MANAGEMENT, TECHNOLOGY AND SPORT

PROCEEDINGS OF THE SECOND INTERNATIONAL CONFERENCE

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# Management, Technology and Sport

Proceedings of the Second International Conference held on 2. 2. 2023 at the Faculty of Sports Studies of Masaryk University in Brno in Cooperation with the Czech Management Association

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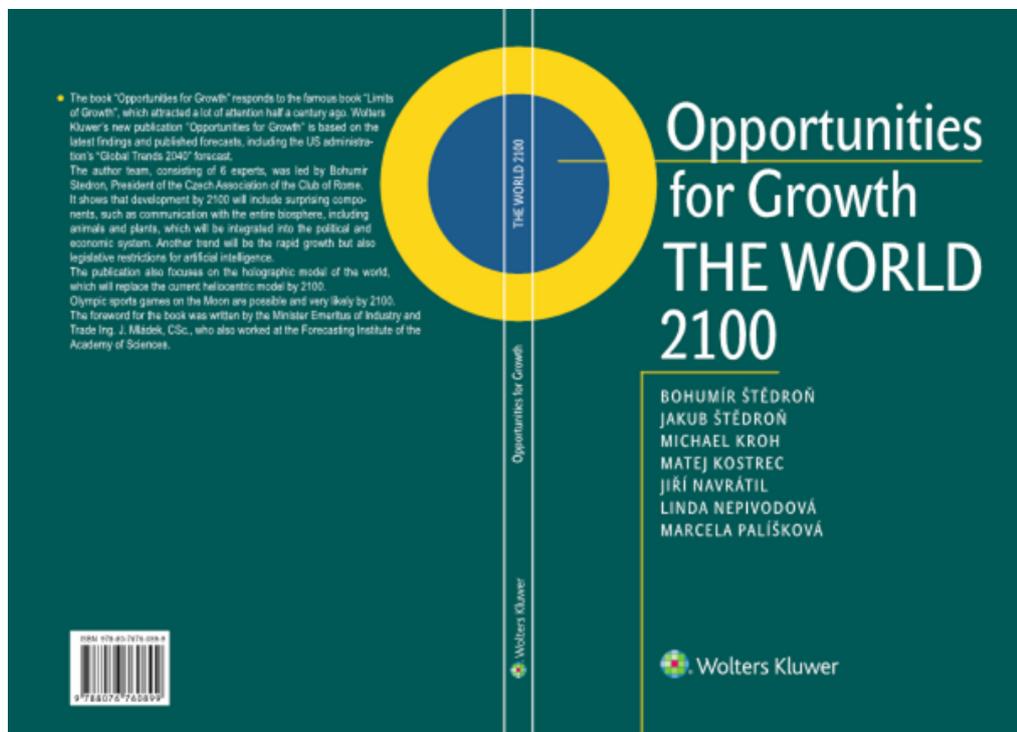
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CONTENTS

Introduction

The importance of the innovative conference "Management, Technology and Sport", organized by the Faculty of Sports Studies of Masaryk University in Brno and the Czech Management Association, is underlined by the fact that the conference was opened by the Minister of Science, Research and Innovation and the President of the Czech Management Association. The presented topics include: The Economic Concept of Willingness to Pay in a Sport Environment (M. Vyroubal); Communication, Technology and Management Models Relations (J. F. Potužník); Possibilities and Difficulties of Using Artificial Intelligence in Sports Arbitration Disputes (J. Navrátil, D. Zimová); E-sports in the Academic Environment (Š. Zachar, M. Kostrec); New Trends: A Systems Analysis of the Volunteer as a Component of Future Sport Event Implementation (I. Pavlova); The Organisation of a Volleyball Major Sporting Event and the Impact of COVID-19 on Spectator Attendance (L. Kozáček); Aspects of Creating Sports Team Budgets in Times of Crisis (J. Kadlec); Statistics and its Limits and Possibilities in the Process of Knowledge (J. Blažek, I. Moll, M. Nečas) and many more. The next, third year of the conference "Management, Technology and Sport" is planned for 2. 2. 2024 in cooperation with foreign universities (USA, Israel, Germany) and the organizers thank the management of the Faculty of Sports Studies MU and the Czech Management Association for their support and inspiring new suggestions.

Doc. RNDr. Bohumír Štědroň, CSc., Chairman of the Programme Committee

Ing. Martin Vyroubal, Chairman of the Conference Organizing Committee

The Economic Concept of Willingness to Pay in a Sport Environment

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Abstract

This paper explores the economic concept of willingness to pay (WTP) in a sporting environment. The paper introduces the specifics of the sports industry, provides insights into current research, and presents methods used in willingness to pay research in scholarly articles, with the greatest emphasis on the contingent valuation method, which is widely used in willingness to pay research. The article is compiled in a research manner and aims to provide an overview of the ways in which research could be conducted that would be useful for finding alternative ways of financing the sports sector, especially in the Czech Republic, where not many similar articles on the topic have been published.

Keywords: willingness-to-pay, contingent valuation method, sport financing

Introduction and synthesis of findings

The notion of willingness to pay (WTP) is a microeconomic concept that deals with the study of market theory and research on the subject is mainly carried out in markets that are to some extent specific, even hypothetically modelled by nature. Orlowski and Wicker (2019) describe goods and services in sport settings as often non-market nature goods and services. Modelling markets is a necessary step to conduct research in the field, as these are often situations or markets where the classical functioning of the market principle that we are familiar with, for example, in the conventional market for goods and services, is not clear at first glance. In such a market, there is a clear price for the goods or services that can be purchased and often, with a basic knowledge of current prices, we know what indicative price range is considered relevant for a given product. Data from these markets are collected by statistical offices for their own purposes or purposes of other authorities. However, the area that we will address in our paper lies slightly beyond this standard operation. Specifically, we will focus on the area of the sports environment, where research on the principle around willingness to pay is a developing area for the reason that it brings interesting insights and often unavailable data for setting and applying various parameters (e.g. membership fees in sports clubs) to the practice itself, which can, for example, make the

financing of sports clubs in a given sector more efficient or bring a different perspective on fundraising for sports projects.

In the case of the Czech Republic, the Czech Statistical Office tracks data from the sports sector only in the area of goods and services, which are additionally classified in the statistical yearbooks according to the European Classification of Individual Consumption by Purpose (ECOICOP), where the items are facilities for sport, camping and recreation, and recreational and sports services. Thus, we can only find general household expenditure or average prices for the whole consumption basket from a given area. Unsurprisingly, often sports clubs or similar entities themselves may lack adequate market information to help them determine their own "pricing strategies" much more effectively when seeking other participatory sources for their operations (here we are talking, for example, about membership fees in non-profit clubs or tickets to professional sports competitions). We are of course aware of the considerable support for sport from public budgets, but despite this fact, the sports industry is trying to look for other sources of income, because the support for sport from public finances, although considerable, certainly does not completely cover the cost side of sports clubs' budgets.

Willingness to pay (WTP)

The very concept of WTP is defined in microeconomic theory as the maximum amount that a buyer is willing to pay for a given good or service. Thus, we can say that it can quantify the value of said good or service to the consumer. The concept of maximum price is not entirely accurate in this respect. According to Breidert (2007), the maximum price is formed by the sum of the reference value and the differentiation value, where the reference value per unit of the product is formed by the cost of a competing product that the consumer considers to be the best alternative. The differentiation value is then a subjective value that reflects the differences between the product in question and its alternative (the reference product).

Hence, the concept of maximum price is not an accurate measurement of what we want to address in our paper. A much more precise concept for determining willingness to pay, and specifically willingness to pay in a sporting environment, is the somewhat simpler definition of reservation price. Economists refer to the maximum willingness to pay for a product or service as its reservation price – i.e., the reservation price is the highest possible price that one is willing to pay for a given good or service, or is indifferent to buying it (Varian, 2003). We have already presented the reasons that lead us to determine willingness to pay in the introduction of this paper. Thus, the reservation price is able to provide sellers with a useful piece of information on which to base their own pricing policy in a given market environment; there are certainly many more circumstances to consider (type of market, competitors' prices, costs, etc...), but specifically in the sports industry it can be a valuable piece to the overall mosaic.

Willingness to pay estimation methods

Overall, according to Breidert (2007), we can broadly divide WTP estimation methods into two main branches:

1. Observation – observation mainly involves working with market data (for goods or services from which data are recorded) or experiments in the field or economic laboratories (deliberately created model situations/games).

2. Questioning (surveys) – questioning is divided into direct and indirect. Direct polling includes expert surveys, sales force surveys and consumer surveys. Indirect surveys include preference analysis (conjoint analysis) and discrete choice analysis.

Another basic division to be considered in WTP research is whether we are determining real willingness to pay or hypothetical willingness to pay. The fundamental difference is that estimating real WTP requires a real financial commitment by the respondent (real payment), whereas guessing hypothetical WTP eliminates this commitment. In most studies, due to their feasibility, the estimation of hypothetical WTP is chosen, with the two most important methods being the contingent valuation method (CVM) and preference analysis (Voelckner, 2006). Other methods that appear in scientific studies are, for example, the methods of calculating the probability of purchase called the Gabor Granger method, the calculation of price sensitivity called the Van Westendrop method, and the Brand-Price-Trade-Off (BTPO) method. One of the most used methods of estimating WTP in the sports environment is the aforementioned contingent valuation method[1].

Contingent valuation method (CVM)

This method is widely used in the field of valuation of non-market goods and its application, in addition to the sports sector, can be found in the environment of environmental economics, health, transport and education (Walker, Mondello, 2007). These are areas that are defined in economic theory as public or public goods and for which public subsidies are very often used. The specificity of these goods is the essence of the use of this method.

Estimates produced using the CVM method are primarily based on hypothetical situations, hypothetical questionnaire surveys, which of course opens up room for speculative answers from individuals or for giving higher WTP values than would be the case in a real situation. On the other hand, CVM assumes that respondents will behave according to rational economic theory – i.e. maximise their utility, based on their income. Of course, estimation bias can occur here as well, in the case where the respondent makes decisions primarily based on his or her budget constraint. The CVM essentially measures substantive (cognitive) and emotional (affective) behaviour, and if respondents over-weight the emotional component (e.g. in a very budget constrained situation), estimation bias

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1 See, e.g., studies by Johnson et al. (2007), Wicker (2011), De Boer et al. (2019), Wicker, Frick (2020), etc.

may occur due to the individual's perception. This does not have to be a directly extreme situation, but the emotional component may play a role if, for example, the person considers the situation to be binding or a moral obligation. Then, the substantive component may be suppressed in this method and the reliability of the estimate may be compromised. As a further limitation of this method, its aforementioned hypothetical nature is often cited – respondents respond with their possible reactions under hypothetical conditions. Such a procedure naturally introduces room for criticism of the method and questioning the relevance of the results (Walker and Mondello, 2007).

Nevertheless, despite all the limitations, CVM is widely used in scientific papers. This is mainly due to its relatively simple applicability and inexpensive nature. Overall, the method is simple to implement, but questions must be asked correctly and thoughtfully about the hypothetical situation that is the focus of the study. The CVM represents a very good trade-off between the power, difficulty and cost of the method, which is also why it is one of the most important methods that gives economists and researchers insight into specific areas of non-market goods and services (Walker, Mondello, 2007).

Willingness to pay in sports environment

As mentioned above, there are many situations in the sporting environment in which researchers find estimates of willingness to pay using the CVM. As such, sport is a good that is valued as a good or activity that is publicly beneficial[2], and is often said to produce positive externalities such as positive impacts on health, local economy, social aspects of life, etc...

A key area in the sports environment where WTP research has been applied is in the area of membership fees in sports clubs (see e.g. Wicker, 2011 or Johnson, 2007), where the presented model is relatively simple and maps the current level of membership fees for sports clubs in Germany and uses a questionnaire survey and CVM to estimate how this current level differs from the potential WTP of respondents. Furthermore, studies focusing on financial participation towards the education of elite athletes (e.g. Wicker, Frick, 2020 or Funahashi, 2020), where in the case of the Wicker, Frick (2020) study two hypothetical situations are used in the context of three major winter sport events in alpine skiing. The first one is a modification of the tax system, where the authors ask the research question whether the respondent would be willing to accept a tax increase of a certain percentage, which will then be used for the development and education of athletes in winter sports in Austria. The second is an estimate of the willingness to pay for potential streams of the mentioned events, knowing that the proceeds from the broadcasts will be primarily used again for the development and education of athletes in the sports in question. Another focus of studies measuring willingness to pay is the hosting of major international sporting events (e.g. De Boer et al., 2019) or studies focusing on the funding of sport infrastructure or local sports club funding (e.g. Castellanos et al., 2011; García et al., 2014; Wicker et al., 2016).

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2   See Czech Republic: Act on the Promotion of Sport 115/2001 Coll.

The common denominator of all these studies is the valuation of non-market goods and the highlighting of the benefits of these actions and the justification for the flow of public funds for sport-related purposes. In the case of studies focusing on elite athletes, the quantification of a certain phenomenon of national pride, or local pride, that citizens of a given state, city or region feel when "their" athletes succeed, which is usually positively correlated with higher values of WTP[3], plays a very important role.

In the above-mentioned contributions we are able to find a large number of interesting concepts that can be adopted in thinking about the Czech sports environment. Unfortunately, there are not many studies that have the ambition to look for alternative ways of financing sport, to present new models that could be put into practice and help in financing the education of athletes or the construction or modernisation of sports facilities. Of course, the current state of public finances does not suggest any major increase in funding for the sports sector, but this is also why it should be the aim of researchers to bring new perspectives, models and participatory solutions of public and private resources to move the sports environment forward.

Conclusions

The search for sources and ways of financing sport is a topic that is felt only by the interested or professional public, at least in the Czech Republic, but unfortunately it does not receive much attention at the highest levels. Foreign research in this area tries to point out ways or alternatives to find additional means of financing children's sport activities or the education of elite athletes, and also to bring to light the positive externalities that sport activities bring. As already mentioned, the topic of WTP is not yet well developed in the Czech sports environment and not much research has been done on the issue. This paper, although it is only a research paper, has the ambition to be a kind of summary of current knowledge and trends that could be used as a basis for research in the field of sport economics in the Czech Republic and where academics or researchers interested in the economics, financing and management of sport could go.

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3   Conditional on other variables such as income, educational attainment, age, economic activity, etc...

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Communication, Technology and Management Models Relations

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Matter, Life, Culture (Existence)

The exchange of information in matter and living organisms has a similar form and content. The physical relations of atoms inside a molecule, the bonds of chemical elements in compounds, and RNA and DNA information sharing in cells determine:

1. Energetic balance for self-preservation (existence).
2. A safe space for the propagation of its species (expansion).
3. Equalization of adverse effects and reproduction (evolution).
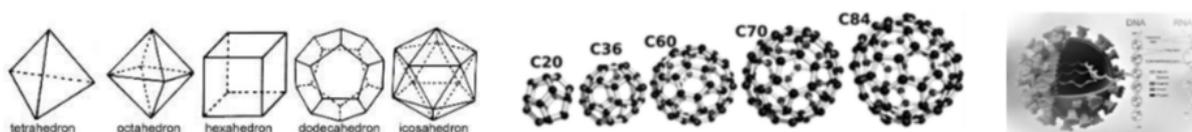
The regular structures in mineral crystals (simultaneously "Platonic perfect bodies"), fullerenes C20-C84 (quadruporate bonds of carbon – an element of cosmic origin and at the same time the basis of living matter); the structure of DNA and RNA (unlike TNA, DNA doesn't have a hydroxyl group OH in the nucleotides on the dual carbon of ribose ($C_5H_{10}O_5$)).

