event more efficiently and cheaply by predicting likely behaviours. Of course, this means that we can only do with a live police presence. It means that it is

recommended to use predictive software in parallel with police presence. In summary, in sports, in the field of sports policing, and during the safe conduct of sports events, predictive analytical methods play a major role.

We consider it important to establish a digital education framework for sports professionals, to ensure the conditions for sports informatics training, and to establish many more university knowledge and research centres. The organisation of a sporting event on a digital platform also requires detailed regulations.

These technologies not only provide new training tools for professional and hobby athletes, but also lay the foundation for new sports and business models. The spread of digital solutions is particularly important in the field of youth education and talent management.

As a result of all this, the traditional concept of sport has loosened up very strongly, and today a large number of new sports are being formed, or old ones are differentiating on digital bases and electronic interfaces. The topic also raises a number of data protection questions, and the question may also arise as to whether chatbots, robots and systems operating on the basis of artificial intelligence will require less living human power, and whether all these can replace human labor. The next decade will provide the answer to this question, because what will define our lives ten years from now is unknown even to researchers today. Innovation and digitalization are transforming the world of sport to an unprecedented extent, providing lifelong research opportunities for those working on this topic.

## **6. Conclusion**

According to the authors, increasing security at sports, mass events and tourism can be achieved not by increasing the number of forces working in police and private security services, but by increasing digital technology and using new tools. There are several studies on novel technical solutions used at sporting events and tourism, but development is mostly moving “in one direction”.

The research found that many innovative and digital solutions are used in sports policing to create better public safety. Nevertheless, there are a number of solutions that could further increase the safety of sports and mass events. To the authors’ knowledge, they have not yet been used or published more widely. In the case of the present research, the authors consider it a novelty to mention these new types of devices and the possibility of using them in the field of sports and sport tourism safety. These tools include geographic profiling, predictive analytics, crime mapping and crime geography.

These tools have not yet been used at sport events and tourism, although they have already proven their crime prevention and investigation support effect in other areas of life.

According to the authors, artificial intelligence cannot replace manned protection, but it can play a major role in ensuring the safety of sports and tourism.

**Author contributions:** Conceptualization, MS, TNÁ, BZ, MG and DLD; methodology, MG and TGJ; software, TGJ; validation, MS, TNÁ, BZ and DLD; formal analysis, TGJ and MG; investigation, MS; resources, TNÁ, BZ and DLD;

data curation, TGJ; writing—original draft preparation, MG, MS, TNÁ and BZ; writing—review and editing, DLD, TGJ and MG; visualization, TNÁ; supervision, DLD; project administration, DLD; funding acquisition, DLD. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research received no external funding.

**Acknowledgments:** The authors would like to thank the Hungarian University of Agriculture and Life Sciences and the Stipendium Hungaricum, Tempus Public Foundation, for their support.

**Conflicts of interest:** The authors declare no conflict of interest.

## References

- Abdullaev FT, Pardayev BP (2020). The role of public sports and health measures in strengthening children's bodies. *Academic research in Educational Sciences* 1(4): 9–14.
- Ákos K (2018). Legal assessment of electronic sport (e-sports) (Hungarian). In *Medias Res: journal of Press Freedom and Media Regulation (Hungarian)*, 7(2): 248–258.
- Asatryan G, Kalpakian J (2021). The drone age: How drone technology will change war and peace. *Critical Studies on Terrorism* 14(3): 392–394. doi: 10.1080/17539153.2021.1948651
- Ayamga M, Akaba S, Nyaaba AA (2021). Multifaceted applicability of drones: A review. *Technological Forecasting and Social Change* 167: 120677. doi: 10.1016/j.techfore.2021.120677
- Brosnan S (2019). The impact of sports participation on crime in England between 2012 and 2015. *Sports in Society* 23(6): 1080–1090. doi: 10.1080/17430437.2019.1631805
- Bujdosó Z, Dávid L (2013). Extreme sports and other activities in tourism with special regard to the Mátra Mountain. *Journal of Physical Education and Sport* 13(1): 39–45. doi: 10.7752/jpes.2013.01007
- Chang MX, Choong YO, Ng LP, Seow AN (2022). The importance of support for sport tourism development among local residents: the mediating role of the perceived impacts of sport tourism. *Leisure Studies* 41(3): 420–436. doi: 10.1080/02614367.2021.2011950
- Dell'Aquila P (2020). Olympic games as mega-sport events: Some social-historical reflections on recent summer olympic games. *Italian Sociological Review* 10(2): 271–289. doi: 10.13136/isr.v10i2.340
- Eck JE, Chainey S, Cameron JG, et al. (2005). Mapping crime: Understanding hot spots. *NCJ, Pittsburg*.
- Herjanto H, Amin M, Okumus F, Cobanoglu C (2022). Airline service: Low-cost-carriers (LCCs) failure and passenger emotional experience. *Tourism Review* 77(3): 945–963. doi: 10.1108/TR-01-2021-0025
- Higham J (2021). Sport tourism: A perspective article. *Tourism Review* 76(1): 64–68. doi: 10.1108/TR-10-2019-0424
- Horky T (2021). No sports, no spectators—No media, no money? The importance of spectators and broadcasting for professional sports during COVID-19. *Soccer & Society* 22(1–2): 96–102. doi: 10.1080/14660970.2020.1790358
- Houben R, Blockx J, Nuyts S (2022). UEFA and the super league: Who is calling who a cartel? *The International Sports Law Journal* 22: 205–216. doi: 10.1007/s40318-021-00201-2
- Hutchins B, Andrejevic M (2021). Olympian surveillance: Sports stadiums and the normalization of biometric monitoring. *International Journal of Communication* 15: 363–382.
- Mátyás S (2017). Predictive policing researches in Hungary. In: Biljana, Simeunovic-Patic (szerk.) *Predictive Policing Researches*. Belgrád, Szerbia: Academy of Criminalistic and Police Studies. Belgrade. pp. 150–158.
- Mátyás S (2020). *Bűnözésföldrajz*. Available online: [http://real.mtak.hu/90113/1/M%C3%A1ty%C3%A1s%20Szabolcs\\_B%C5%B1n%C3%B6z%C3%A9s%C3%B6ldrajz.pdf](http://real.mtak.hu/90113/1/M%C3%A1ty%C3%A1s%20Szabolcs_B%C5%B1n%C3%B6z%C3%A9s%C3%B6ldrajz.pdf) (accessed on 13 November 2023).
- Mátyás S, Mészáros B, Szabó I (2020). Predictive policing (Hungarian). In: Ruzsonyi P (editor). *Közbiztonság (Fenntartható Biztonság és Társadalmi Környezet Tanulmányok, 3)*. Ludovika Egyetemi Kiadó.
- Mátyás Sz, Nagy-Tóth NÁ, Dávid, LD, et al. (2022). The role of sports policing and tourism safety at the summer Olympics. *Sustainability* 14(10): 5928. doi: 10.3390/su14105928

