

Beyond the Sport: A Holistic Understanding of Safety in the Sports Industry – A Systematic Literature Review

Tünde Máté, Judit Módné Takács

Obuda University, Alba Regia Faculty

Budai út 45, H-8000 Székesfehérvár, Hungary

mate.tunde@amk.uni-obuda.hu, modne.t.judit@amk.uni-obuda.hu

Abstract: The aim of our research is to use a systematic literature review to explore how safety can be understood in the sport business in relation to sport events. In 2020, the Covid-19 pandemic changed the way people think about safety, with a major impact on the repositioning of security. The focus has shifted to health safety, but other areas have also gained in importance. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol has been followed in the development of this systemic review, ensuring the traceability and reproducibility of the search, appraisal and selection procedures for research. As a result of applying the screening criteria, 78 studies were selected and analyzed out of 2225 articles. The review describes the understanding of safety in the sport economy is defined by three broad themes: sport event safety, athlete safety and consumer safety. As a result, this study identifies a complex security system for those involved. It recommends that rights holders, sports associations, sports clubs, and organizers apply a holistic approach in addition to economic considerations, especially in the case of athletes and consumers.

Keywords: sportbusiness; sport event; safety; safety protocols

1 Introduction

Safety is a relative and subjective concept. Is it relative in terms of what safety is, and subjective in terms of what the individual's sense of safety is? And the desire for security is a natural need to protect oneself or to be protected from these dangers [1]. The subjectivity of safety is based on the fact that safety and its optimal degree are different for each person. It is a central product of the sport economy in sporting events, both professional and recreational [2], one of the main characteristics of which is the experience of sport in the community. These events are usually mass events, attracting hundreds, thousands, tens of thousands of people. Finding a way to provide safety for participants without taking away

from the consumer's enjoyment is a key issue. According to Cserny and Christián, *"the excessive desire to achieve more and more safety often works against progress, and the permanent presence of uncertainty in human communities is also a performance limiting factor"* [3 p 72]. Since 2020, however, this area has taken on a new meaning and health safety has become the main issue. Between 2020 and 2022, the health situation affected international sporting events attracting large crowds and the consumers who watched them in person on the spot [4]. Knowing the challenges of recent years, the implementation of safety is a complex task that has multiple aspects in the field of sport economy and requires coordinated measures to reduce hazards and risks.

In our research, we used a systematic literature review to examine the role of safety in the sports economy and then narrowed the question to its central product in the organisation of international sporting events. Our chosen research method is systematic literature analysis, which is a literature review based on an explicit, structured, predefined set of criteria. The literature review helps identify research gaps and can point the way for further research. The focus of the study is on changes, challenges and possible solutions

Our research questions are:

- Q1 What are the most used interpretations of safety in the sports economy, in relation to international sporting events?
- Q2 How has Covid-19 changed safety arrangements for international sporting events?
- Q3 How do safety measures at sporting events affect spectators' consumption patterns and behaviour?

2 Theoretical Introduction to the Subject

The research topic is based on three pillars of literature. Sport economy, sport governance and safety. The sport economy is the field of social activity where people produce, distribute, exchange and consume sport services, either actively or passively, to meet their needs for sport services. The participant in the sports economy can be either active (recreational sport) or passive (professional sport consumer: on-site or media consumer) [5].

In the case of a sporting event, in addition to the professional organisation of the sport, complex strategic planning and a business approach are also involved. The sporting event is publicised and can be viewed by market players of the sport economy, spectators, fans and, from a business point of view, consumers. For the consumer, the sporting experience is a break from everyday life, an entertainment and an experience. Stakeholders include media, sponsors and service sector

players. The consumer of the product (sporting event) can also benefit from additional services beyond watching the competition, such as meals, entertainment during the break, prize draws. International sporting events are the highest level of these sporting events.

When it comes to the definition of safety, there is no single de-definition. There is no single concept of safety that can be used in all research fields. The dual use of the term "safety" appears in both French and English [6]. In English, the words "safety" and "security" are translated as safety. In English, "safety" refers to immunity from, or some kind of protection against, human and technical errors, unintentional harm to humans, natural disasters and system problems, while "security" refers to protection against harm caused by intentional human behaviour [7]. The difference lies in the different nature of the protection. According to Korinek [6], it is convenient to define security as the absence of danger or threat, and it can also be said to exist when the possibility of harm occurring exists but can be avoided. Tálas [8], based on national and international literature, arrives at the same conclusion: security is both the absence of danger and threat and the possibility of avoiding danger and threat. Security is not an achievable state, it is always relative. Safety is more a matter of perception, i.e. what individuals and communities think about safety is determined by a combination of objective safety (safety situation) and subjective safety (safety perception), and it is far from certain that these two approaches always coincide [8]. Szakali and Szűcs[9] call for both military and non-military security sectors to respond to a complex crisis situation. The 'non-military security dimension has not gained ground and is not deeply rooted in security policy and practice', but the Crown virus has significantly changed this thinking. A recurring assertion in the security literature is that current security challenges are highly complex and rapidly changing, and can only be met by developing common capabilities and joint action. [9-14]

The aim of our research is to identify areas in the functioning of the sport economy where safety can be understood and needs to be addressed.

3 The Research Methodology

The aim of systematic reviews is to identify all the research on a given topic, so as to provide a balanced and unbiased summary of the topic [15]. The systematic literature review methodology used in this research follows the principles of PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses).

3.1 The Search Strategy and Selection Process

The search strategies for systematic reviews aim to identify all research relevant to a given question [15, 16]. To ensure a sufficient scope of review, a comprehensive search was conducted, taking into account aspects of sport events and security, using combinations of relevant search terms, by applying logical relationships of synonyms. In several databases (Scopus, WoS, IEEE Xplore), the following key combinations were used to filter the English articles: ('sports facility' OR 'Olympics' OR 'sporting event' OR 'world competition' OR 'international competition' OR 'sporting event' OR 'sporting economy' OR 'sports industry' OR 'sports organisation' OR 'sports consumer behaviour' OR 'fan behaviour') AND ('sports safety' OR 'safety' OR 'safety' OR 'safety strategies' OR 'safety protocols' OR 'safety policy' OR 'safety approach' OR 'safety strategy' OR 'safety risk' OR 'safety measures' OR 'health risk' OR 'Covid'). Due to the limited availability of Hungarian language databases and the small number of available studies, it was not feasible to include Hungarian language studies in the systematic review. The screening and data selection process followed the retrieval of articles, and the systematic review process followed PRISMA guidelines [17].