Individual inorganic and organic species are being exposed to the effects of two or more surrounding cultures – an inevitable collision. The action of internal and external forces causes the cultures to shrink or expand – pulsation of matter and organisms.

Information Transfer (Potency)
Physical, chemical, and genetic bonds enable the exchange of basic information in a double binary system between units of one kind – that is, the combination of 0:1 and 0:1, and the meanings are "is/isn't" and "favorable/unfavorable" (they are/not resources, is/not danger):

1. Crystals grow, and chemical compounds chain on the level of physical and chemical bonds.
2. On the organic level, cells balance environmental influences and transmit this information to the next generations.
3. On the cultural level, individual species spread in space throughout generations.

Biological cultures are divided into pure, mixed, plant, and tissue – colonies of bacteria spread in four forms: circular, irregular, filamentous, and rhizoid; human communities' centers: circular megaliths (Stonehenge), oppida copying the terrain (Zavist), cities with infrastructure around the center (Athens), the expansion of tribal culture (Celtic).

Organic community spreads in a similar way when favorable and suppressed unfavorable life conditions are provided. Unlike bacterial and animal culture, human culture is aware of itself – man thinks of himself in time and space.

Circles (Civilization)

During the global geographical spread and parallel generational development of human cultures, spatial and time limitations cause the necessary defining the places and moments of their penetrations – that is, the battle for the domination of the stronger and the dependence of the weaker culture:

1. Homo sapiens becomes the globally dominant species – tribal communities fill the entire world.
2. Tribal communities of approximately 30 members control food-providing territory – at a day's walking distance.
3. Tribes mark the territory with vertical symbols of power and maturity – megalithic buildings from Mesopotamia to England.

The spread of Homo sapiens around the world (PK.): 200 thousand – SE Africa, 125 thousand – NW Africa, 100 thousand – Eurasia, 75 thousand – SE Asia, 50 thousand – Australia, 25 thousand – NE Asia, 15 thousand – N America, 10 thousand – S America; technologically and structurally similar megalithic buildings spread through distant European centers as well as other skills – for example, metallurgy.

The influence of the most powerful center depends not only on the resource base but also on communication and technological advancement.

The boundaries of the controlled territory expand proportionally with the information accessibility (control) of its periphery – organization of objectives.

Pyramids (structural expansion)

A relatively stable (pulsating in planetary cycles) environmental balance is interrupted by sudden (random) natural and climate changes – decline of resources and space leads more advanced cultures to mass migration:

1. A shift of Earth's axis and rapid drying of the Sahara drives local tribes to the Nile basin – climate change brings the empire.
2. Administrative knowledge of neighboring cultures enables the organization of a community of hundreds of thousands.
3. The power structure of the whole corresponds to communication and technology – laws and pyramids withstand time.
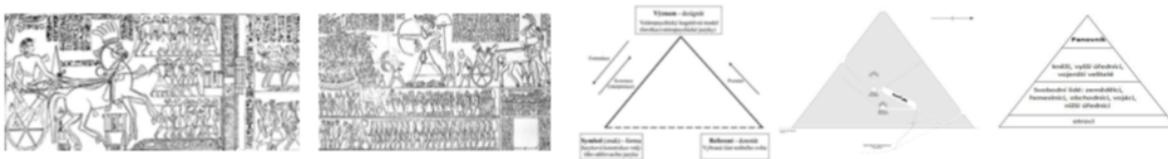
Tomb paintings, much like cave paintings before, immortalize the claims and technology of power: Seti I (father of Ramesses II). And slave labor, Ramesses III (great-grandson of Ramesses II) and fights with the sea nations (both 19th dynasty). The semantic structure is the same as the structures of the symbols of technological advancement and social hierarchy – pyramids.

- The pyramid structure of society management requires preservation of the ratio between the height and the width of the base to maintain stability.
- A growth too vertically high of the administration or horizontal decrease of resources will lead to emptying and collapse of the whole.

Dialogue (competence delegation)

Civilization dominance using open communication channels enables to take technological knowledge and cultural advantages even from weaker units – the rigid pyramid structure is successfully alternated by a chain structure of powerfully connected links:

1. The sea nations' coordination without a single administrative center and the community of Greek cities present flexible bonds.
2. Conversation is in the form of Plato's dialogues or self-administration of Athens, a functional tool of knowledge and decision-making.
3. Language and common cultural values (from religion to civil virtues) create national identity.

The power dialogue, i.e. the fights and cooperation of the Greek cities – territorial boundaries defined by the cultural ones (the Hellenes with knowledge of Greek from the barbarians who speak differently); cognitive process diagram and society management diagram with delegation of responsibilities and rights.

- The delegation of competences in the chain communication structure enables the fluent replacement of individual parts.
- A uniform communication code and a uniform interpretation of meaning founds a uniform ethics – a culture of good and evil (virtues and crimes).

The ethical imperative (communication of good and bad)

The ethical values of good and evil overcome the meanings of good and evil on a basic self-preservation level in the sense of "there are resources" (hence "there are not resources") and "there are dangers" (hence "there are not dangers"):

1. The New Testament unites community through cultural values – the Ten Commandments, countable on human fingers.
2. Two-world thinking is enforced in social structure – earthly and heavenly, temporary and eternal.
3. Double interpretation of imperatives leads to permanent collision – Rome and New Rome, Europe and Byzantine, state and church, Europe and Islam.

The scheme of the communication "belief system", the semantic triangle (see comparison with the pyramid power structure), and the competence model of information spreading and management.

- Efforts to monopolize value interpretation (belief and trust) create closed pyramid-like communication structures.

- The bipolarity of society is symbolized by two towers (the pyramid of the Gothic temples – two power authorities, two concepts of legality).

One world (an economical globalization)

The pulsation of society between the strengthening of communication units (attempts for the cultural and power integrity of society) and their fragmentation (collapse and dissolution into independent parts) reflects the pace and the temperature of the development of civilization (consciousness and knowledge):

1. The ratio of the functional communication of power centers with the peripheries and energy resources still remains determining – the use of colonies.
2. Efficiency is always reflected on knowledge and technological advancement – transport, military and administrative capacities.
3. Natural changes are again interfering with development – from storms through prolonged harvest failures to transcontinental epidemics.


Map of oceanic discoveries 15th and the 16th century and global air transport of the 21st century – intercontinental transport speeded up from a range of months to a range of hours, military power was replaced by economic power when subjecting overseas territories; with common commodities centers also exchange diseases – flu, syphilis, coronavirus.

- Adoration of wealth and new resources establishes a tradition of government loans and bankruptcy – one world of Philip II, Sun King Louis XIV.
- Adoration of knowledge and science founds a tradition of ideological utopias (islands with a better civilization) – global social change projects.

Information network (global communication) projects of global units – powerful (government of one empire) and spiritual (government of one ideology) – are based on historical developmental statistics (historicism) and scientific development (technological innovations):

1. Global communication (in the sense of transport and information transfer) branches – mass media, railways, telephones.
2. Scientific fields divide and become independent – physics and chemistry dominate in mechanics, natural science and medicine in organic.

3. The volume of scientific information exceeds the memory capacity of human brain – artificial intelligence takes over competence.
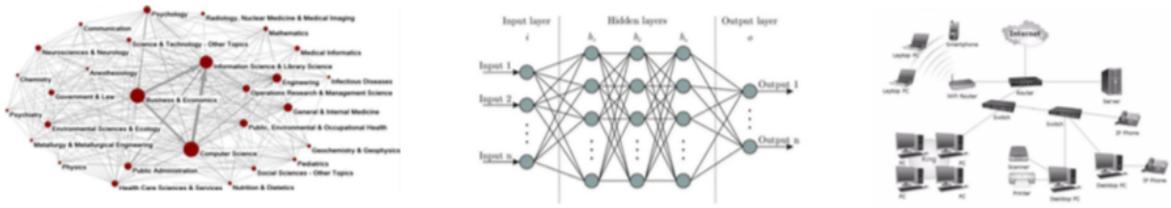
Scheme of secularization and connection of scientific fields; basic scheme of neural network (five layers of neurons) with error backpropagation algorithm; scheme of active computer network technologies – the projection of cognitative structures into society reduces it to a majority system of links and suppresses the significance of individual elements.

- Scientific theories on the laws of the development of human civilization produce dysfunction totalitarian projects – communism, racial superiority.
- The balance of individual needs of energy sources and global stability are maintained by international organizations – UN, NATO, EU.

Information as value (virtualization) transfer of evaluation competencies, decision-making and management to communicatively distant centers – this delegation does not understand from smaller units or individuals the essential need for self-preserving information exchange ("is: isn't", "favorable: unfavorable", "good: bad"):

1. Prognostics based on development statistics of selected quantities and relationships project the future in graphs – faith in science.
2. Artificial intelligence and computer animation model and display "real virtual reality" – sci-fi projects in science and film.
3. The global information network allows the creation of virtual power and economic values – transnational legal standards and currencies.


A map of the most active Bitcoin mining focuses, a map of the spread of the coronavirus SARS-CoV-2 (COVID-19), and a map of the fastest warming areas (1.5 C on average from 1900).

- Energy production connects virtual currencies and climate change – essential for mining and contributing to planet warming.

- The structure of enhanced immunity, computer networks, and the international community is destroyed by viruses – HIV/SARS, computer worm, terrorism.

Forecasts (data projection) model scenarios of further development of global society are based on the energy and space dispositions of the planet (limited resources), demographic and civilization curves (aging population), and on the development and application of technological innovations:

1. Organic forecast (OECD): The planet will feed 10 billion people with increased food production and reduced greenhouse gas.
2. Technological (Lausanne University): With a stay in low-energy hi-tech "caves", the planet will support 20 billion people.
3. Cosmological (Washington University): The population will reach 10 billion and then stabilize at 9 billion due to a lower birth rate.
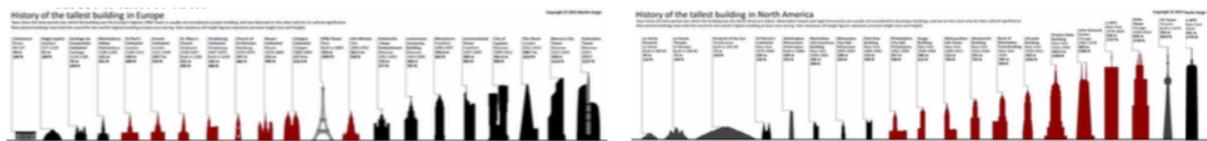
For centuries, the tallest buildings mostly symbolized religious values. The fifty-meter Roman Colosseum surpassed the Byzantine Temple of the Holy Wisdom, which was built up to 56 meters in 537. The Cologne Temple from 1880 is one hundred meters higher and was humbled nine years later by the Eiffel Tower of 324 meters in Paris. Europe's cathedrals were exceeded in 1904 by Philadelphia's City Hall at 167 meters, by Chicago's Willis Tower with 531 meters in 2000. Tokyo's Skytree from 2012 is 634 meters, and Dubai Burj from 2010 is 828 meters.

The global economic crisis of the 20th century began in the regions with the world's tallest buildings, which were symbols of the real estate fever.

The largest development projects are implemented by KSA today, including a kilometer skyscraper in Riyadh and a line for 9 million people in the desert.

Prognostic Considerations

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Abstract

Prognostic considerations are a kaleidoscope of different prognostic expressions of both quantitative and qualitative nature. The quantitative considerations are based on the theory published in the monograph Production Functions as a Tool for Representing Economic Reality. The temporal production function is used to forecast the GDP of the economies of the US, China and India to 2030 and 2050 respectively. The prolongation of the absolute level of GDP shows that India, in addition to China, which is already in first place, will be ahead of the US.

Keywords: Forecast, extrapolation, gross domestic product GDP.

Development of the USA, China and India according to GPD

A current example of the use of the time production function is the forecast of the three largest world economies, the USA, China and India. The output variable of this production function is GDP at constant prices in purchasing power parity (international $2011) and the input variable is time. Extending the development over the period 1992 to 2020 for the next 10 or 30 years shows that there will most likely be changes in the ranking of the largest economies by GDP. It can be assumed that inertia tendencies will naturally prevail in huge national economies for the 10-year or longer forecast period. These are complemented by some expected and unexpected disturbances, such as the effects of across-the-board restrictions and lockdowns triggered by efforts to influence the evolution of the COVID-19 epidemic.

   Table 1 shows the top 3 economies in order of absolute GDP in 2020. There have been some changes compared to 1992: China has moved up to 1st from 5th place; the US has dropped to 2nd place; India has moved up to 3rd from 8th place. The projection to 2030 was calculated as the product of the prolonged population L and the live labour productivity GDP/L, for which first, second and third order polynomial functions or exponential functions were used according to the corresponding tightness measured by the aggregate coefficient of determination R^2. I have also implemented this forecast for aggregate factor productivity instead of just live labour productivity. Since the resulting order changes were virtually the same, I decided to publish only the simpler and clearer version.

Table 1. 10-year forecast for the three strongest economies

		HDP (bilion $)						HDP/L	L	i
		1992	2020	2030	2020/1992	2030/2020	2030/1992	2030/1992	2030/1992	2030/1992
1	China	2151	24283	41416	12.9 %	6.1 %	8.3 %	7.7 %	0.6 %	92.9 %
2	United States	9503	17918	22281	3.2 %	2.5 %	2.3 %	1.5 %	0.8 %	64.6 %
3	India	1628	8870	28020	8.8 %	13.6 %	8.0 %	6.5 %	1.4 %	81.7 %

Source: Data for 1992 and 2020 are taken from the World Economic Outlook Database of the International Monetary Fund. They are in purchasing power parity, international $

The explanatory variable in all cases is the time t, given in years through years, e.g. 1990 or 2030. The large number of decimal places to which the regression parameters are reported is necessary. Reducing the number of decimal places introduces significant deviations between measured and estimated values. The summary coefficient of determination R^2 is also given for each equation.

Regression equation for population L:

- USA, $R^2 = 0,9917$

$$L = 2,5546.t - 4827,8 \tag{1}$$

- China, $R^2 = 0,9980$

$$L = -0,1274824170.t^2 + 519,4496547752.t - 527\ 707,0728967320 \tag{2}$$

- India, $R^2 = 0,7297$

$$L = -0,20545319.t^2 + 842,23139928.t - 861\ 584,35660050 \tag{3}$$

Regression equation for gross domestic product per capita GDP/L:

- USA, $R^2 = 0,9656$

$$GDL/L = 677,46894719.t - 1\ 311\ 116,77411355 \tag{4}$$

- China, $R^2 = 0,9992$

$$GDL/L = -0,22921711.t^3 + 1\ 397,47724405.t^2 - 2\ 838\ 932,93517677.t +$$
$$+1\ 921\ 697\ 385,47686000 \tag{5}$$

- India, $R^2 = 0,9950$

$$GDL/L = 1,2.10^{20}.e^{0,05361916821173360000.t} \tag{6}$$

The coefficients of determination are high, mostly explaining more than 99% of the association. Only the linear estimate of the evolution of GDP/L labour productivity in the US explains the also high 96%. The linear evolution is convincing here. The only regression equation with a relatively lower, but sufficiently high, coefficient of determination of 73% is the quadratic equation expressing the evolution of population as a function of time in China. No better equation in terms of tightness could be found. This is due to the fact that the evolution is not as smooth as in all other cases, as there are ripples in the population data for the period 2005 to 2020. The ripple is that the gradual reduction in the rate of population growth seen over the last 5 to 10 years is increasing.