- Murcia Verdú FJ, Antón RR, Rubio LMC (2022). Comparative analysis of the quality of sports reports prepared by artificial intelligence and journalists. *Revista Latina de Comunicación Social* 80: 91–111. doi: 10.4185/RLCS-2022-1553
- Nafziger JAR, Gauthier R (2022). *Handbook of International Sports Law*. Edward Elgar Publishing Inc.
- Perić M, Đurkin J, Vitezić V (2018). Active event sport tourism experience: The role of the natural environment, safety and security in event business models. *International Journal of Sustainable Development and Planning* 13(5): 758–772. doi: 10.2495/sdp-v13-n5-758-772
- Sandoval-Martín T, La-Rosa Barrolleta L (2023). Research on the quality of automated news in international scientific production: Methodologies and results (Spanish). *Cuadernos.Info* (55):114–136. doi: 10.7764/cdi.55.54705
- Soto-Fernández A, Camerino O, Iglesias M, et al. (2022). Lince Plus software for systematic observational studies in sports and health. *Behavior Research Methods* 54: 1263–1271. doi: 10.3758/s13428-021-01642-1
- Szebeni Z, Salojärvi V (2022). “Authentically” maintaining populism in Hungary—Visual analysis of prime minister Viktor Orbán’s Instagram. *Mass Communication and Society* 25(6): 812–837. doi: 10.1080/15205436.2022.2111265
- The evolution and future of infocommunication tools in law enforcement. (2019) Faculty Scientific Students’ Association Conference National University of Public Service RFaculty of Encyclology 6 November 2019.
- Torres-Ronda L, Beanland E, Whitehead S, et al. (2022). Tracking systems in team sports: A narrative review of applications of the data and sport specific analysis. *Sports Medicine-Open* 8(15): 2–22. doi: 10.1186/s40798-022-00408-z
- Tóth NÁ (2019). Sport policing in the system of sport administration (Hungarian). Available online: [https://tudasportal.uni-nke.hu/xmlui/bitstream/handle/20.500.12944/12782/T%c3%b3th\\_Sportrend%c3%a9szet\\_IH\\_FINAL.pdf?sequence=1&isAllowed=y](https://tudasportal.uni-nke.hu/xmlui/bitstream/handle/20.500.12944/12782/T%c3%b3th_Sportrend%c3%a9szet_IH_FINAL.pdf?sequence=1&isAllowed=y) (accessed on 14 December 2023).
- Tóth NÁ (2020). Innovative sports policing tools. *Belügyi Szemle*; Before publication.
- Tóth NÁ (2020). Legal regulation of E-sports. *Sports Law I*. Budapest, HVG-ORAC.
- Tóth NÁ (2021a). Technological innovations in the field of sports policing. *Chasopys Natsional’noho universytetu Ostroz’ka akademiya*.
- Tóth NÁ (2021b). The application of innovative sports policing tools in Hungary. Available online: <https://www.akademiapz.sk/sites/default/files/2022-08/008%20%20Nikolett%20%20C3%81gnes%20T%20%20C3%B3th%20The%20application%20of%20innovative%20sports%20policing%20tools%20in%20Hungary.pdf> (accessed on 14 December 2023).
- Woods CT, Araújo D, Davids K, Rudd J (2021). From a technology that replaces human perception—Action to one that expands it: Some critiques of current technology use in sport. *Sports Medicine-Open* 7: 76. doi: 10.1186/s40798-021-00366-y
- Zeitner I, Clages H (2016). *Kriminologie*. VDP.