3.1.1 Protocol Design - Inclusion and Exclusion Criteria

In line with the objectives of the study, inclusion and exclusion criteria for the studies were defined [16]. The primary aim of the screening was to identify and summarise the impact of Covid on the safety of sporting events, and to assess the understanding of safety in the sport economy, the role and importance of safety in the degradation of sporting events. In particular, we will examine the ability to respond effectively to cyberthreats, health threats, the effectiveness of safety measures at sporting events, and the behaviour of users.

The search is limited to peer-reviewed papers published in English. Articles reporting on non-independent research, systematic literature reviews, summaries, meta-analyses were excluded. Studies that did not focus on sport events, organisational areas or the human, athlete, consumer side were excluded. Books, book extracts and studies representing non-original research were also excluded.

Inclusion criteria included only original, peer-reviewed research published in English. The time of publication was limited to the period between 2012 and 2023, which was further divided into three different phases: before the Covid (2012-2019), during the Covid (2020-2022) and after the Covid (2023). Journal articles and conference proceedings were eligible document types. The studies were required to provide either quantitative or qualitative data relating to the organisation of sports events within the specified time frame, with a particular focus on safety and security considerations. In addition, the selected studies had to address the safety of sporting events and their participants, as well as provide insights into the expected safety measures implemented during these events. These

criteria have been developed in accordance with methodological requirements and quality standards, ensuring the inclusion of relevant studies in our review.

3.1.2 The Filtering and Data Selection Process

The systematic review followed the PRISMA guidelines. A comprehensive search of the relevant electronic databases (IEEE Xplore, Scopus, Web of Science) was performed using a combination of previously provided keywords. A multi-step filtering process was applied during the search. From the identified studies, publications that did not meet the predefined criteria, duplicates or incomplete data were removed. The titles and abstracts of the remaining studies were assessed by independent experts, who then reviewed the full text to decide on their sub-qualification. Data extraction and quality control were performed using a pre-defined database. The first set of search results contained a total of 2225 articles, from which a total of 78 studies were selected as the final set.

The detailed screening process, the selection results and the reasons for the exclusions are detailed in Figure 1.

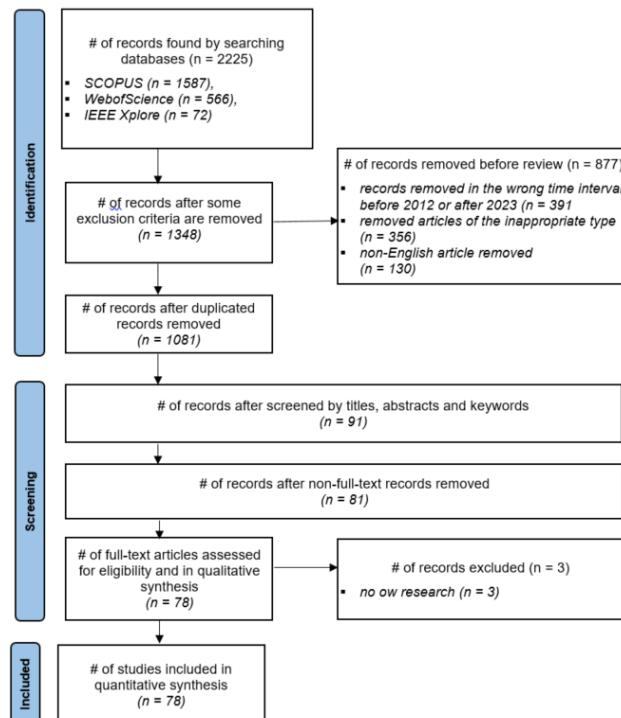


Figure 1
Flowchart of article selection according to PRISMA guidelines
Source: Author's construction

3.1.3 Data Analysis and Synthesis Methods

The systematic review summarised the results of studies identified using the meta-analysis method [15]. To categorise the studies, qualitative content analysis methods were used to classify information relevant to the research question. Data were extracted according to the criteria defined in the PICO framework. General information such as: the purpose and method of the research, the type and year of the event under study, the interpretation of safety, safety measures and the impact on consumers were used to collect the data. A narrative synthesis approach was used for further analysis. Finally, an in-depth review of the articles was used to extract relevant data to help answer the research questions.

4 Results

4.1 Safety Concepts in Sports Economics

The 78 articles examined all have in common that security is a basic human need which, when compromised, takes precedence over all other factors. The safety of sporting events should be understood as a system of measures and activities to protect against hazards, as well as the ability to manage risks and prevent dangerous situations.

Table 1
Interpretations of the concept of security and thematic overview of related studies

Safety Interpretation Category	Safety Interpretation Subcategories	Studies	Total
Health Safety	<i>air pollution, epidemiology</i>	[17], [18]	2
Cybersecurity	<i>cyberattacks, cyberthreats</i>	[19], [20]	2
Transport Safety	<i>monitoring, surveillance technologies</i>	[21], [22]	2
Public Safety	<i>compliance with standards, police</i>	[23-25]	3
Facility Safety	<i>structure, construction process</i>	[26-29]	4
Safety of Sport Consumers	<i>attitude, health, physical safety, tourism, epidemiology</i>	[30-50]	21
Safety of Athletes	<i>health, mental, physical safety, epidemiology</i>	[51-72]	22
Sport Event Safety	<i>environmental factors, health, terrorism, risk management, technologies</i>	[73-94]	22

As a result of, the systematic review, it has been possible to identify the areas (Table 1) that are the results of the interpretation of safety in the studies examined.