In addition to Table 1, population trends are also shown in Figure 1. The US population in the base year 1992 is one-third that of India and one-fourth that of China. The population growth of the USA is convincingly linear, with a further 50 million inhabitants over the next 50 years. For China and India, a polynomial of degree II seems most appropriate. The essential difference is that the curve for China is approaching its peak, while for India it is still growing significantly. This is clearly a consequence of the fact that China has been seeking some population control for some time, while in India, given traditional attitudes towards reproduction and fertility control, nothing of the sort has been happening and will not happen in the horizon under consideration.

Figure 1: GDP forecast in purchasing power parity of the world's three largest economies
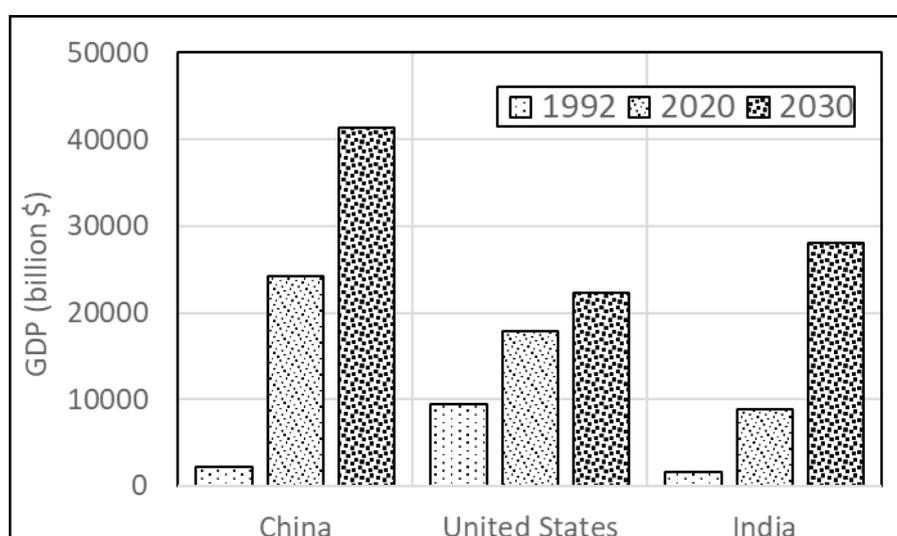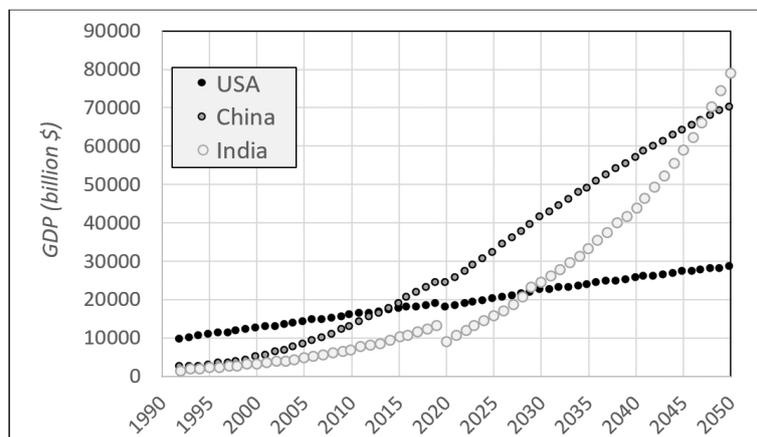

Source: own implementation

The evolution of the productivity of live labour GDP/L, shown in Table 1 and Figure 4, convincingly demonstrates the significantly higher level of technical sophistication of the US, which has a GDP/L about 15 times greater than both China and India in the base year 1992. Despite the slight undulations in the evolution of GDP/L, the linear regression function is ill-suited to convincingly express the evolution of this indicator. The evolution of live labour productivity GDP/L of both China and India is accelerating. China's increasingly rapid productivity growth is best captured by a third-degree polynomial, while India's development is best captured even as exponential. This means, of course, that GDP/L will, if these trends in China and India continue, converge legitimately towards GDP/L in the US.

In 2020, the forecasting calculations took into account measures related to the COVID-19 epidemic. The IMF database, from which all the baseline empirical data was drawn, gives the following growth rates for 2020: the US -4.27%; China 1.85%; and India -10.29%. The deepest economic recession in 2020 occurred in India. The US has also experienced recessions, with only China experiencing a mere slowdown in GDP growth rates. This is a similar situation to

that of the last global mortgage crisis in 2009, which confirmed that China in particular, but also India, despite their increasing absolute openness, are still relatively closed economies. If there are restrictive measures in China, they are virtually non-existent in basic industries. Table 1 shows that there are also changes in the ranking in the forecast year 2030: the US drops to 3rd place here, with India ahead of it. The gradual changes in the ranking of the top three positions can be clearly seen in Figure 1, which plots the GDP values of the three largest economies over the three periods under consideration.

Using average annual growth rates, Table 1 shows the dynamics for both periods, i.e., the 2020/1992 retrospective, the 2030/2020 forecast and the entire 2030/1992 analysis period. In the retrospective, GDP grew fastest in China, with the second highest growth rate in India. In the retrospective, the fastest GDP growth is again in India. In Table 1, the average annual growth rates of living labour productivity GDP/L and population L can still be observed. Population grows fastest in India, where an annual average growth rate of 1.4% was calculated for the whole period under review 2030/1992. Similar to China, the growth rate is projected to be about half as high in the US at 0.8% and in China at 0.6%. The fastest population growth in India is due to the fact that, unlike China, there is virtually no consideration of birth control in that country. Sex has traditionally been seen as a 'sacred dimension' that no one dares or wants to interfere with because it is taboo for Indians.

**Figure 2: GDP prolongation of the USA, China and India**

Source: own implementation

The basic information on the quality of growth is given by the intensity (i), which indicates the share of intensive factors in the development achieved and therefore to what extent the development is intensive or extensive. Despite the fact that the intensity thus conceived is based only on the labour factor in the inputs, it has a very good predictive power. Intensity is ranked by GDP in 2020 in the last column of Table 1. In all three countries studied here, over the entire period 1992 to 2030, all three countries are predominantly intensive. An admirable 92.6% is

achieved by China. India follows with 81.7%. The lowest intensity of 64.6% was reported for the USA. This illustrates well the qualitative upsurge in China's technological and scientific potential, which is also reflected in its mastery of some cutting-edge technologies. Examples include the success of their space programme, but also elsewhere. The high intensity of India's economic development is due both to its own potential and to the process of convergence towards global development. The intensity of the US should be seen as the fact that its technology is still at a good level, but it is 'just' maintaining it, which will inevitably result in lower intensity. Another reason is that the US is still among the leaders in the development of some unique technologies, which also contributes to showing lower growth rates than the 'copycats'. At the same time, however, it should be noted that the US has shown some alarming trends since the 1970s, for example in the further growth of its already astronomical debt burden, which is made possible by the annual increase in the debt ceiling. A serious process is the increasing dedollarisation, the massive sale of land to foreign nationals, the crisis in primary and secondary education, the differentiated development of the various federal states, etc.

Figure 3: Prolongation of population trends in the USA, China and India
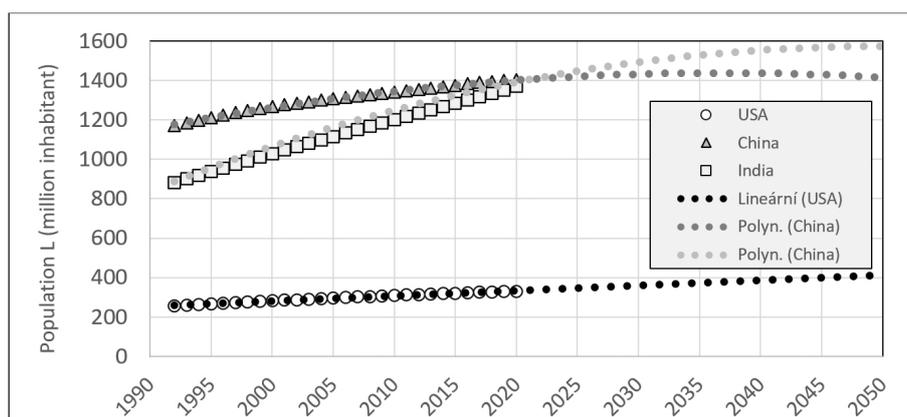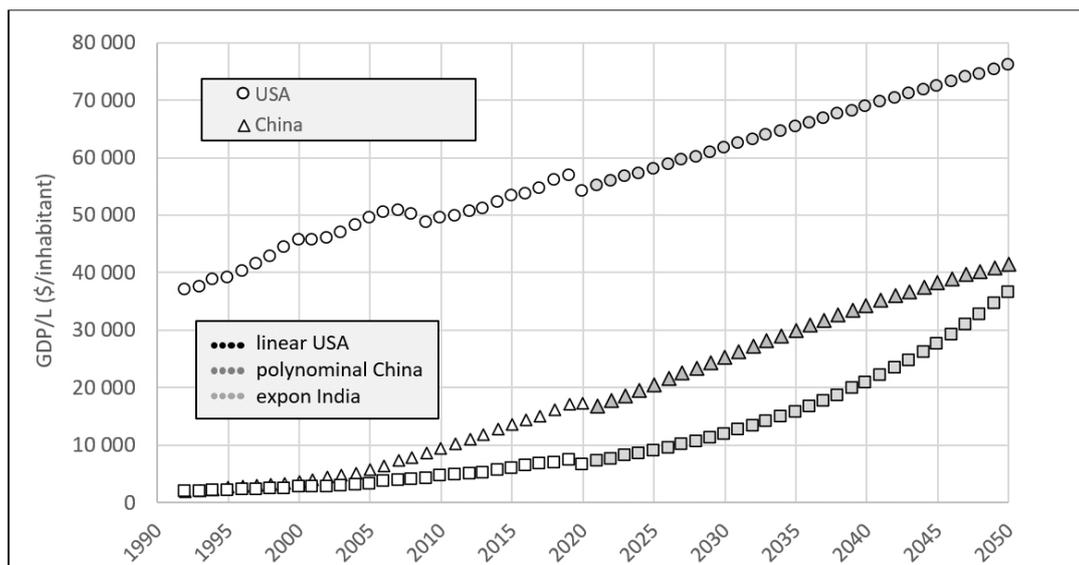

Source: own implementation

GDP growth for the world's 3 strongest economies was also projected up to 2050. Figure 2 shows that India is still likely to overtake even China in absolute GDP during this period. The prolongation of the absolute GDP trends for the US, China and India was obtained by multiplying the population L by the labour productivity represented by GDP/L. Both of these initial variables were prolonged by an appropriate regression function, as shown in Figure 3 for population L and Figure 4 for live labour productivity GDP/L. The one-off impact of the COVID-19 area measures is significant in 2020 (especially for India), but not yet so significant in the long run. Figure 2 shows declines in 2020 over the course of both GDP and GDP/L in Figure 4, which flatten out again in subsequent years. Of course, other global problems may arise, but these are difficult to predict, see the well-known publication Black Swan Part Two Predict, not possible (Taleb, 2011, p. 151). In this monograph, we are mainly concerned with inertial processes, which are all

the more significant the more robust the entities we deal with. Inertia is an extremely important phenomenon that protects nature and society from the risk of the consequences of too sudden changes. Inertial processes are fundamental to forecasting considerations, and only on top of them can some sudden, unexpected and difficult to forecast changes be "superimposed".

Figure 3 shows the current demographic evolution of the analysed national economies and the subsequent forecast up to 2050. If the much smaller population of the USA is growing almost exactly linearly, the faster growing population of China and the even faster growing population of India show a gradual slowdown in the growth rate.

The labour productivity growth in Figure 4 shows that the substantially higher US labour productivity grows linearly. China is also approaching it linearly as it has a somewhat higher growth rate. Although India has the lowest values of GDP/L of living labour productivity for the whole period under study, an exponential function seems to be the most appropriate for prolongation.

Figure 4: Prolongation of GDP/L, USA, China and India

Source: own implementation

Partial statements

Within ten years:

- A third of EU countries will express an interest in leaving the Union.
- Effectiveness of ideological diversion to drop by 50% in 10 years.
- Cashless payments will be the almost exclusive payment method.
- Drug use will fall by 15%.
- BRICS will become a key international financial institution after its enlargement.
- Production will be at the point of consumption! Products will be individualised!

- 40% of jobs will disappear without replacement. Average working hours will be 4–5 h/day.
- Artificial intelligence will reduce the number of employees in all sectors except teaching.
- Social issues will be comprehensively addressed by an unconditional basic income.
- Automobile and air transport safety will increase. Cars will have:
    - Self-parking,
    - Black box,
    - Driver fatigue detection,
    - Emergency braking,
    - Alcohol detection,
    - Gradually, a new world system will be create.

Conclusion

This paper examines the time series production function that is used to forecast the GDP of the economies of the US, China and India to 2030 and 2050, respectively. The prolongation of the absolute level of GDP shows that India will be ahead of the US in addition to China, which is already in first place. The paper shows that despite the turbulent global developments, inertial linkages are the determinant for now.

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Statistical Simulations for Measuring Operational Risks

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Introduction

Under Basel II methodology there are distinguished three main risks - market, credit and operational risk. In all cases, it is possible to determine the capital requirement using the basic method, which consists of multiplying the size of the exposure by a predefined coefficient. At the same time, a more advanced approach is allowed for all categories, subject to regulatory approval. The capital requirement may be calculated on the basis of the VaR (ValueAtRisk) risk acquiring method.

In the case of the advanced approach for operational risk (the aim of this study), only basic qualitative and quantitative requirements are defined and it is the bank's responsibility to use appropriate methods to estimate the required amount of risk capital.

Keywords – Operational risk, loss distribution, loss frequency, loss severity, composite distribution, AMA methods, LDA approaches, IMA methods, Monte Carlo methods, MILDA_E oprisk calculator, Excel simulation add-ins

Solution Objectives

Statistical simulation solutions for finding a composite distribution of losses (severities and frequencies), in operational risk of banks/companies, application of LDA methods (Loss Distrib. Approaches), implementation of MC simulations, including program solution (custom model **MILDA_E**)

1.1 Risk definition and basic requirements for the advanced approach
Operational risk is defined in the CRD (Capital Risk Directive) as the risk of loss arising from deficiencies or failures in internal processes, people and systems or from external events and also includes legal risk. Quantitative requirements include the requirement a confidence level of 99.9% (unexpected loss). The following risk capital requirement must include both expected (reserves) and unexpected losses. The operational risk measurement system (and the determination of risk based capital) must take into account the **tails** of the loss distribution (as for severity), that means its thickness (fatness) determining type of distribution used. We are using (for this demo usage) lognormal, which is the type of middle fat distro. Other ones are,

e.g., Gamma, Gumbel, expon. There exist both thin and heavy types. Esp. heavy types are often investigated when studying EVT (Extreme Value Theory) risk loss events. This is not, at the moment, the object of our study.