As shown in Figure 2, the majority of studies are focused on safety interpretations related to sports events, athletes, and sports consumers. It should be highlighted that, in these cases, the safety of sports facilities must be established at the planning stage, bearing in mind the organisation of mass events.

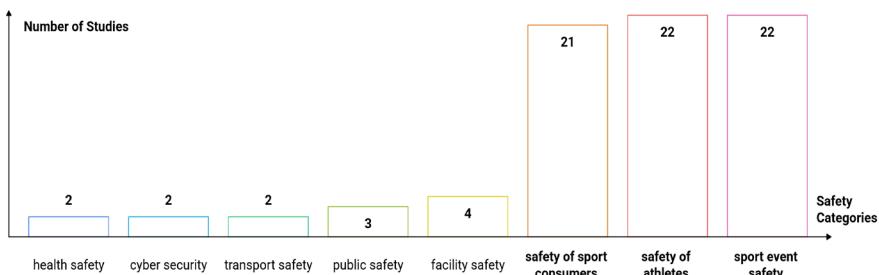


Figure 2
Distribution of studies across safety interpretation categories

Source: Author's construction

In the case of the safety of sport consumers, safety as a state that gives a sense of trust and the guarantee of its preservation, which is a fundamental expectation of the consumer when using a product or service [42]. Physical safety is a basic consideration for the safety of athletes, the safe conduct of competitive events (prevention of accidents and injuries). When Mountjoy and co-authors [69] asked athletes in their research to define 'safe sport', athletes primarily defined it as general physical and environmental safety, fair play and clean sport, rather than sport free from harassment and abuse. The topic of mental safety focuses on the preparation process of athletes and examines relationships [54] [62] [64] [66]. Health, or more narrowly epidemiological safety, provides a healthy state in which the athlete is able to perform at his or her best in competition [51] [52] [55] [56] [58] [80]. The safety of a sporting event is limited to the duration of the event, the main factor is the management and protection against various external environmental risks, the development of related strategies and the application of innovations and technological solutions.

4.2 COVID-19's Impact on Sports Safety Measures

We examined the period from 2012 to 2023, according to the publication of the articles, and the results clearly show that security as a research topic in sport became a focus in 2021 and 2022. An analysis of the temporal distribution of publications indicates a noteworthy trend in sports safety research. The distribution of publication dates of the studies was as follows: 20.5 % were published prior to the onset of the pandemic ($N = 16$), 29.5 % during the pandemic

($N=23$), and 50 % in the post-pandemic period ($N=39$). This data evidently demonstrates the catalytic role of the pandemic in the scientific investigation of the safety aspects of sporting events, as half of the publications were published in the post-pandemic period, significantly boosting research interest in this area.

During the first waves of pandemic COVID-19, many sporting events were cancelled or held without spectators. Therefore, a containment strategy to ensure safe event requirements was developed and tested. In a pandemic COVID-19 situation, a strategy for the safe return of sporting events was needed, with researchers aiming to pave the way for a new normal based on existing experience [36]. 46% of the articles reviewed deal with the Covid-19 pandemic. The two main areas affected by the Covid-19 epidemic were athletes and consumers. For athletes, it was a serious dilemma at this time to stay active and prepare for a world competition in the midst of a global epidemic affecting millions of people, all while safety was paramount. Measures have brought changes in athlete safety that have influenced training work, for example, the use of a face mask increases the physiological stress on the body [70].

Figure 3 shows the population of studies included in the research, broken down by country, and highlights the work published in the post-Covid period. The size of the bubbles in the visualisation represents the frequency of references per country.

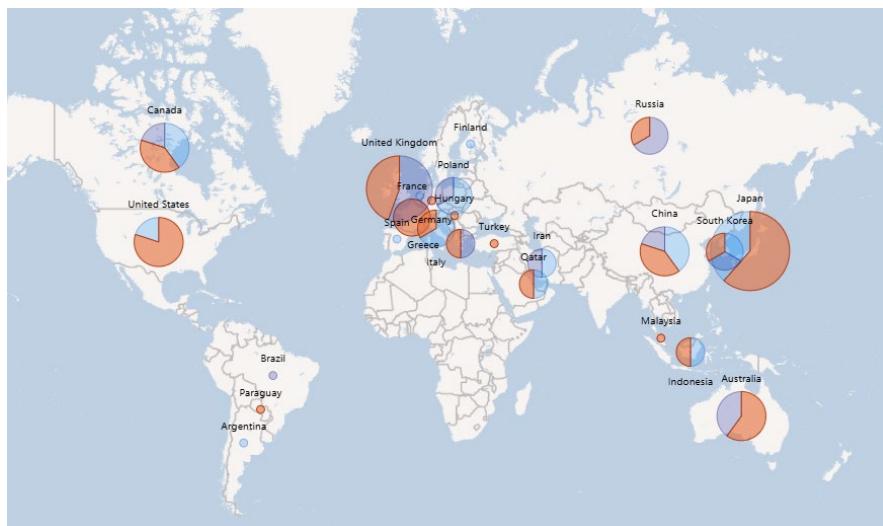


Figure 3

Distribution of studies by country with emphasis on post-COVID publications

Source: Author's construction

The protocol for athletes and immediate staff includes: regular PCR testing, monitoring and isolation of athletes and their traceable contacts in case of suspected COVID; monitoring and isolation classes at training camps and

competition venues, vaccination of athletes. Research also highlights the importance of understanding the psychological consequences of the COVID-19 epidemic, emphasising the role of perceived safety in the training environment on athletes' well being and sporting performance [65]. Psychological counselling and rehabilitation programmes for athletes recovering from COVID-19, return to training under medical supervision, are an important part of the protocol [60].

For consumers (spectators, supporters): use of disinfectant, transparent information, reduced occupancy, optimised ventilation, wearing a mask, measuring body temperature at the entrance, negative test, filling in a health questionnaire, as well as not taking breaks and not eating are the main elements. According to the research results, combining relevant measures and applying them to the situation can give fans a sense of security. However, people's perception of safety is subjective, measures to positively influence it may not be entirely appropriate for everyone, there are target group-specific differences in the evaluation of measures that need to be taken into account when designing safety strategies.[32]

In response to the COVID-19 pandemic, several international sporting events and leagues created "bubbles" that restricted the movement and social in-actions of athletes to minimise the risk of infection and allow competitions to continue. This was a new way of working and living for elite athletes and completely excluded fans from viewing the event, but it represented the highest level of safety [32].

4.3 Safety Measures and Spectator Behavior

More than 52 percent of the articles we examined address the impact of security measures on consumers. In some cases, excessive levels of security can suppress the civil liberties of spectators and citizens and act as a catalyst to reinforce a police state approach to safety and security, thereby undermining the fan experience, positive experience and sense of community that sporting events are meant to generate [92]. However, the potential for the application of biometric technologies to enhance security at sporting events is an innovative mega-approach, and the perception of its potential to enhance security at sporting events is ambiguous[31].

On the one hand, the organisers are resisting the introduction of these stricter measures because they fear an exodus of fans. On the other hand, the measures could increase the participation of new groups, such as families, after the exodus of dangerous supporters. Quantitative surveys aim to find out fans' views on what security arrangements they consider appropriate and when they would feel safe. As explained in the theoretical introduction, safety is relative, so it is very difficult to determine the appropriate level of safety. In their research, Vegara-Ferri and co-authors [37] measured measures related to the Covid-19 epidemic. 92.8% of the respondents would not have attended a live match without social distancing

measures or vaccination. Vegara-Ferri and Perić[35] found that once restrictions on physical activity and attendance at sporting events were lifted, the majority of respondents would attend events in their home country within a few weeks. Compliance with the protocols put in place has decreased as the epidemiological situation has improved, and the aim is for COVID-19 risk reduction measures to become the 'new norm' for supporter behaviour at future events [77].

Discussion

The understanding of safety in the sport economy is defined by three broad themes: sport-event safety, athlete safety and consumer safety. Other priority areas are health security, cybersecurity, transport security, public safety and facility security. All of these are constantly evolving in relation to the ever-changing context of sport and wider society [53].

The Covid-19 pandemic has been the catalyst for a whole process of re-engineering the organisation of sporting events in terms of space and participation. And security measures affect the way consumers behave [32] [92]. Pandemic COVID-19 significantly affected sports events and posed new challenges for their safe management. Research has shown that the safety protocols developed during the epidemic were effective in reducing the risk of being infected [37] [60]. At the same time, these measures significantly impacted the experience of both athletes and spectators, as well as the economic aspects of sporting events [31]. Research has shown that psychological factors are important and that safety needs to be balanced with respect for civil rights [35]. In the future, the aim is to develop long-term safety strategies based on the lessons learned from the COVID-19 pandemic. These strategies should adapt to the evolving public health situation, while maintaining a balance between safety and entertainment [36] [65] [70] [77].

Safety is a fundamental human need that takes precedence over other factors when compromised, according to the systematic review of 78 articles. Safety in sport must be understood as a comprehensive system involving protecting against hazards, managing risks and preventing dangerous situations. As shown in Table 2, the results show that safety in sport is a multifaceted concept, interpreted through different categories and subcategories. They include health security, cybersecurity, traffic security, public security, facilities security, consumer and sports security and event security.

An important finding of the review is the need to include facility safety in the planning phase, especially for mass events. For sports consumers, a fundamental expectation when engaging with sports products or services is that safety is a condition that fosters trust and guarantees the preservation of well-being. For athletes, physical safety is paramount and involves preventing accidents and injuries, while mental safety focuses on preparing and interacting. Health and epidemiological safety is a prerequisite for athletes to be at their best in competition. The COVID-19 pandemic, with 46% of the articles reviewed addressing the issue, had a profound impact on safety measures at international

sporting events. Containment strategies such as regular testing, isolation protocols and vaccination requirements for athletes and staff have been developed as a result of the pandemic. Spectator safety measures included reduced attendance, mask requirements and health screening. However, the research highlighted the subjective nature of perceived security and the impact of security policy on different groups. Creating 'bubbles' for elite athletes, while ensuring safety, excluded supporters and changed the traditional experience. The review also considers how security measures affect spectators' patterns of consuming and behaving. Innovative approaches, such as biometric technologies, have the potential to enhance security, while excessive security measures can stifle civil liberties and negatively impact the fan experience. Finding the right balance between ensuring safety and security and maintaining a positive fan experience continues to be a critical challenge for event organisers. However, there is a tendency for compliance to decline as the epidemic progresses.

Conclusions

In conclusion, the findings emphasise the complexity of safety in sport and the need for a holistic approach that integrates physical, mental and health safety considerations. The COVID-19 pandemic has accelerated the adoption of new safety protocols, which may become the "new norm" for future sports events. In order to achieve this, it is important to have a clear understanding of what security is and how it can be improved. Our practical conclusion is that safety is essential, without safety there can be no event, but the business approach to events requires that the consumer experience is not diminished. Sporting events are not only part of the sports economy, but also part of the entertainment industry, where economic efficiency is necessary. It is the event organizer's task to apply a strategic approach and systematically ensure various areas of safety for consumers, but it is not only consumers who should be the focus of attention. As a future research opportunity, our goal is to examine the various stakeholders. The research identifies which organizations are responsible for ensuring various aspects of safety. It is important to note that a holistic approach is recommended in the case of athlete safety, as athletes are service providers but cannot be treated as machines. The safety of athletes is of paramount importance as a special resource. Ensuring this is the responsibility of sports clubs and sports associations.