The operational risk measurement system must take into account the four basic elements of the advanced approach – internal and external data, scenario analysis, business environment factors and internal control factors. The different elements may be taken into account in different ways and at different stages of modeling, and the CRD leaves a large degree of discretion to individual banks in this area. A bank may still take into account the effect of insurance before the final capital requirement is determined. This is what the definition says.

1.2 Simulation model for calculation of composite frequency distribution and loss severity

This paper is focusing (as mentioned) on the Loss Distribution Approach (LDA), which is based on statistical methods applied to internal/external loss data of "ordinary" shape (frequent appearance, with a moderate-middle tail of the distribution). The objective of the study was to demonstrate the effectiveness of simple apps in calculating risk-based capital using an Excel spreadsheet and relevant simulation add-ins.

Furthermore, the existing software for the implementation of Monte Carlo, as well as other methods suitable for risk calculations, was studied too. As byproduct of the solution, the described problem, the Internal Measurement Approach (IMA) method, assuming a normal distribution of loss severity and a Poisson distribution of loss frequency, were used. Some smaller institutions use this simple sort of apparatus.

As the main problem in the task of implementing MC simulations, finding a composite distribution of the total losses by LDA was used. It is necessary to perform statistical simulations of the distribution of total loss values based on simulations of frequency distributions (Poisson, alternatively Binomial) and the distribution of severity loss values (lognormal). Alternatively, more sophisticated analytical procedures are available to calculate the composite distribution of total losses (see Panjer et al, 1998 [3]). The main output in this section is the implementation of the MC method algorithm by simulations on the LDA solution in a concrete implementation in the MILDA_E model. This assumes that verified parameters of the input distributions are available (this step is not included).

1.3 SW dependencies

- Windows 7, Excel 2003 and lower (higher versions not tested), Jensen simulation libraries (available on the web)
- libraries ran_var, simulation, simtools, installed as Excel add-ins
- Excel functions POISINV, LNORMINV (check availability)
- our application MILDA_E

Note: If the Visual Basic (Excel) module reports an error, it is usually because the Jensen libraries are not compatible with one of the other system components. Since the libraries are

unavailable, there is no remedy other than to swap versions of the system (e.g. in a virtual machine, which does not interfere with the existing fresh configuration) and/or Excel.

A simplified solution was described using the Internal Measurement Approach (IMA), assuming a normal distribution of loss severity and a Poisson distribution of loss frequency. The numerical results of the IMA method can be used for a rough comparison with the outputs of MC simulations. It is involved in our app too (it goes beyond MC).

Solution of the LDA problem (with comparative calculations using IMA) and description of the underlyined calculation program MILDA_E

2.1 Overview of AMA methods investigated in the task

- IMA (Internal Measurement Approach)   (1)
- LDA (Loss Distribution Approach)   (2)

Methods of type (1), (2) are statistical in nature. This approach preliminarily monitors the occurrence of loss events and their severity and measures them using certain statistical characteristics. As a result, the amount of risk capital contribution is derived from these values. The factor of time is not taken into account, the occurrence and severity of losses have stable probability distributions, unchanging over the period of the year under consideration.

2.2 Business lines and risk types in terms of statistical approach, aggregation of sub-capital requirements

In order to achieve greater homogenity of data processing, the entire scope of the operation risk in the bank is divided into a matrix consisting of 8 business lines and 7 risk types (e.g. BL corp. banking, ET insider trading, "not under inspection here"). This is also applied to the statistical description used by methods (1), (2). It is necessary to subject the individual fields of the matrix to partial statistical procedures. The LDA and IMA methods respond to this requirement by calculating the impact of partial loss distributions. For the smooth application of these methods, it is necessary that the loss severities and its frequencies come from a statistically homogeneous source. It is not desirable that the loss distributions (within a matrix) are a mixture of several types of distributions. The corresponding sub-capital requirements have to be sumarized.

2.3 Brief characteristics of statistical AMA methods, overview

For these methods, empirically obtained loss data with a minimum 3 years history is required (by Basel methodology). These data need to be transformed into the form of loss probability distributions. They are further procesed for the purpose of validating certain theoretical probability distributions and determining their parameters needed for MC analysis. From these theoretical distributions, the statistical characteristics are calculated using analytically derived relations or simulation techniques. Validation is performed by testing statistical hypotheses that

the observed data confirm the validity of the specified type of distribution at a given level of significance. To determine the shapes and parameters of the distribution, a longer interval of observation of the loss data is required, so that the resulting estimates of the parameters of the distribution of the loss events are based on sufficiently numerous observations.

For processing, two statistical features are taken into account – the occurrence of loss events and their significance (severity).

Both are subject to certain probability distributions that need to be estimated from the data. These distributions are different for the two aspects of the loss data and differ in the magnitude of the parameters and between the elements of the matrix (intercepts B/L × E/T). In addition, a monitoring horizon of 1 year is essential. These data aspects are not solved here (it needs special care).

1. **IMA** is based on the following inputs:
- Total number of potential loss events
- Probability of a loss event within this set (frequency of occurrence)
- Mean and standard deviation of the loss (severity of the loss)

The IMA is characterised by setting the unexpected loss as a multiple of the expected loss. The Risk Capital requirement is given by the unexpected loss. It is derived as the product of:
- the gamma coefficient γ,
- the indicator exposed to risk (potential loss coincidence),
- the probability of a loss event (in terms of frequency), and
- average loss (in terms of severity)

at a given confirmation margin (e.g. set for banks at 99.9 %).

Two types of distributions appear in the formula, for the frequency of loss events and the severity of losses. Analytically, the binomial (for smaller frequency of occurrence) and Poisson distributions are used, respectively. For the severity of losses, the normal distribution is used.

2. **LDA** types of methods are based on direct measurement of unexpected loss as a characteristic of composite frequency distribution and loss severity. The lognormal distribution is used as a type of distribution of loss severities. The frequencies of occurrence of loss events are again binomial or Poisson. The unexpected loss is quantified as 99.9 % quantile of the composite probability distribution minus the expected loss (usualy stated before). The capital requirement is therefore calculated from the characteristics of the composite distribution. When applying the LDA procedure, the basic problem is the calculation of the composite distribution. It does not introduce the assumption of the size of the unexpected loss as a multiple of the expected loss.

The application of both procedures results in a capital requirement for operational risk. This requirement is given by the sum of the requirements in each risk line and risk type, assuming

statistical independence of the occurrence of losses and their values for each field of the matrix. Theoretically (assuming independence), this leads to the so called convolution of the distribution, to the calculation of an aggregate distribution under uncorrelated losses.

Briefly summarized:

- IMA is much simpler than LDA, where the composite loss distribution is assumed
- The LDA approach is probably preferable, IMA is simpler, the difference is in the combination of distribution types
- LDA leads to aggregation of distributions, IMA introduces a simplifying assumption and does not go into detail in the statistical description
- The input to LDA is the frequency distribution of loss events (usually Poisson) and the distribution of losses (lognormal). The result is a composite true distribution of loss values weighted by their incidence.

2.4 Brief IMA calculation algorithm

This is based on the number of *N* events potentially burdened with oprisk in the annual horizon. Further, the probability of a loss event *p* from *N* possible events. The basis is an estimate of the expected loss $N * p * \mu L$. To do this, we need to estimate the average loss from one event μL. This characteristic is calculated from two sources, the distribution:

- Frequencies of losses (binomial distribution); parameters *N, p*
- Loss severities (normal distribution); parameters μL, σ^2 (mean value, variance)

Calculations of the distributions *A* and *B* and their characteristics yield the magnitudes of γ from the value of the coefficient *k*. The IMA is characterized by the fixed size of the difference between the expected (the mean of the distribution) and the unexpected loss (the tail of the distribution given by 99.9 percentile.

In the underlying theory, formulas are derived as:

Figure 1

$$\gamma = k * \frac{\sqrt{1 + (\frac{\sigma_L}{\mu_L})^2}}{\sqrt{N * p}}$$

where $k = \frac{(\alpha \text{ percentile of distrib. } B - N * p)}{\sigma_L}$

A simpler form of the formula is (with unknown variance σ_L):

$$\gamma = \frac{k}{\sqrt{N * p}}$$

$$k = k * \mu_L \sqrt{N * p}$$

The alternative distribution to *A* (frequency) is Poisson, to *B* (loss) lognormal.

Capital requirement calculation:

The OR capital requirement is determined by the unexpected loss, the expected loss is covered by reserves that can be set aside apriori. This is derived using the coefficient γ, an indicator of the exposure *EI* to risk, e.g. loss event *PE* and the average loss *LGE*, *I*, *J* denotes the line/type, *K* denotes the capital requirement.

$$Ki,j = γi,j * EIi,j * PEi,j * LGEi,j = γi,j * ELi,j \qquad (3)$$

The calculation according to the IMA algorithm is taken as a guideline for the purpose of comparing the results with the LDA method, whose results are taken as a reference.

2.5 Brief calculation algorithm according to LDA

The goal is to create a model for aggregate losses - to determine the probability distribution for the total loss.

The total loss S is defined as the sum of:

$$S = X1 + \ldots + XN \quad (N = 0, 1, 2 \ldots) \qquad (4)$$

where random number *N* is number of individual losses ($X_1 \ldots XN$). The assumption of independence and equal distribution of *Xi* is introduced. Also, *N* and *Xi* are independent. That is:

- Assuming *N* = *n*, the random variables $X_1 \ldots Xn$ are independent and equally distributed
- The distribution of *N* does not depend on the values of $X_1, X_2 \ldots$

The calculation problem focuses on:

- Estimation of probability distribution for *N* based on random sampling
- Estimation of probability distribution for *Xj* based on random sampling
- Using these distributions, construct the distribution of random variable *S*
- The distribution (4.3 in the next theoretical form-we don't use it analyticaly) is called the composite distribution. This is as for the theory. We are following the apps way.

Figure 2: LDA characteristics, see article EVT-box

2.6 Analytical methods for calculating the composite distribution.

Under certain circumstances, the normal or lognormal distribution can be a good approximation of the distribution. S. This concerns the limiting values of the parameters of the Poisson distribution.

Obviously, the direct calculation according to (4.3, 4.4) is not straightforward.

An approximation of the distribution using the known stat. moments of the distribution is offered. There are significant drawbacks to this solution; a satisfactory degree of agreement of the approximation with the true distribution is not known.

The direct convolution method (4.4) leads to computationally demanding task.

Another method invents a reduction in the number of computational steps according to the above direct computation method, but it depends on certain types of distributions. Nevertheless, it remains a suitable method for verifying results from multiple sources.

The last method uses the inversion of the characteristic function and uses the appropriate software. This method also deserves attention as a promising but specialized one. Both recursion and inversion are based on the assumptions of independence and equal distribution.

The assumption of equal distribution over a long time interval does not seem to be completely realistic. The problem is that a higher incidence of loss events leads to corrective measures that reduce their incidence and thus modify the original loss distribution, which then follows a different law during the run.

*2.7 Simulation method*

This process can be characterized as follows:

- Build a model for *S* which depends on random variable *X, Y, Z . . .* ……...
- For $i = 1, . . . , n$ generate pseudorandom variables x_i , y_i , z_i . . . and then compute s_i using the model from step 1
- The cdf (cumulative distrib. Function) of *S* may be appropriated by FS{s}, the empirical cdf based on the pseudorandom sample s_1, . . . , s_n.

The goal is to determine an empirical distribution function based on a sequence of (pseudo) random numbers s_1, . . . s_n. The question is how large n to choose. Clearly, as the number of values increases, a correct estimate can be achieved with an increased degree of precision. It is not a problem to shift it effectively to the order of 104. We take the empirical values of their estimates (e.g. sample means, standard deviations, quantiles, etc.) as the characteristics of the observed distribution. We are confident that with a sufficiently large number of observations, these characteristics can be identified with a high degree of precision, with the sought-after unknown values of the underlying distribution.

This is also useful for our case of finding the aggregate loss distribution. Therefore, this method of calculation, which is an alternative to analytical procedures, is advantageous.

Algorithmically, it is simple but requires a large number of computations, which is not so much of a problem.

**Figure 3: Expected and unexpected losses**
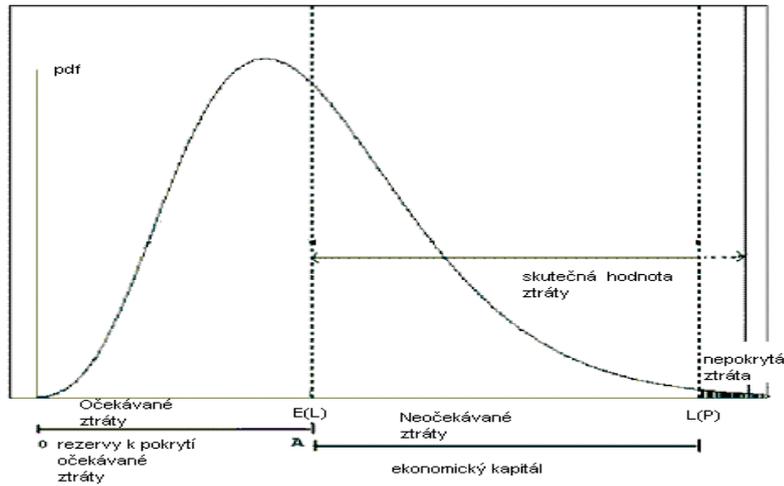
Figure 4: The process of aggregating the loss distributions within the matrix can be shown schematically.

A simulation is well demonstrated with a roll of two dice:

Figure 5: Roll of dice

Basically, a Monte-Carlo simulation is a big dice-rolling exercise where the dice are shaped such that their different sides fall with different frequencies (given by the corresponding distributions). One set of dice is for the frequency distributions, the other set for the severity distributions. Each iteration starts with a roll of one of the frequency dice. The number that falls determines how often the corresponding severity die has to be rolled. Say, for instance, the frequency die shows 3. This means that we roll the corresponding severity die 3 times. The severities are all added up to make the potential loss for this iteration. This procedure is repeated many times, resulting in the corresponding number of potential losses. The histogram of these potential losses makes up the overall aggregated loss distribution. The overall procedure and the resulting aggregated potential loss distribution are illustrated in figure 5.
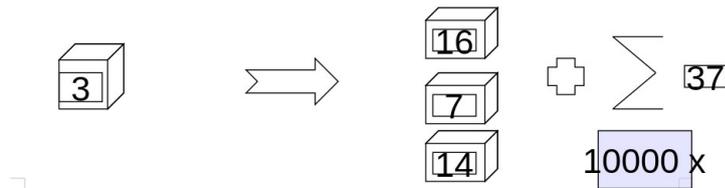
Figure 6: Simulation calculation scheme for business lines, risk types
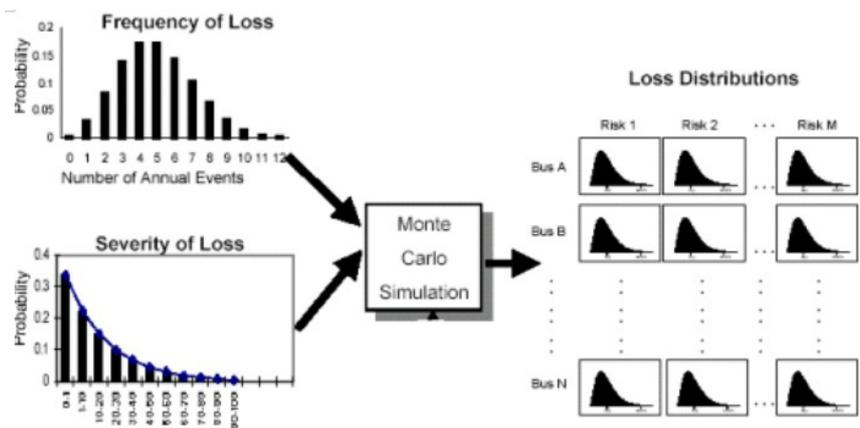
Implementation of MC simulations in an Excel program.