References

- [1] A. Takács, „We affirm that the citizen and the state share the common goal of the good life, security, order, justice and freedom (Valljuk, hogy a polgárnak és az államnak közös célja a jó élet, a biztonság, a rend, az igazság, a szabadság kiteljesítése”): *Rendhagyó kommentár egy rendhagyó preambulumról*, Dialóg Campus, 2019, pp. 339-340
- [2] T. Máté, „Involvement and evaluation - an international sporting event, the European Youth Olympic Festival (EYOF) in Győr, from the public's perspective (Bevonódás és értékelés-egy nemzetközi sportrendezvény, a

Győri Európai Ifjúsági Olimpia Fesztivál (EYOF) a lakosság szemszögéből”, *Vezetéstudomány*, Vol. 53, No. 6, 2022, pp. 65-81

- [3] Á. Cserny et al., „Ideas for Enhancing Security of (Sports) Events (Gondolatok a (sport) rendezvények biztonságának fokozásához)”, *Betügyi Szemle*, 68(11), 2020, pp. 71-88
- [4] T. Máté, K. András, „The impact of COVID-19 on the organisation of international sport events (A COVID-19 hatása a nemzetközi sportrendezvények szervezésére)”, *Magyar Sporttudományi Szemle*, Vol. 23, No. 3, 2022, pp. 46-55
- [5] K. András, „The economic returns of the TAO support scheme for sport - And what if there is no TAO? (A TAO támogatási rendszer sportgazdasági hozzádékai - És mi lesz, ha nem lesz?)”, *A felsőoktatás szerepe a sportban, élsportban és az olimpiai mozgalomban, különös tekintettel a társasági adóból (TAO) támogatott sportágak helyzetére és a támogatások hasznosítására tanulmánykötet*, 2014, pp. 12-22
- [6] L. Korinek, „A natural and social science approach to security. Living and non-living security (A biztonság természettudományi és társadalomtudományi megközelítése. Élő és élettelen biztonság)”, *Magyar Tudomány* 183, 2022, pp. 752-767, DOI: 10.1556/2065.183.2022.6.7
- [7] S. H. Jore, „The Conceptual and Scientific Demarcation of Security in Contrast to Safety”, *European Journal for Security Research*, Vol. 4, No. 1, 2019, pp. 157-174
- [8] P. Tálas, „Definition of safety (Biztonság fogalmának meghatározása)”, *Közszolgálati Online Lexikon*, 2022
- [9] M. Szakali et al., „Interpretation of security in relation to the Corona - virus epidemic”, *Safety and Security Sciences Review*, Vol. 2, No. 1 (SI), 2020
- [10] P. Marton, „Rethinking Empirical Analysis in Security Studies”, *Nation and Security-Security Policy Review*, 2017, 10(6), 61-78
- [11] B. Buzan et al., „Security: A new framework for analysis”, *Lynne Rienner Publishers*, 1998
- [12] B. Buzan, „People, States and Fear”, *Boulder CO.*, 1991, pp. 18-19
- [13] V. Szücs et al., „Security awareness of HCI in DigitAll Reality”, *Acta Polytechnica Hungarica*, Vol. 22, No. 6, 2025, pp. 9-23, doi: 10.12700/aph.22.6.2025.6.2
- [14] A. Tick et al., „Cyber Security Awareness and the Behaviors of Higher Education Students, using Smartphones in Vietnam”, *Acta Polytechnica Hungarica*, Vol. 21, No. 12, 2024, pp. 111-131, doi: 10.12700/aph.21.12.2024.12.7

- [15] A. Nightingale, „A guide to systematic literature reviews”, *Surgery (Oxford)*, Vol. 27, No. 9, 2009, pp. 381-384, doi: 10.1016/j.mpsur.2009.07.005
- [16] E. Linares-Espinós et al., „Methodology of a systematic review”, *Actas Urológicas Españolas (English Edition)*, Vol. 42, No. 8, 2018, pp. 499-506, doi: 10.1016/j.acuroe.2018.07.002
- [17] J. A. L. Ludvigsen et al., „Toward COVID-19 secure events: considerations for organizing the safe resumption of major sporting events”, *Managing Sport and Leisure*, Vol. 27, Nos. 1-2, 2020, pp. 135-145, doi: 10.1080/23750472.2020.1782252
- [18] Y. Li, H. Xu, „Assessment of Reductions in Emission-driven Air Pollution during the Beijing Olympic Games, Shanghai World Expo, Guangzhou Asian Games and Wuhan COVID-19 Lockdown”, *Aerosol and Air Quality Research*, Vol. 21, 2021, doi: 10.4209/aaqr.200644
- [19] T. Mishina et al., „Network security”, *Deleted Journal*, Vol. 20, No. 1, 2022, pp. 91-95, doi: 10.53829/ntr202201fa15
- [20] M. Duan M., „Optimization of cyber tactics in sports strategies using hybrid AI De-cision-Making technologies”, *Computational Intelligence and Neuroscience*, 2022, pp. 1-9, doi: 10.1155/2022/3762755
- [21] A. Kazeev et al., „Landslide hazard criteria for transportation safety of the 2014 Olympics in Sochi”, *International Multidisciplinary Scientific GeoConference Surveying Geology and Mining Ecology Management, SGEM*, 2 (1), 2014, pp. 567-572
- [22] P. German et al., „About the landslide hazard criteria for the transportation safety of the 2014 Sochi Olympics”, in *Springer eBooks*, 2015, pp. 1469-1472, doi: 10.1007/978-3-319-09057-3_260
- [23] A. J. Park et al., „Testing Various Riot Control Police Formations through Agent-Based Modeling and Simulation”, *11th Annual IEEE Information Technology, Electronics and Mobile Communication Conference, IEMCON 2020*, Art. No. 9284852, 2020, pp. 765-770, doi: 10.1109/iemcon51383.2020.9284852
- [24] M. James and C. Ryden, „Radiation screening at the London 2012 Olympics”, *60th IEEE Nuclear Science Symposium and Medical Imaging Conference, NSS/MIC 2013*, 2013, doi: 10.1109/nssmic.2013.6829436
- [25] E. J. Nascimento et al., „Digital Public Safety Radio Communication”, *Progress in Electromagnetics Research Symposium, PIERS 2013* Stockholm, 2013, ISBN: 978-193414226-4
- [26] B. H. Kwak et al., „Development of evaluation indicators for the safety management of sports facilities in South Korea”, *Industrial Engineering &*

Management Systems, Vol. 22, No. 2, 2023, pp. 188-198, doi: 10.7232/tems.2023.22.2.188

[27] Y. A. D. Ekmekçi et al., „Occupational Health and safety in Sports: Risk analyses and Consumer’s Point of view for a sports center”, *Pamukkale Journal of Sport Sciences*, Vol. 13, No. 1, 2022, pp. 1-21, doi: 10.54141/psbd.1050824

[28] K. Taehee, C. Kyungro, „Developing a measure of user-perceived universal design for sport facilities”, *South African Journal for Research in Sport, Physical Education and Recreation*, Vol. 40, 2018, pp. 25-38, ISSN: 03799069

[29] H. T. Nobari and S. Mohammadi, „Status of risk management in indoor sports arena of rasht based on existing standards”, *Research Journal of Pharmaceutical, Biological and Chemical Sciences*, Vol. 6, 2015, pp. 1590-1597, ISSN: 09758585

[30] C. Supriyanto et al., „The influence of environmental quality, safety awareness, and supporter satisfaction on the behavior of sports supporters”, *International Journal of Human Movement and Sports Sciences*, Vol. 11, No. 6, 2023, pp. 1391-1397, doi: 10.13189/saj.2023.110625

[31] B. Kotkova „The Use of Biometric Technologies to Increase Security at Sporting Events”, *27th International Conference on Circuits, Systems, Communications and Computers (CSCC)*, 2023, pp. 1-6, doi: 10.1109/CSCC58962.2023.00035

[32] M. Weber et al., „Perceived importance of pandemic interventions for attending cultural events – findings from Germany”, *BMC Public Health*, Vol. 22, No. 1, 2022, doi: 10.1186/s12889-022-13358-8

[33] K. Smith and A. Templeton, „Social identity processes associated with perceived risk at pilot sporting events during COVID-19”, *British Journal of Social Psychology*, Vol. 61, No. 4, 2022, pp. 1376-1399, doi: 10.1111/bjso.12541

[34] E. N. Rakhmanova et al., „The legal and organizational basis of ensuring safety of sports activities in Hungary”, *Vestnik of Saint Petersburg University Law*, Vol. 13, No. 3, 2022, pp. 759-770, doi: 10.21638/spbu14.2022.311

[35] M. Perić et al., „Getting back to the event: COVID-19, attendance and perceived importance of protective measures”, *Kinesiology*, Vol. 53, No. 1, 2021, pp. 12-19, doi: 10.26582/k.53.1.2

[36] I. Dergaa et al., „Organising football matches with spectators during the COVID-19 pandemic: What can we learn from the Amir Cup Football Final of Qatar 2020? A call for action”, *Biology of Sport*, Vol. 38, No. 4, 2021, pp. 677-681, doi: 10.5114/biolsport.2021.103568

[37] J. M. Vegara-Ferri et al., „Fan’s perspective on professional leagues and sporting events during COVID-19 confinement period”, *Journal of Human Sport and Exercise*, Vol. 16, No. 4, 2020, doi: 10.14198/jhse.2021.164.07

[38] G. Cai et al., „An Evaluation of Green Ryokans through a Tourism Accommodation Survey and Customer-Satisfaction-Related CASBEE–IPA after COVID-19 Pandemic”, *Sustainability*, Vol. 13, No. 1, p. 145, 2020, doi: 10.3390/su13010145

[39] M. Dróżdż, „Changes in Polish legislation to do with sporting events-organizer responsibility not only for the health of players. A good example for other legal systems?”, *Journal of Physical Education and Sport*, Vol. 2020, No. 4, 2020, doi: 10.7752/jpes.2020.s4327

[40] R. Spica et al., „Swimming Pool safety and prevention at the time of Covid-19: a consensus document from GSMS-SItI”, *Annali Di Igiene Medicina Preventiva E Di Comunità*, Vol. 32, No. 5, 2020, pp. 439-448, doi: 10.7416/ai.2020.2368

[41] B. Blocken et al., „Can indoor sports centers be allowed to re-open during the COVID-19 pandemic based on a certificate of equivalence?”, *Building and Environment*, Vol. 180, 2020, doi: 10.1016/j.buildenv.2020.107022

[42] I. Sowier-Kasprzyk, S. Kowalski, „Safety of sports mass events in the context of creating a marketing product”, *System Safety Human - Technical Facility - Environment*, Vol. 1, No. 1, 2019, pp. 851-858, doi: 10.2478/czoto-2019-0109

[43] A. J. Herdt et al., „Outdoor Thermal Comfort during Anomalous Heat at the 2015 Pan American Games in Toronto, Canada”, *Atmosphere*, Vol. 9, No. 8, p. 321, 2018, doi: 10.3390/atmos9080321

[44] R. George, K. Swart, „Tourists’ perceptions of London, United Kingdom (UK), as a safe host city during the 2012 Olympic Games”, *Journal of Travel and Tourism Marketing*, Vol. 32, No. 8, 2015, pp. 1117-1132, doi: 10.1080/10548408.2014.962723

[45] R. George, R. I. Mawby, „Security at the 2012 London Olympics: Spectators’ perceptions of London as a safe city”, *Security Journal*, Vol. 28, No. 1, 2013, pp. 93-104, doi: 10.1057/sj.2013.37

[46] M. Kim et al., „The influence of tourist risk perceptions on travel intention to mega sporting event destinations with different levels of risk”, *Tourism Economics*, Vol. 27, No. 3, 2019, pp. 419-435, doi: 10.1177/1354816619879031

[47] Y. H. Tran et al., „Observation of spectators’ mask-wearing behavior at a national basketball tournament”, *Managing Sport and Leisure*, Vol. 29, No. 3, 2022, pp. 433-444, doi: 10.1080/23750472.2022.2046492

[48] V. T. Hoang et al., „The Tokyo Olympic Games and the risk of COVID-19”, *Current Tropical Medicine Reports*, Vol. 7, 2020, pp. 126-132

[49] K. Koronios et al., „Sponsorship, Covid-19 and mega sport events: the case of UE-FA Euro 2020”, *Sport Business and Management an International Journal*, Vol. 14, No. 2, 2023, pp. 211-235, doi: 10.1108/sbm-05-2023-0059