2.8 „MILDA_E – Malý Ima LDA calculator (Excel)"

The initial software solution for simulation calculations is prepared in Excel. The calculation is performed in six sheets. The aim is to convert the above algorithm into a formal program form suitable for the interactive calculation of the above characteristics, including the capital requirement. The calculation is performed in parallel for two types of distributions, Binomial and Poisson on the quotient side, of lognormal weight. The analytical figures are accompanied by a graphical representation with automatic recalculation of the shape of the distribution and its characteristics when the input data are changed.

List and functionality of worksheets:

- **Selecetion**: shows list BL/ET (matrix 8×7 for banks), after the user makes a selection, it moves to the sheet:
- **Inputs and Outputs**: for the selected BL/ET combination, the inputs and the calculation of the output values are introduced vstupy – the number of loss events N, the probability

of loss events *p*, the coefficient λ of the Poisson distribution, the average loss and variance of the loss distribution, the confidence limit α, výstupy IMA – capital contribution of type **a** (with knowledge of loss severity variance) and **b** (without knowledge of loss severity variance), expected total loss

Sheet contains an LDA softkey that moves the calculation to the next simulation phase.

- **Binomial_distr.**: contains calculations based on the Binomial distribution
- **Poisson_distr.**: contains calculations based on the Poisson distribution. The last two sheets are complemented by the Normal distribution of loss severities.
- **Simulace (1)**: It is a sheet in which the computations of the composite distribution are performed. The empirical distributions of frequencies and loss magnitudes are generated (using pseudo-random numbers) and displayed. The computation problem focuses on generating random upper bounds for the summed *sn* values. An algorithm has been prepared that converts the random numbers generated from the Poisson distribution of occurrences into the computation of random upper bounds for the summation cells. These summation values (in aggregate) produce an empirical distribution of aggregate losses. A histogram of this distribution is calculated using the appropriate Excel function. In addition, the mean, standard deviation, 0,999 quantile and, followingly, the capital contribution for operational risk coverage are calculated.
- **Simulation (2)**: is a sheet in which the calculated values of the characteristics of the composite distribution are displayed.

2.9 Program characteristics

The calculation uses Excel's statistical and search functions, including Visual Basic macros within Excel. The calculation is supported by a number of simulation libraries to generate pseudo-random numbers from prescribed distributions. These libraries are installed as Excel add-ins. Can be found at [**4**]

The basic element providing the calculations is SIMULATION TABLE, in a selected range, tabulates outputs from repeated recalculations of a MC simulation model. The outputs to be tabulated should be in the top row of the selected range, but the top-left cell of this selected range should be unused. Recalculated values of the simulation outputs will fill the lower rows of the selected range, with each row containing the output values from an independent recalculation of the simulation model. The left column of the selected range is used for a percentile index, which can be useful for making cumulative-distribution charts after the output data is sorted (but the Simulation Table procedure itself does not sort the output data).

It is not a limitation (due to the use of other analytic functions) to calculate the Binomial distribution for a large value of the product N ∗ p, also a Poisson distribution. even for high λ. For μ, σ, no restriction on values is required. For this calculation, the capital ratio is set as the target, then the parameters N, p, λ, μl , σ² as influencing parameters. It also allows to determine how sensitive the change in the capital requirement is to the input values.

2.10 Graphic design of input/output sheets

Figure 7: Selection (business lines, risk types*)*

Figure 8: Inputs and outputs (parameters of loss distributions)

Figure 9: Simulation of frequency distribution and loss severity (distribution aggregation)
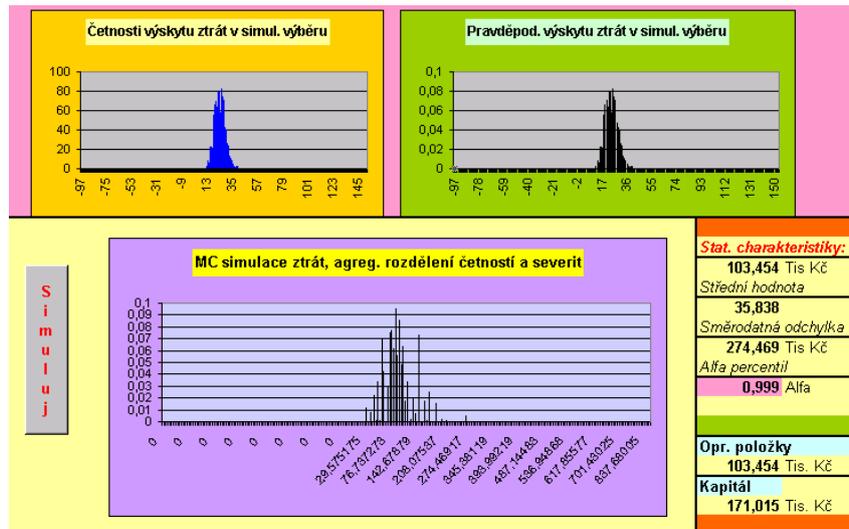
Figure 10: Calculation detail for business line 3 and type *2*

B/L	3							S V O D N Á	
	R/T							Soucet Kap.	
Data	1	2	3	4	5	6	7		
Počet všech jevů N		200							
Pravděp. ztrát. jevu p		0,05							
Lambda		10							
Průměrná ztráta tis. Kč		20,000							
Rozptyl		9,987							
a) Kapitál. příspěvek (tis. Kč)		252							252

This table provides information on the amount of capital per line for all types and the distribution parameters used. If we select "ALL" as the line, then only the capital row is meaningful and we get the sum for all lines/types and the total capital amount.

2.11 Further development of the program

Further use is determined by the possibilities of Excel for a high number of simulated values from the densities of Binomial and Poisson distributions, 1000 simulations are performed in the program. For refinement purposes, the number of simulations should be increased to 5 to 10 thousand.

A useful extension would be a sensitivity analysis, back calculating the influencing values of the distribution parameters from the prescribed target value of the risk capital contribution. This would make it possible to see what loss distribution parameters lead to the appropriate level of a given capital requirement. This is also relevant when knowledge of the distribution parameters is incomplete and we cannot rely on reliable estimates. This functionality is commonly obtained by using Excel's "solver" function, which allows the equation to be solved backwards for one parameter at a time. However, such a procedure cannot logically be applied to the value obtained by the simulations. It is necessary to perform multiple simulations with impact tracking.

The introduction of AMA methods and their appropriate use can lead to a reduction in the capital requirement by influencing the loss process towards a reduction in loss incidence and severity.

Brief characteristics of Monte Carlo simulation methods

Numerical methods, which are known as Monte Carlo methods, can be described as statistical simulation methods, where statistical simulation is defined as a method using sequences of random numbers to perform simulations.

Statistical simulation methods can be compared with conventional numerical methods. In many Monte Carlo applications, the procedure is simulated directly. The only requirement is that the system is described by a probability density function. If the probability density is known, the Monte Carlo simulation can proceed by randomly selecting from the population given by this density. Then an order of magnitude of simulations are performed and the desired result can be taken as the average of a number of observations.

Main components of the Monte Carlo algorithm
The components of the Monte Carlo simulation are as follows:
- probability distribution functions (densities) – the system must be described by a set of densities
- Random number generator (source)
- Selection rule a rule for selecting from a specified distribution
- Error estimation – estimate of statistical error (variance)
- Variance reduction techniques – methods for reducing variance in the estimated solution

The goal of the Monte Carlo method is to simulate a given system using samples from a population with these densities.

Conclusion

The problem statement is based on the needs of risk quantification and management, in particular the determination of risk capital. A statistical approach is applied to advanced operational risk measurement methods, which is the basis of Advanced Measurement Approach (AMA) methods. This statistical modelling approach results in risk concepts and methods being introduced in a methodologically consistent manner. Statistical methods have a useful place in the determination of ValueAtRisk (here OpVar) and the determination of the capital contribution to cover unexpected losses. Their use leads to advanced techniques, including Monte Carlo simulations. These techniques have proven to be viable in implementations, simplifying the finding of solutions, shifting the focus of the problem to the computer and bypassing difficult analytical formulas. The results of simulations should be viewed in the same way as any empirical data. The question of the plausibility of the characteristics obtained by MC simulations in terms of sample

size and stability of the estimates is logically raised. A large number of simulations (of the order of 104) need to be performed.

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Possibilities and Difficulties of Using Artificial Intelligence in Sports Arbitration Disputes

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Abstract

The development of computing technology in the field of artificial intelligence (AI) has made it possible that even the current artificial intelligence can not only replace human intelligence in some areas, but can also surpass it with a great advantage. If artificial intelligence can beat any chess player, including world champions, by such a margin that it wins all chess games, the question naturally arises whether artificial intelligence can replace humans in some other intellectual activities, for example in the field of law. This contribution attempts to outline both the performance capabilities of current computing technology and the possibilities of using artificial intelligence to decide in the legal cases in sports arbitration. In doing so, it highlights the strengths and weaknesses of artificial intelligence, the difficulties of its use in sports arbitration, and also suggests possibilities for further developments in this area.

Keywords: AI Research SuperCluster (RSC), Anthropology of law, artificial intelligence, computerized due process, computing, digital terror, fair trial, human-centric AI, ChatGTP, chess, law, Shannon's number, sports arbitration

Introduction

With the development of computing technology, the use of artificial intelligence in more and more human activities is developing lawfully. In some cases, artificial intelligence can already replace human skills, or at least complement them, quite successfully. We are also increasingly using artificial intelligence without even realising it in everyday life, for example in domestic kitchen appliances, mobile phone cameras and so on. So why shouldn't artificial intelligence be able to decide of the legal cases. After all, AI is impartial, incorruptible, does not change moods, AI is not tired or angry. Similarly, then, AI could be used in the field of arbitration dispute resolution, including sports arbitration. What benefits and difficulties such use of AI could bring are discussed in this contribution.

1. A brief introduction to the anthropology of law

In order to apply artificial intelligence well and to understand the workings of law properly, we must also start from how law itself was created. This is the subject of the scientific field called "anthropology of law". The English lawyer Sir Henry James Sumner Maine (August 15, 1822 – March 3, 1888) is considered to be its founder; another recognized expert in this field is the Czech-American Leopold Jaroslav Pospisil (April 26, 1923 – October 25, 2021). Famous is also quotation of Marcus Tullius Cicero: "Ubi societas, ubi ius", or, loosely translated, "Where there is society, there is law". The inception of law has evolved essentially from the very beginning of mankind. Even species lower than humans have rules governing their relationships and behaviour within their communities. In this context, it could even be said that law is genetically given to some animals and is supplemented by acquired knowledge and experience. Thus, that law is also to some extent an instinctive property (see the publication STEDRON, B. et al., Law and Artificial Intelligence. Pilsen: Ales Cenek, 2020, ISBN 978-80-7380-803-7). This is the first problem that complicates the creation of an artificial intelligence system for the purpose of arbitration (or, more generally, litigation).

2. The main legal systems in the world

As challenging as the tasks must be for AI used in law, it is pertinent to recall here that we currently have five main systems of law – continental law (civil law), Anglo-American law (common law), customary law, Muslim law, also known as Sharia law, and Halacha (Jewish religious law). These legal systems then usually form different combinations even within individual countries. To this we can add the division into customary law and written law. This is another obstacle to the creation of an AI-based system that could arbitrate disputes.

3. A brief overview of the performance of current computer technology in terms of its replacement of human thinking

In the early days of computing, the game of chess became one of the benchmarks of computing capability, as the number of possible moves is approximately 10^{123}. This is called "Shannon's number" after the American scientist Claude Elwood Shannon (1916–2001), who has been called the "father of information theory". To give you a better idea, there are an estimated 10^{78} to 10^{82} atoms in our entire observable universe. Incidentally a water drop – a cube with an edge of 1 mm – can fit 90 trillion atoms, or 90^{18}. Therefore, to master the game of chess by computers, we can well imagine how powerful computers are today compared to humans, and what they can do in their work (see the publication STEDRON, B. et al., Law and Artificial Intelligence. Pilsen: Ales Cenek, 2020, ISBN 978-80-7380-803-7). Yet today, none of the best chess players in the world

stands even the slightest chance against a computer. And today's computing technology has such powerful tools as e.g. AI Research SuperCluster (RSC) – is an AI supercomputer built by Meta, which was introduced to the world on January 24, 2022 as one of the fastest supercomputers (link: https://about.fb.com/news/2022/01/ introducing-metas-next-gen-ai-supercomputer/) and/or ChatGTP, this model is designed for conversation (link: https://openai.com/blog/chatgpt/).

4. Even artificial intelligence can be dangerously wrong

Despite this almost unimaginable performance mentioned above, AI can be fatally wrong (see e.g. accidents of autonomous cars). Similarly fatal could then be the mistakes of AI in arbitration in sports.

5. What human AI cannot yet do (empathy, etc.)

Although artificial intelligence is an extremely powerful tool, and law is actually very similar in nature to, for example, chemistry, a certain degree of empathy on the part of judges or arbitrators, life experience, and a simple sense of justice is a prerequisite for fair decision-making. This aspect is probably still largely lacking in artificial intelligence.

6. The risk of digital terror

With regard to all aspects of the behaviour of computing, the human world must also be protected against the arbitrariness of artificial intelligence and its dehumanisation. In any age, there will be enough excessively progressive and capable people who will want to impose their visions and convictions regardless of everything else, even to the point of a kind of digital terror. The introduction of artificial intelligence should therefore not be pushed headlong. The worst of all would be a digital totalitarianism akin to extreme political regimes.

7. Human-centric artificial intelligence

However, the use of artificial intelligence will not only involve the interpretation of law by artificial intelligence, but also a clash between the approach of artificial intelligence and that of living judges endowed with great life and work experience, empathy, the ability to detect falsehood and so on. This area of AI activity is usually dealt with by "human centric AI", i.e. human-centric artificial intelligence. It is assumed that the algorithms on which AI works must be strictly human-centric, or rather support this human-centric dimension even more broadly than the way we think of human rights today, but should also include humanity as such (see the publication STEDRON, B. et al., Law and Artificial Intelligence. Pilsen: Ales Cenek, 2020, ISBN 978-80-7380-803-7).