[50] J. Cleland, „Sports Fandom in the Risk Society: Analyzing perceptions and experiences of risk, security and terrorism at elite sports events”, *Sociology of Sport Journal*, Vol. 36, No. 2, 2019, pp. 144-151, doi: 10.1123/ssj.2018-0039

[51] H. Caniza et al., „Safety of international professional sports competitions during the COVID-19 Pandemic: The Association Football Experience”, *Sports Medicine*, Vol. 53, No. 4, 2022, pp. 765-768, doi: 10.1007/s40279-022-01763-3

[52] A. A. Musleh et al., „Bio-secure bubble during the COVID-19 pandemic to host the Asian Football Confederation (AFC) Champions League: A retrospective observational study”, *Health Science Reports*, Vol. 6, No. 1, 2022, doi: 10.1002/hsr2.985

[53] J. J. Gurgis et al., „Exploring stakeholders’ interpretations of safe sport”, *Journal of Sport and Social Issues*, Vol. 47, No. 1, 2022, pp. 75-97, doi: 10.1177/01937235221134610

[54] C. Lambert et al., „Depressive symptoms among Olympic athletes during the Covid-19 pandemic”, *BMC Sports Science Medicine and Rehabilitation*, Vol. 14, No. 1, 2022, doi: 10.1186/s13102-022-00427-z

[55] F. Vitali et al., „A moderated mediation analysis of the effects of the COVID-19 pandemic on well-being and sport readiness of Italian Team sports players: The role of perceived safety of the training environment”, *International Journal of Environmental Research and Public Health*, Vol. 19, No. 5, p. 15, 2022, doi: 10.3390/ijerph19052764

[56] E. Kroshus et al., „Concussion education for youth athletes using Pre-Game Safety Huddles: a cluster-randomised controlled trial”, *Injury Prevention*, Vol. 29, No. 1, 2022, pp. 22-28, doi: 10.1136/ip-2022-044665

[57] P. Liu et al., „A Machine-Learning-Based medical imaging fast recognition of injury mechanism for athletes of winter sports”, *Frontiers in Public Health*, Vol. 10, 2022, doi: 10.3389/fpubh.2022.842452

[58] S. Marshall et al., „Elite sport hubs during COVID-19: The job demands and resources that exist for athletes”, *PLoS ONE*, Vol. 17, No. 7, 2022, doi: 10.1371/journal.pone.0269817

[59] D. P. Anna et al., „Halting the pandemic outside ‘CORTINA2021’ alpine world ski championships: a challenge for sport and public health in times of

COVID-19”, *Journal of Public Health*, Vol. 44, No. 2, 2021, pp. 203-210, doi: 10.1093/pubmed/fdab351

[60] A. V. Zholinsky et al., „Federal medical biological agency of Russia’s efforts to support Russian athletes during COVID-19 outbreak”, *Sport Sciences for Health*, Vol. 18, No. 3, 2021, pp. 831-837, doi: 10.1007/s11332-021-00861-5

[61] R. Hasegawa et al., „Close-Contact detection using a single camera for sports considering occlusion”, *IEEE Access*, Vol. 10, 2022, pp. 15457-15468, doi: 10.1109/access.2022.3146538

[62] M. R. S. Txi et al., „The Prevalence of Emotional Distress among Athletes during COVID-19 Movement Control Order Period in Malaysia”, *Annals of Applied Sport Science*, Vol. 10, No. 2, 2022, doi: 10.52547/aassjournal.1018

[63] S. Peckover et al., „An Analysis of Congestion During Running Events from The Perspective of Runners: Prevalence, Impact on Safety And Satisfaction, and Preferred Controls”, *Event Management*, Vol. 26, No. 5, 2022, pp. 967-978, doi: 10.3727/152599521x16367300695870

[64] R. J. Schinke et al., „International society of sport psychology position stand: mental health through occupational health and safety in high performance sport”, *International Journal of Sport and Exercise Psychology*, Vol. 20, No. 6, 2021, pp. 1711-1733, doi: 10.1080/1612197x.2021.1992857

[65] J. D. Galdieri et al., „Descriptive epidemiology of orthopedic injury and illness during the Special Olympics of Pennsylvania Summer Games from 2008 to 2017”, *Orthopedic Reviews*, Vol. 14, No. 3, 2022, doi: 10.52965/001c.35276

[66] M. J. Martínez-Patiño et al., „Effects of COVID-19 home confinement on behavior, perception of threat, stress and training patterns of Olympic and Paralympic athletes”, *International Journal of Environmental Research and Public Health*, Vol. 18, No. 23, 2021, doi: 10.3390/ijerph182312780

[67] A. S. McIntosh et al., „Managing head injury risks in competitive skateboarding: what do we know?”, *British Journal of Sports Medicine*, Vol. 55, No. 15, 2020, pp. 836-842, doi: 10.1136/bjsports-2020-102013

[68] A. Villa et al., „Ski world cup in safety in the context of coronavirus disease 2019 (COVID-19) pandemic”, *Journal of Health and Social Sciences*, Vol. 6, No. 2, 2021, pp. 221-230, doi: 10.19204/2021/skwrt8

[69] M. Mountjoy et al., „#SafeSport: safeguarding initiatives at the Youth Olympic Games 2018”, *British Journal of Sports Medicine*, Vol. 54, No. 3, 2019, pp. 176-182, doi: 10.1136/bjsports-2019-101461

[70] A. Y.-Y. Wong et al., „Impact of the COVID-19 pandemic on sports and exercise”, *Asia-Pacific Journal of Sports Medicine Arthroscopy Rehabilitation and Technology*, Vol. 22, 2020, pp. 39-44, doi: 10.1016/j.asmart.2020.07.006

[71] S. Djobova et al., „New dimensions of safety and security of special Olympics athletes during events”, *Strategies for policy in science and education*, Vol. 29, 2021, pp. 101-110, doi: 10.53656/str2021-4s-11-dimen