8. Fighting "engines" and human surveillance

In the context of the use of artificial intelligence, another question arises: 'Will "artificially intelligent" justice or "AI justice" become a battle of legal "engines", i.e. judicial computer programs, where sports results will be decided in arbitrations instead of on the field?

9. The right to a fair computer trial

With AI, lawyers will gain a powerful tool for their work, but not a full-fledged replacement. The ideal of AI adjudication, then, should be the words of the German philosopher Immanuel Kant (1724–1804), "Act as if the maxim of your action should, by virtue of your will, become a general law of nature." (See Immanuel Kant - Grundlegung zur Metaphysik der Sitten, 1785, in the Czech Republic e.g. published by Svoboda publishing, 1990).

10. Conclusion

The use of artificial intelligence in sports arbitration practice can be a very good tool, but also a tool of digital terror. This does not mean, however, that we should not look for ways to use AI to decide in the legal cases in sport better and fairer.

E-sports in the Academic Environment

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Abstract

This article discusses the growth and popularity of e-sports, especially during the pandemic when physical sports events were canceled or postponed. It defines e-sports from different perspectives, including the International Esports Federation, which states that it meets all the sporting criteria. The article also explores the organization of e-sports globally, with a focus on the International Esports Federation's efforts to popularize and standardize rules. It further explains the different game genres for professional competitive e-sports, such as tactical shooters, MOBA, sport simulators, and fighting games. The growth of e-sports is demonstrated by an increase in profits and revenue in the past four years, and new sectors of the studio and gaming industries are emerging. The article then presents the SWOT analysis of e-sports in terms of economics and audience awareness. Finally, the article proposes the vision of organizing e-sports at the Police Academy in Bratislava in the form of an IT Community Club to create a student IT community.

Keywords: E-sport, competition, computer game, COVID-19

Introduction

E-sports are currently experiencing a significant boom. To a large extent, this has been influenced by the pandemic situation accompanied by several lock-downs caused by the COVID-19 disease[1]. The first aspect was that people could not participate in mass activities, including sports, and thus the only option left was online sports streaming. However, the second aspect was the fact that sports activities such as the Tokyo 2020 Summer Olympics, which have been postponed until 2021, could not even be organised[2]. It was highly risky to organise any mass activities and many sporting events were cancelled because of athletes falling ill. However, since people's interest in

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1 FAKAZLI, A., E., The Effect of COVID-19 Pandemic on Digital Games and eSports, International Journal of Sport Culture and Science, 2020, ISSN 2148-1148 (online citation 1.2.2023) Available from: https://dergipark.org.tr/en/download/article-file/1208099

2 Tokio 2020 – internet article (online citation 1.2.2023) Available from: https://www.olympic.sk/podujatie/tokio-2020

watching sports is high, the solution was to implement virtual sporting events or to popularize them since e-sports players can participate in e-sports events even in isolation[3].

E-sport – definition

Defining e-sport can be done from several perspectives. Dictionary definitions focus more on the aspect of playing video games with no further connections to traditional forms of sport. Oxford Learner's Dictionaries defines e-sport as "a video game played as a competition for people to watch as entertainment"[4]. Cambridge Dictionary defines e-sport similarly as "the activity of playing computer games against other people on the internet, often for money, and often watched by other people using the internet, sometimes at special organised events"[5]. We tend to lean towards the definition used by the International Esports Federation "While e-sports does not involve ordinary physical activity as in traditional sports, it meets all the sporting criteria defined in international standards"[6].

Theoretically, e-sports could be classified as so-called mind sports. These are associated in the International Mind Sports Association (IMSA)[7]. These are mainly chess and other board and card games such as bridge, draughts, go, xiangqi, and mahjong. However, IMSA does not yet include e-sports among the games it covers.

In terms of SportAccord's[8] definition of sport, we can say that e-sport meets almost all the requirements as:

- The sport proposed should include an element of competition.
- The sport should not rely on any element of "luck" specifically integrated into the sport.
- The sport should not be judged to pose an undue risk to the health and safety of its athletes or participants.
- The sport proposed should in no way be harmful to any living creature.
- The sport should not rely on equipment that is provided by a single supplier.

Based on these definitions, e-sport can therefore be considered a sporting activity and should be treated like other sports.

Organization of the e-sports in the Slovak republic and world

The organisation of e-sports is an area of sport, as well as information technology that is experiencing explosive growth. Among the most well-known worldwide bodies is the International Esports Federation. Its efforts are:

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3 However, there have also been incidents where an athlete has been replaced by another unqualified person.

4 e-sport noun – Definition, Oxford Advanced Learner's Dictionary (online citation 1.2.2023) Available from: https://www.oxfordlearnersdictionaries.com/definition/english/e-sport?q=esport

5 Meaning of e-sports in English Cambridge Dictionary (online citation 1.2.2023) Available from: https://dictionary.cambridge.org/dictionary/english/e-sports?q=e-sport

6 Esports - True Sports?, IESF home page, (online citation 1.2.2023) Available from: https://iesf.org/esports

7 IMSA home page, (online citation 1.2.2023) Available from: http://www.imsaworld.com/wp/

8 Definition of e-sports, SportAccord home page, (online citation 1.2.2023) Available from:http://www.sportaccord.com/en/members/index.php?idIndex=32&idContent=14881

- Popularizing e-sports and promoting the growth of national e-sports associations,
- standardising rules within the esports ecosystem,
- creating qualified referee and coaching cadres through the International Esports Academy,
- hosting Esport world championships.

The following game genres have been defined for the professional competitive e-sports sphere based on game types:

- **Tactical shooters** – a first-person shooter game where players try to secure their team's objectives while defeating their opponents (Counter-Strike, Call of Duty, PUBG: Battlegrounds),
- **MOBA** (Multiplayer online battle arena) – strategy games where players compete in teams and try to destroy the structure of the opposing team, (LOL, DOTA 2),
- **Sport simulators** – viral games of traditional sports (football, hockey, basketball, cycling),
- **Fighting** – fighting games based on martial arts where the opponent tries to defeat the opponent through their abilities (Tekken, Street fighter).

Over the last four years, e-sports has seen a huge growth in its audience base and the associated revenues from e-sports. According to Newzoo, there is a year-on-year increase in profits[9].

Figure 1: Profit growth in e-sports

Source: https://newzoo.com/insights/trend-reports/newzoo-global-esports-live-streaming-market-report-2022-free-version

9 Newzoo's Global Esports & Live Streaming Market Report 2022 | Free Version (online citation 1.2.2023)
Available from: https://newzoo.com/insights/trend-reports/newzoo-global-esports-live-streaming-market-report-2022-free-version

The same growth and popularity is being noticed in the gaming environment. New sectors of both the studio and gaming industries are emerging. As an example, the Faculty of Mass Media Communication at the University of St. Cyril and Methodius in Trnava has added the Digital Game Theory study programme to its portfolio[10].

Figure 2: SWOT analysis of e-sports in terms of economics and audience awareness

Source: https://iesf.org/esports
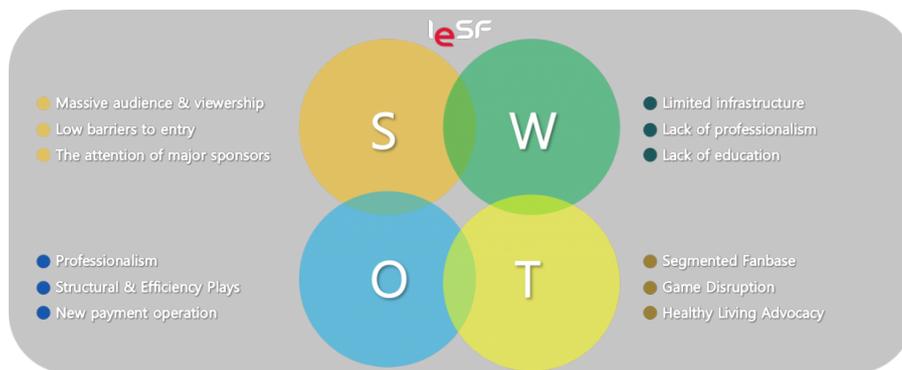
Figure 3: Selected university e-sports clubs

Source: https://saes.sk/index.php/clenovia-asociacie-pravnicke-osoby/

Students of the Academy of the Police Corps took part in the First University esport duel at Profesia days Bratislava in 2020. They competed against teams from the Slovak University of Technology in Bratislava and the University of Economics in Bratislava. They competed in League of Legends, Counter Strike: Global Offensive and Hearthstone.

Vision of organizing e-sports at APZ in Bratislava in the form of an IT Community Club

The Police Academy in Bratislava as a school with a security-legal focus does not have such a large IT community made up of students as other technically oriented universities. For this reason, we decided to try to build such a community on our own in the form of extra-curricular activities. The main idea of the club is to develop IT skills in students who show interest in it.

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10 Študijný program teória digitálnych hier, Fakulta masmediálnej komunikácie, Univerzity sv. Cyrila a Metoda v Trnave. (online citation 1.2.2023) Available from: https://fmk.sk/studijne-programy/tedi/

This vision is currently at the beginning of realization. We have conducted an e-survey to find out the interest of the students in various streams of IT including e-sports. We have divided the areas of development as follows:

- Creating social media content,
- Unconventional hardware,
- Linux and its clones,
- E-sports,
- Multimedia and Graphics,
- Programming.

With the following result:

Figure 4: Displaying the result of the survey of interest in the IT Community Club at APZ in Bratislava
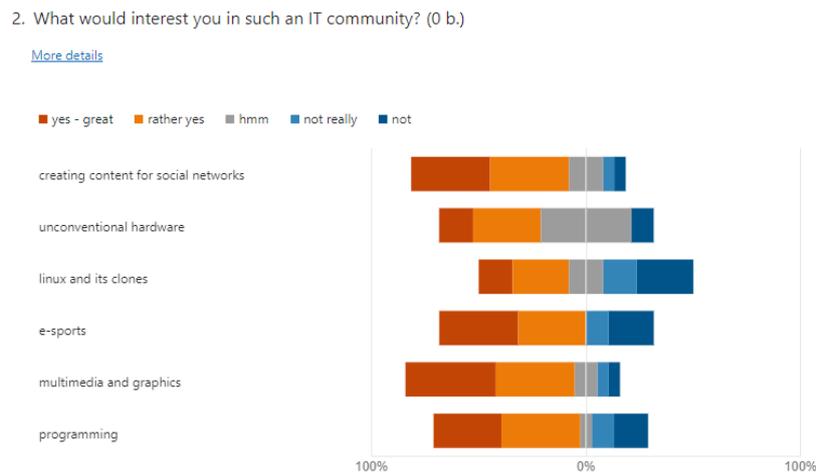
Source: own processing

E-sports came third in this survey, which we consider successful for the student base of our academy's focus.

The survey was also an open-ended question to find out the areas of IT in which students are interested and not defined in the survey. The result was the following finding:

- OSINT, automation, programming, hacking,
- Searching publicly available information,
- Detecting crime through IT,
- Cybersecurity, information systems,
- Crime detection on social networks,
- Cybersecurity,
- Excel charts diagrams but also simple programming and a general overview of programming.

Summary

The next step in building e-sports on our school campus will be to reach out to students who have expressed interest in the IT community club and seek consensus in organizing the club and potentially forming an e-sports team with the support of other club members.

The idea behind creating this IT community club is not only to improve and support IT knowledge, skills, and abilities, but also to seek out talents for practical use by law enforcement organizations. After discussions with representatives of these organizations, this appears to us as a suitable method for satisfying their needs.

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New trends: A Systems Analysis of the Volunteer as a Component of Future Sport Event Implementation

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Abstract

The dissertation will focus on the research of current demographic and technological trends, new segments of sport and new types of civilisation diseases. Furthermore, it will provide a systematically derived answer about the current and future status and role of volunteering in the implementation of sporting events and will give an insight into the shape of future sport organisations and self-sustaining sports clubs.

Keywords: new segments of sport, new civilisation diseases, sports organisations today and in the future, new trends in volunteering

Demography and contemporary diseases of civilisation

A change in demographic behaviour occurred in the Czech Republic after 1989, when the Eastern European model of demographic behaviour disappeared. Today, the Czech Republic is facing real problems due to unfavourable demographic development. Declining fertility, together with falling mortality rates, is causing an unbalanced age structure that is leading to an ageing population. There may be a great burden on the pension and social system, which will have to change or adapt in the future in line with the changing age structure of the Czech population, and there is a statistical increase in the incidence of civilisation diseases. Together, these civilisation diseases are responsible for at least 70 per cent of deaths worldwide, i.e. about 41 million human lives a year. This figure includes the 15 million people aged between 30 and 69 who die prematurely, according to the Association of People Affected by Civilisation Diseases in the Czech Republic, which brings together people affected by cardiovascular disease, diabetes, multiple sclerosis, respiratory diseases, cancer, osteoporosis, vertebrogenic disease and people with physical disabilities.

One of the most significant changes in recent years has been the rise of eSports as a form of competitive gaming, which has attracted a new segment of fans and players. This dissertation will address the link between sports, e-sports, civilizational diseases and the new role played by volunteering in this demographic, which through its immediacy contributes to the quality

of interpersonal relationships, the promotion of exercise and the maintenance of a sporting environment.

Volunteers new trends

E-sports has become a multi-billion dollar industry with millions of people watching to watch competitions and tournaments. This trend has opened up new opportunities for people who are not physically able to participate in traditional sports, and has also created new jobs and career paths for people interested in gaming. Volunteering has always been an important part of sport and has taken on a new role with the advent of new segments of the sporting demographic and technological trends. Volunteering in e sport can include roles such as coaching, event planning and refereeing. With the development of eSports, new volunteer opportunities have emerged such as casting and event hosting.

Volunteering in sport is one way in which society can address these health issues. Volunteers can play a vital role in promoting healthy lifestyles by coaching and guiding young athletes, organising and dedicating their free time to the direct development of physical activities. Movement has always been a direct contributor to improved mental health and reduced stress levels. We must acknowledge with certainty that roles in volunteering in sport are changing and existing research on roles is becoming outdated. Volunteering in sport is becoming more than just a hobby or a way to give back to the community. It is now seen as a way of gaining skills and experience and is becoming an integral part of the sport sector. Sport organisations are now offering volunteering opportunities to young people and are also recognising the importance and indispensability of volunteers in the sport sector.

A systematic analysis of volunteering

Identification of areas for improvement: A systems analysis can help volunteers identify areas of the organization or project that need improvement. For example, if a volunteer organisation is having problems recruiting new members, a systems analysis can help volunteers identify the root cause of the problem and develop a strategy to address it.

Improving efficiency: A systems analysis can also help volunteers identify ways to improve the efficiency of the organisation or project. By understanding the different processes involved in a project or organisation, volunteers can identify opportunities to streamline operations and reduce waste.

Improving communication: system analysis can improve communication within an organisation or project. By understanding the relationships between the different components of the system, volunteers can identify opportunities to improve communication between team members, departments or stakeholders.

Developing better solutions: Systems analysis can help volunteers develop more effective solutions to problems. By understanding the system as a whole, volunteers can develop solutions that take into account the broader context and are more likely to be successful in the long term. Overall, systems analysis is an essential tool for volunteers who want to make a positive impact on the organisations and projects they are involved in. Through systems analysis, volunteers can gain a deeper understanding of the system as a whole and identify opportunities to improve effectiveness, communication and outcomes.

Technological trends

Technology has had a significant impact on sport and new trends have emerged that have changed the way people consume and participate in sport. The use of wearable technology is becoming increasingly popular among athletes, coaches and sports enthusiasts. Wearable technologies include devices such as fitness trackers, heart rate monitors and smart watches that help people monitor their physical activity and performance.

With the increase in sedentary lifestyles due to the use of technology as I have already outlined, new diseases related to lack of physical activity have emerged, such as obesity, diabetes and heart disease. The emergence of these diseases is often linked to the use of technology, for example, spending too much time sitting at a computer or playing video games. But technology has also created new ways for people to engage in physical activity, such as virtual reality sports games and fitness apps. With the rise of social media and digital platforms, sports fans now have access to live streaming of matches from anywhere in the world. In addition, wearable technology is being used to track athlete performance and prevent injuries. In addition, virtual and augmented reality is being incorporated into sports training to provide immersive experiences for athletes and enhance their skills.

Perhaps we should also not forget to mention current technological equipment in sports venues – such as automatic lawn mowers, robots for painting lines, robots for collecting balls, training robots in tennis. And it is also worth mentioning the introduction of robots into the game itself. The role of the volunteer, in this case, I would describe as that of a programmer and a person who effectively checks the functionality of the robot. Also, the question of the self-sufficiency of the sports club offers a solution to replace the old key lockers with automatic ones and by switching the subjectivity of the sports club, we also leave the already volunteer part-time hours in the premises, which are replaced by paid service. The self-sustaining sports club is becoming a phenomenon. Let us not forget that goodwill and the joy of movement, is an irreplaceable interpersonal fuel.

One of the key factors driving the growth of eSports is the development of new technologies. Thanks to the rise of streaming platforms such as Twitch and YouTube, it is easier than ever for fans to follow their favourite players and teams and get involved in their activities. Meanwhile, advances in gaming hardware and software have allowed games to become more immersive,

realistic and competitive, further fueling the growth of e-sports. As we move forward, it is essential to be aware of these trends and developments and their impact on the industry to ensure that sport continues to provide us with the physical, mental and emotional benefits we need.

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The Organisation of a Volleyball Major Sporting Event and the Impact of COVID-19 on Spectator Attendance

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Abstract

The origins of the Czech volleyball movement's ideas to organise the European Men's Volleyball Championships as the culmination of the celebration of 100 years of volleyball in the Czech Republic date back to 2015. After challenging discussions and negotiation of terms, the Czech Republic's hosting was confirmed by the signing of the organisational contract in 2019. At this point, the organisational preparations by both the CEV and the Czech Volleyball Federation began. The hosting of the entire European Championships was unconventionally divided between four co-organisers: the Czech Republic, Poland, Estonia and Finland. This fact in itself meant that it was necessary to set up a functional management system for the most important international volleyball event as a whole, with central organisational processes and partial management autonomy in the individual countries.

Keywords: management, sport, COVID-19, volleyball, organizing committee

Introduction

For the management and planning of a project of a given scope, a combination of traditional project management with waterfall management (Dvořák, Mareček 2017) was used from the initial moments, which were supplemented in the individual sub-areas of planning with elements of the classical Gantt chart. The choice of this method for sporting events of a similar type and scale seems to be an appropriate solution leading to successful project implementation. However, the actual management of the specific project took a completely different turn with the beginning of the coronavirus pandemic in March 2020, when all the set management processes were stopped or frozen from one day to the next due to the uncertainty of whether the project would be implemented at all. The period of uncertainty led, after the hibernation, to the restart of the processes in early 2021, but already with a change in the project management approach to a more agile approach, where the project was building as the pandemic evolved and changed. It was necessary to prepare not only the specific area managers for the change in project management,

but also all other people involved in the overall project output (support staff, volunteers, etc.). Improvising and adapting to the prevailing conditions, related external influences and constantly reacting to changes were the order of the day, which often led to complex situations that had to be addressed urgently in an operational manner, thus de facto approaching the often crisis-like approach to the successful delivery of the project (Tidd, Beasant 2009).

However, in the concurrence of all external and internal influences, the organizational group managed to fully implement the project with adequate spectator backdrop and parameters of an international sporting event with significant economic, social and sporting impact not only in the Czech Republic but also throughout Europe.

Major sport events during COVID-19 pandemic

The COVID-19 pandemic has had a significant impact on major sports events, and it is likely to continue to affect them in the future. Here are some of the ways that the pandemic may continue to impact major sports events:

1. Health and Safety Measures: The pandemic has led to the adoption of strict health and safety measures, such as regular testing, mask-wearing, and social distancing, which will likely continue to be enforced in the future. This will likely affect the number of fans that can attend events and the overall experience of attending major sports events.

2. Financial Impact: The pandemic has had a significant financial impact on sports events, with reduced revenues from ticket sales, broadcasting rights, and sponsorships. As a result, sports organizations may need to adopt new revenue models, such as pay-per-view or digital streaming, to recover lost revenue.

3. Rescheduling and Cancellations: The pandemic has led to the rescheduling and cancellation of many major sports events, and this may continue to happen in the future, depending on the course of the pandemic and the local health and safety guidelines.

4. Changes in Format: The pandemic has led to changes in the format of some sports events, such as the introduction of bubbles, the reduction of the number of games, and changes to the playoff format. These changes may continue in the future, depending on the course of the pandemic and the health and safety guidelines.

In summary, the COVID-19 pandemic has forced sports organizations to adapt to new health and safety guidelines, financial models, and changes in the format of sports events. These changes may continue to impact major sports events in the future, as the world continues to deal with the ongoing pandemic.

The COVID-19 pandemic has significantly impacted sport mega events, both in the present and the foreseeable future. The pandemic has disrupted schedules, resulted in event cancellations or postponements, and led to the implementation of stringent health and safety protocols. The

prognosis for the future of sport mega events remains uncertain as the world continues to navigate the evolving landscape of the pandemic.

One of the most significant impacts of the pandemic on sport mega events has been the disruption of schedules. Major events such as the Olympic Games, FIFA World Cup, and other global tournaments have been postponed or cancelled, resulting in financial losses for organizers, sponsors, and host cities. The postponement of the 2020 Tokyo Olympic Games to 2021 was a historic decision, and it required massive adjustments in terms of logistics, planning, and preparation. Similarly, other major sporting events have faced challenges in rescheduling and reorganizing, leading to uncertainties and logistical complexities.

EuroVolley 2021 – Ostrava in figures

During EuroVolley 2021 we conducted a survey among spectators who attended at least one match in Ostrava. A total of 152 respondents out of a total of 30,000 spectators took part in the survey, which is 0.5% of all spectators.

Important findings from the research:

- 56.6% of spectators come from the Moravian-Silesian Region or Ostrava,
- 18.4% of spectators visited tournament from another region of the Czech Republic,
- 25% of spectators came from other EU countries,
- 80% of the audience visited tournament more than 2 playing days,
- 63.8% used their own car for transport to the tournament,
- 34.9% of spectators spent more than one night in the region,
- the average expenditure per spectator on transport related to tournament was 852 CZK,
- the average expenditure per spectator on tournament (excluding transport) was 4,335 CZK,
- the total expenditure incurred by all spectators in attending EuroVolley was CZK 155,610,000.

Conclusion

Moreover, the implementation of stringent health and safety protocols has become a new norm in sport mega events during the pandemic. Measures such as testing, quarantines, bubble environments, and limited or no spectators have been enforced to minimize the spread of the virus. These protocols have added additional costs, complexities, and challenges for event organizers, teams, athletes, and spectators alike.

The financial impact of the pandemic on sport mega events has been significant. With reduced or no spectators, limited sponsorship revenues, and increased costs associated with health and safety protocols, many events have faced financial challenges. Smaller or less established events have struggled to survive, while larger events have had to re-evaluate their budgets and revenue

streams. The economic consequences of the pandemic are likely to be felt for years to come, and the recovery process may be slow and uncertain.

Looking ahead, the prognosis for the future of sport mega events remains uncertain. The trajectory of the pandemic, including the emergence of new variants and the effectiveness of vaccines, will play a crucial role in determining the return to normalcy for such events. While the resumption of events with full capacity crowds and pre-pandemic operations is the desired outcome, it may take time to achieve. Continued monitoring of the global health situation, advancements in medical science, and adherence to robust health and safety protocols will be critical in shaping the future of sport mega events.

In conclusion, the COVID-19 pandemic has had a significant impact on sport mega events, with disruptions in schedules, implementation of stringent health and safety protocols, and financial challenges. The prognosis for the future remains uncertain, and the recovery process may be slow and challenging. However, with continued vigilance, adaptability, and adherence to health and safety measures, sport mega events may gradually return to their pre-pandemic operations in the foreseeable future.

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Forecast of Development Trends in Sport – Year 2030

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Abstract

The paper discusses the intersection of sports and technology, focusing on trends related to globalization and technology in professional sports. Forecasting provides insights into how sports will develop up to 2030, identifying current trends and available data. The modern trends visible in sports are divided into three categories: globalization, technology, and performance. The paper focuses mainly on how globalization breaks national borders through sports and how sports contribute to climate change. It also examines how technology is being used to push the boundaries of human capabilities. The article explores the potential impact of technologies such as e-sports, artificial intelligence, data analytics, cryptocurrencies, blockchain, and virtual reality in sports. A result is several hypotheses that indicate the world of sports in 2030.

Keywords: sport, forecast, technologies, development, globalization, prognosis, climate change, professionalism

Introduction

Sport is nowadays one of the most prominent areas where the application of technological innovations can be seen on a practical level. Whether directly on the sports field, in television broadcasts, or training units, various methods are used to maximize the chances of victory, success, or viewing enjoyment. This is particularly true in the field of professional sports, which is the primary focus of this paper. Using the identification of current trends and available data, coupled with the author's academic orientation in the link between globalization and sport, this paper aims to provide a forecast of developments in sports up to 2030. The year is chosen as the reference one due to several factors, such as the long-term framework strategies of individual states or international organizations to adapt for the future. One of the most discussed examples is climate change strategies or the UN Sustainable Development Goals, which are known as the SDGs and fall under the 2030 Agenda.

Forecasting is a adequate tool with the potential to predict world events. However, with a description and, in particular, an understanding of the empirical experience to date, its

implementation is possible. For this reason, the presence of given trends in sports and their relevance for future developments will be demonstrated through empirical data. The modern trends visible in sports can be divided into three categories, which are related to globalization, technology, and performance. These parts of sports trends do not stand apart from each other and overlap. Their division is transferred for a more effective grasp of the activity under study. The paper focuses on the first two categories mentioned.

Globalization and sport

The focus of globalization is mostly at the breaking down of national borders through sport; nowadays, it is pretty standard for the majority of a professional football team in national leagues to be made up of foreigners. People in Asia or Africa have their favorite clubs in the English Premier League, or the most famous tennis players have their fans all over the world. Linked to this is the role of social media and television broadcasting, which are globally accessible, and viewers can enjoy real-time coverage from anywhere in the world. With this phenomenon of breaking down national boundaries within the sport, there is also a massive transfer of personnel and material resources.

Although world sport is a victim of climate change, it also contributes to it. Although no one has yet done a complete carbon study of global sport, Goldblatt says the industry's output is worth $5 billion to $6 billion a year, generating more transport than some other sectors of public life while accounting for about 0.6 percent to 0.8 percent of all global emissions. In addition to urging sporting institutions to achieve carbon zero over the next decade, he says the global sportswear industry needs to be more transparent about the carbon it produces and make a similar net-zero commitment. "The best sports franchises are making changes," Goldblatt said, "but we still need to convince others. What will it be like to play soccer outdoors in Africa ten years from now? It may not be possible." (Viola, 2021).

The sport also has a unique position in society because most consumers follow it with interest and desire, which creates a tendency to receive various campaigns and social phenomena more positively than from classical news or media. As the Deloitte report shows, the sport has contributed significantly to the visibility of the BLM movement or has helped to combat a global pandemic (Deloitte, 2021). However, the more critical aspect is the effort to fight climate change or adapt to its possible consequences. Despite the knowledge that the consequences of not taking environmental issues seriously enough could be catastrophic, responses to sport-related environmental problems still need to prove more vital, hollow, or half-hearted in many cases. The sports industry still prioritizes economic interests over environmental concerns (Wilson and Millington, 2020).

However, this is gradually beginning to change, as evident in the commitments and targets the major international sporting organizations set. The International Olympic Committee has

joined the 'Race to Zero,' which means that they, along with FIFA and F1, want to reduce their carbon footprint by 50% by 2030 (IOC, 2021). One of the most developed documents that set out sustainability goals and the transition to carbon-free events is produced by the International Association of Athletics Federations (WA), which has shown a commitment to becoming a leader among sports federations in hosting the highest level of sustainable events. It wants to become the most carbon-neutral organization by 2030, along with all events it will organize, and thus is currently being talked about as a decarbonization leader in sport (WA, 2020). Thus, based on an examination of these documents and commitments, the first hypothesis of this forecast is: "*More than 50% of the world's sporting events will be carbon neutral in 2030.*" If the climate crisis does not improve, by 2050, more than half of the 21 cities that have hosted the Winter Olympics will not have sufficient snow conditions to host the Winter Olympics again (Scott et al., 2017).

Technologies and sport

Technology in sports is closely related to pushing the boundaries of human capabilities. In the near future, we may create a world where humans are not the only primary competitors and may be replaced by robots or minimal, automated, computation-based decision-making. Significant challenges in this area include e-sports, artificial intelligence, data analytics, cryptocurrencies, and blockchain or virtual reality. All of these concepts are already well known and are starting to appear more and more in the world media, but their use is still, in some cases, only at a theoretical level. However, artificial intelligence and data analysis are almost necessary for every top athlete's training. Thanks to self-analysis or high-quality analysis of opponents, many athletes manage to break records, win trophies and maintain a high level in their sport.

The sports industry is experiencing rapid growth, and new technologies and data are becoming the new currency in sports (Ratten, 2019). The rise of data analytics is causing sports to acting as a test lab for new technologies (Michelman, 2019). According to experts, more than $2.5 billion was invested in global sports technology businesses in 2019, primarily in fitness, e-sports, and sports content creation (Penkert & Malhotra, 2019). The current value of the sports data analytics market is at $889 million in 2021, but early forecasts are for a value of $3.44 billion in 2028. In 7 years, the value is expected to nearly quadruple higher, indicating significant growth in this area (Research and Markets, 2021).

From the perspective of the fan, and therefore the target customer of the sports business, one of the critical factors in the next decade will be the active involvement of audience in sports. The first germs in this area are visible, for example, in the Formula E racing series, where there is a "Fanboost" option. This innovation allows fans to influence which drivers will have an additional performance during the race based on their votes. This means that a fan can actively contribute to the attractiveness of a race with his or her vote by favoring a driver (FIA, 2022). A similar example

is the American concept of Your Call Football, where fans in the app can choose what action their favorite team should play, or they can simultaneously guess what play the coach will choose and other advanced options that have the potential to glue the viewer to the TV screen (Matchar, 2019).