[72] Z. Su et al., „How to join and stay in the Olympic COVID-free ‘bubble’?”, *Brain Behavior and Immunity - Health*, Vol. 20, 2022, doi: 10.1016/j.bbih.2022.100424

[73] J. Wang et al., „Research on the risk of the 2022 Beijing Winter Olympic Games and the countermeasures of the preparatory work transition under the influence of COVID-19”, *2021 International Conference on E-Commerce and E-Management (ICECEM)*, Dalian, China, 2021, pp. 248-251, doi: 10.1109/ICECEM54757.2021.00056

[74] J. Cadet et al., „Public safety messaging during super bowl LVI: A pilot study and modified framework”, *PLoS ONE*, Vol. 18, No. 4, 2023, doi: 10.1371/journal.pone.0284921

[75] K. Al-Dosari et al., „Mega Sporting event scenario analysis and drone camera sur-veillance impacts on Command-and-Control Centre situational awareness for dynamic Decision-Making”, *Safety*, Vol. 9, No. 3, 2023, p. 54, doi: 10.3390/safety9030054

[76] J. A. L. Ludvigsen et al., „Redesigning the Games? The 2020 Olympic Games, Playbooks and new sports event risk management tools”, *Managing Sport and Leisure*, Vol. 28, No. 4, 2021, pp. 442-454, doi: 10.1080/23750472.2021.1928538

[77] R. I. Purves et al., „Attending sporting mega events during COVID-19: mitigation and messaging at UK EURO 2020 matches”, *Health Promotion International*, Vol. 38, No. 1, 2023, doi: 10.1093/heapro/daac176

[78] M. Szabolcs et al., „The role of sports policing and tourism safety at the Summer Olympics”, *Sustainability*, Vol. 14, No. 10, 2022, doi: 10.3390/su14105928

[79] A. Bistaraki, K. Georgiadis, „Interorganizational Communication at Mass Gatherings: Professionals’ Perceptions during the Planning and Implementation Stage of Marathon Events”, *Prehospital and Disaster Medicine*, Vol. 37, No. 2, 2022, pp. 179-184, doi: 10.1017/s1049023x22000395

[80] Y. Zhang et al., „Lessons learned from the COVID-19 control strategy of the XXXII Tokyo Summer Olympics and the XXIV Beijing Winter Olympics”, *Emerging Microbes & Infections*, Vol. 11, No. 1, 2022, pp. 1711-1716, doi: 10.1080/22221751.2022.2090859

[81] A. Matzarakis and K. Graw, „Human bioclimate analysis for the Paris Olympic Games”, *Atmosphere*, Vol. 13, No. 2, 2022, p. 269, doi: 10.3390/atmos13020269

[82] I. Dergaa et al., „FIFA World Cup 2022: What can we learn from the inspiring Tokyo 2020 Olympic Games held in COVID-19 times?”, *Biology of Sport*, Vol. 39, No. 4, 2022, pp. 1073-1080, doi: 10.5114/biolspor.2022.113293

[83] J. Pauser et al., „SARS-CoV-2 transmission during an indoor professional sporting event”, *Scientific Reports*, Vol. 11, No. 1, 2021, doi: 10.1038/s41598-021-99997-0

[84] M. D. Revindo et al., „Factors explaining the expenditure of sports event participants and spectators: evidence from the 2018 Asian Games”, *Journal of Sport and Tourism*, Vol. 25, No. 2, 2021, pp. 105-127, doi: 10.1080/14775085.2021.1883460

[85] K. Ważny, „Legal aspects of sport during the covid-19 pandemic-case study of Poland in the global context”, *Journal of Physical Education and Sport*, Vol. 21, No. 2, 2021, pp. 1276-1283, doi: 10.7752/jpes.2021.s2162

[86] M. Mountjoy et al., „Athlete health and safety at large sporting events: the development of consensus-driven guidelines”, *British Journal of Sports Medicine*, Vol. 55, No. 4, 2020, pp. 191-197, doi: 10.1136/bjsports-2020-102771

[87] A. Bistaraki et al., „Organizing Health Care Services for the 2017 ‘Athens Marathon, The Authentic:’ Perspectives on Collaboration among Health and Safety Personnel in the Marathon Command Center”, *Prehospital and Disaster Medicine*, Vol. 34, No. 05, 2019, pp. 467-472, doi: 10.1017/s1049023x19004722

[88] F. Wang, „Application of electronic commerce intelligent safety management system in sporting events”, *BioTechnology: An Indian Journal*, Vol. 10, No. 5, 2014, pp. 1042-1049

[89] A. Donaldson et al., „Understanding safety management system applicability in community sport”, *Safety Science*, Vol. 60, 2013, pp. 95-104, doi: 10.1016/j.ssci.2013.06.007

[90] J. Sugden, „Watched by the Games: Surveillance and security at the Olympics”, *International Review for the Sociology of Sport*, Vol. 47, No. 3, 2012, pp. 414-429, doi: 10.1177/1012690211433482

[91] H. E. Børve and T. A. Thørning, „A stakeholder perspective on risk and safety planning in a major sporting event”, *International Journal of Event and Festival Management*, Vol. 13, No. 4, 2022, pp. 472-485, doi: 10.1108/ijefm-11-2021-0082

- [92] B. E. Menaker et al., „Rethinking sport event Security: From risk management to a community driven approach”, *Journal of Global Sport Management*, 2021, pp. 1-23, doi: 10.1080/24704067.2021.1929388
- [93] S. Djoberova, I. Kirilova, „Building Social Capital through Safety and Security: A Focus on Sports Events for Persons with Disabilities”, *Strategies for Policy in Science and Education*, Vol. 31, No. 5s, 2023, pp. 24-31, doi: 10.53656/str2023-5s-2-bui
- [94] J. A. L. Ludvigsen and P. Millward, „A security theater of dreams: Supporters’ responses to ‘Safety’ and ‘Security’ following the Old Trafford ‘Fake bomb’ evacuation”, *Journal of Sport and Social Issues*, Vol. 44, No. 1, 2019, pp. 3-21, doi: 10.1177/0193723519881202