These technological innovations are contributing to more vital audience interaction, and, on this basis, it can be expected that this trend will be upward. Currently, 42% of virtual reality users see this technology as a form of watching sports, and with demand for VR increasing 16-fold in the last four years, the potential for this area is enormous (Petrov, 2022). The American NBA is one of the first professional leagues to offer virtual reality games (NBA, 2021). However, given the drastic increase in interest in virtual reality and the refinement of video footage, it can be expected that other sports leagues will be added in the coming years. This leads to another hypothesis: "*Virtual reality will be a common way of watching sports – every world sporting event from 2030 onwards will be watchable via virtual reality.*"

Another area of technology currently being increasingly mentioned is cryptocurrencies, which are based on the blockchain system. Blockchain technology will become the de facto solution for transactions between multiple parties. It will even lead to new business models where the short-term benefits of this model will outweigh the drastic changes that the sports industry will have to embrace, and blockchain is precisely why it is its future (Khaund, 2020). Blockchain technology is also being used to solve complicated broadcasting rights and licensing issues. The principle of blockchain is built on a smart contract that automates transactions and determines which entity receives the resource and how much it must pay. Transactions are recorded securely and accurately on the blockchain, potentially eliminating intermediary companies involved in such deals (Maryville, 2022).

Other potential uses of this technology include

- ticketing,
- more significant interaction with the club,
- selling and buying players,
- fans participating in the club's management, or
- betting directly through the blockchain system.

It is possible to find examples of all these possibilities that work, but in 2022 it cannot be said that this mediation technology will be prevalent in sports. The future will undoubtedly be influenced by blockchain, and many sports clubs/associations/organizations will head in this direction to determine the primary advantages and possible disadvantages. Given that this is a new segment whose impact will be more likely to mirror global developments in other areas, sports may react quickly and follow suit. However, based on data from the U.S., there is evidence that sports fans are twice as engaged with cryptocurrencies as people who are not interested in sports. The almost half report being knowledgeable about cryptocurrencies, and more than a quarter also have their portfolios (Silverman, 2021). For sports leagues and clubs, this may be

positive news for the future should they choose to implement various forms of blockchain use in their club management, and thus the final hypothesis of this paper is: "*The majority of revenue for professional sports clubs in the U.S. will be generated through blockchain technology by 2030.*"

Conclusion

This paper aims to highlight the trends in professional sports coming to the fore and their future, which will be mainly influenced by how the sporting environment begins to respond to them. The climate crisis is one of the significant challenges facing the world today, which is why the response of international sports organizations is crucial. The World Cup is the most watched event in the world globally and it is the responsibility of organizers to show the importance to tackle the biggest challenges of this century.

Another critical area is technology, which has developed exponentially over the last decades. Their role in sports is becoming increasingly crucial, whether from the perspective of athletes or fans. Athletes are beginning to use non-traditional holistic approaches in their training that integrate the mind, body, spirit, and soul connection. Personalized diets, neuro coaching, gene therapy, and sleep management will all be tools for future athletes (Mons, 2020). In the world of those mentioned above, virtual or augmented reality, the next decade will offer an unprecedented development of these technologies that may change how we watch sporting events forever.

Cryptocurrencies and blockchain systems are also increasingly entering the world of sports through sponsorship deals, player sales, or custom tokens. Their potential to democratise sport while bringing it closer to the end consumer, is unquestionable and it will also be interesting to see how sport adapts to these phenomena.

This paper is a partial summary of the author's master thesis on the future of professional sports and its trends until 2030.

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Aspects of Creating Sports Team Budgets in Times of Crisis

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Abstract

In my paper, I focused on the importance of crisis management for sports teams, especially budget changes in response to a crisis. It turns out that, just like other environments, the sports environment at various levels did not have elaborated and set up crisis mechanisms in case of a crisis of the scale of the COVID-19 pandemic. In my contribution, I would like to describe the reactions as well as the reactions and recommendations for creating budgets in the OECD environment, the Czech Republic and sports teams in general, as well as specific examples of the reactions of sports teams.

Keywords: Crisis, Crisis management, Manager, Budget, Sports Team Budgeting, Crisis plan

Introduction

Crisis management is relevant part of the management of institutions, companies, the state, but also the life of every individual. The main goal of crisis management is the prevention of accidental events that threaten normal functioning in any way. It can be about the functioning of the company (e.g. the current level of the price of fuel or high inflation). In general, crisis management is the coordination and management of resources to prepare for, mitigate, and respond to an emergency that may occur.

Crisis management is defined by Antušák (2016) as a set of specific approaches, methods and tools used by managers to ensure the functionality of the entity under the conditions of adverse effects caused by the escalation of threats of a certain type.

Sports teams budgeting is a crucial aspect of managing a successful team, regardless of the level of competition. Whether it is a professional team in a major league or a community team in a local tournament, every team needs to have a well-planned budget to ensure financial stability and growth.

Budgeting involves the process of estimating and allocating resources, including expenses and revenue, for a particular period. It is a comprehensive plan that considers all aspects of the team's operations, including player salaries, equipment, travel expenses, marketing, and other expenses.

Effective budgeting helps teams to make informed decisions, optimize their resources, and ultimately achieve their goals. In this era of increased competition, economic uncertainties, and changing market trends, sports teams must adopt sound budgeting practices to remain competitive and sustainable.

In the world of sports, crises can arise at any time and have a significant impact on the reputation and success of a team or organization. A crisis can be defined as an unexpected event that threatens to harm the interests, image, or operations of a sports organization. Examples of such crises include player scandals, fan violence, financial troubles, and even natural disasters.

Effective sports crisis management involves developing a comprehensive plan to prevent, respond to, and recover from a crisis. The goal of crisis management is to minimize the damage caused by the crisis, protect the organization's brand and reputation, and maintain the trust of stakeholders such as fans, sponsors, and media.

Effective crisis management requires a well-trained crisis management team, clear communication, and a proactive approach to identifying and addressing potential risks. In today's fast-paced, 24/7 news cycle, sports organizations must be prepared to handle crises quickly and effectively to minimize the impact on their brand and operations.

OECD Crisis Budget Reactions

The Organization for Economic Co-operation and Development (OECD) has been at the forefront in providing policy guidance and recommendations to its member countries. The OECD has played a key role in ensuring that government policies are aimed at mitigating the impact of the pandemic on the economy, and promoting a sustainable and inclusive recovery. In this chapter, let me analyze the budget reactions of the OECD member countries to the crisis.

The COVID-19 pandemic has had a significant impact on government finances, as countries have had to increase their spending to address the pandemic's health and economic impacts. In response to the crisis, the OECD has called on governments to take a multi-pronged approach to mitigate the crisis's impact on the economy. The OECD has recommended that governments increase their spending on healthcare, social protection, and education, while also promoting investment in infrastructure and green technology to promote inclusive and sustainable economic growth.

In terms of government spending, the OECD has recommended that countries increase their investment in healthcare to ensure that healthcare systems are adequately equipped to respond to the pandemic's health impacts. The OECD has also recommended that countries invest in social protection measures such as unemployment benefits, wage subsidies, and cash transfers to support household consumption and help mitigate the impact of the economic downturn. The OECD has also stressed the importance of investing in education and training to ensure that people are equipped with the necessary skills to transition to new sectors and adapt to changes in the labor market.

The OECD has also called for investment in infrastructure and green technology to promote sustainable economic growth. Infrastructure investment can help boost economic activity, especially in sectors such as construction, and can create jobs. Green infrastructure investment can also promote the transition towards a more sustainable, low-carbon economy. The OECD has recommended that countries prioritize investments in renewable energy, clean transportation, and energy efficiency to promote a sustainable recovery.

In terms of government revenue, the OECD has recommended that countries adopt progressive taxation measures to ensure that the burden of the crisis is shared equitably among all citizens. This could include measures such as wealth taxes, corporate taxation, and digital taxes. The OECD has also stressed the importance of international cooperation, with countries working together to ensure that there is a coordinated response to the crisis.

In conclusion, the COVID-19 pandemic has had a significant impact on the world economy, and governments have had to take measures to mitigate the crisis's impact. The OECD has played a key role in providing policy guidance and recommendations to its member countries, and these have been aimed at promoting a sustainable and inclusive recovery. The OECD has emphasized the importance of investment in healthcare, social protection, education, and infrastructure, while also promoting sustainable economic growth through green technology. The OECD has also called for progressive taxation measures to ensure that the burden of the crisis is shared equitably among all citizens. Going forward, international cooperation will be essential to ensure that countries can work together to combat the ongoing impact of the pandemic.

Czech Government Budget Reactions

The Czech Republic is no stranger to budget crises, having faced several in recent years. A budget crisis occurs when the government's revenue is not enough to cover its expenses, resulting in a budget deficit. This deficit can lead to a range of problems, including inflation, debt, and economic instability.

To manage budget crises, the Czech government employs several strategies. One of the most common is austerity measures, which involve cutting government spending to reduce the budget deficit. These measures can include reducing public sector wages, pensions, and social benefits, as well as cutting funding for public services like healthcare and education.

Another strategy is to increase revenue by implementing new taxes or raising existing ones. However, this approach can be challenging in the Czech Republic, where the government has a history of struggling to collect taxes effectively. Additionally, raising taxes can be politically unpopular and may lead to protests or unrest.

In some cases, the Czech government has turned to external sources of funding to manage budget crises. For example, it has received loans from international organizations like the International

Monetary Fund (IMF) to help stabilize the economy. However, these loans often come with conditions attached, such as implementing structural reforms or reducing government spending.

Overall, managing budget crises in the Czech Republic is a challenging task that requires careful balancing of competing interests. The government must prioritize fiscal responsibility while also meeting the needs of its citizens and maintaining social stability. This requires a nuanced approach that involves a range of strategies, including austerity measures, tax increases, and external funding. Ultimately, the key to successful budget crisis management in the Czech Republic is a combination of careful planning, effective communication, and decisive action.

Sports teams Crisis Budgeting

Crisis budgeting is a critical aspect of financial management for sports teams. A crisis can occur in several forms, including economic downturns, natural disasters, player injuries, or pandemics, among others. During these times, sports teams may face significant revenue losses, increased expenses, and other financial challenges that require effective crisis budgeting strategies. Here are some key aspects of crisis budgeting for sports teams:

- Forecasting and Scenario Planning: The first step in crisis budgeting is to develop a detailed forecast of the financial impact of the crisis. This requires a thorough analysis of the team's revenue streams, including ticket sales, sponsorship, merchandise, and other sources of income. Teams should also develop different scenarios based on best-case and worst-case scenarios to determine how much they need to cut expenses or generate additional revenue.

- Contingency Plans: Teams should develop contingency plans for different scenarios, outlining the specific steps they will take to cut costs and generate revenue. For example, they may consider reducing player salaries, renegotiating contracts with sponsors, or implementing new marketing initiatives.

- Communication: Effective communication is critical during a crisis. Teams should communicate their contingency plans to all stakeholders, including players, coaches, sponsors, and fans. This can help to build trust and confidence in the team's ability to manage the crisis.

- Cash Flow Management: During a crisis, cash flow management becomes critical. Teams should carefully monitor their cash flow and prioritize payments to ensure they can continue to operate. This may involve delaying payments or negotiating payment terms with suppliers.

- Innovation: Crisis situations can also provide opportunities for innovation. Teams may need to explore new revenue streams or develop new business models to adapt to the changing landscape. For example, they may consider offering virtual events or developing new merchandise lines.

In conclusion, crisis budgeting is a critical aspect of financial management for sports teams. By forecasting and scenario planning, developing contingency plans, effective communication, cash flow management, and innovation, sports teams can successfully manage crises and emerge stronger on the other side.

Examples of Crisis Strategies

There are several concrete examples of crisis strategies employed by sports teams to manage unexpected events and financial challenges. Here are some notable examples:

- Manchester United's Sponsorship Deals: In 2013, Manchester United faced a financial crisis due to a lack of on-field success and poor commercial deals. To address the crisis, the team renegotiated its sponsorship deals with Adidas and Chevrolet, securing long-term contracts worth millions of dollars. This helped the team to stabilize its finances and regain its position as one of the world's top sports brands.

- The NBA's Bubble Experiment: In 2020, the COVID-19 pandemic forced the NBA to suspend its season. To resume play, the league developed a "bubble" concept in Orlando, Florida, where teams were isolated from the outside world to prevent the spread of the virus. This innovative approach allowed the NBA to complete its season and protect its revenue streams, including broadcasting and advertising deals.

- FC Barcelona's Salary Reductions: In 2020, FC Barcelona faced a financial crisis due to a decline in revenue caused by the COVID-19 pandemic. To address the crisis, the team negotiated salary reductions with its players, cutting their wages by up to 70%. This helped the team to reduce its expenses and maintain its financial stability during a challenging time.

- The NFL's Social Justice Initiatives: In response to the Black Lives Matter movement and widespread protests against police brutality in 2020, the NFL launched a series of social justice initiatives, including a $250 million fund to support social justice causes. This move helped the league to address a crisis of public perception and rebuild its relationship with fans and players.

These examples highlight the importance of crisis management in sports and the range of strategies that teams can employ to address unexpected events and financial challenges. From renegotiating sponsorship deals and salary reductions to innovative concepts and social justice initiatives, sports teams can adapt and innovate to emerge stronger from a crisis.

Conclusion

In conclusion, sports crisis strategies are crucial for any sports organization looking to mitigate the damage caused by unexpected events that threaten their operations, image, and reputation.

Effective crisis management involves developing a comprehensive plan that identifies potential risks, establishes a crisis management team, and outlines a clear communication strategy. This

approach allows organizations to respond quickly and effectively to crises, minimize the damage caused, and maintain the trust of stakeholders such as fans, sponsors, and media.

Ultimately, sports organizations that invest in crisis management strategies are better equipped to navigate unexpected events, protect their brand and reputation, and emerge stronger from the crisis.

In conclusion, crisis budget reactions are critical for any organization facing unexpected events that threaten their financial stability. Effective crisis budget reactions involve developing a comprehensive plan that outlines potential risks, identifies areas where cost-cutting measures can be implemented, and establishes a clear communication strategy with stakeholders.

This approach allows organizations to respond quickly and effectively to crises, minimize the financial impact, and maintain their long-term viability. It is important to note that crisis budget reactions should not be a one-time event, but rather an ongoing process of monitoring and adjusting the budget based on changing circumstances.

Organizations that invest in crisis budget reactions are better equipped to weather unexpected events, emerge stronger from the crisis, and position themselves for long-term success.

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New Technological Trend: Turbulent Cryptocurrencies and Sport

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Abstract

The article deals with new segment in the financial market: cryptocurrencies and their application. In the introductory part the current turbulent situation is analysed. Examples and system considerations in the segment of sport are presented in the second part. Final concluding analyses are predicting three scenarios of future development.

Keywords: cryptocurrencies, sport, forecast

Introduction

The global development of cryptocurrencies in the first half of 2021 demonstrated a turbulent pendulum motion, as selected significant pieces of information from public sources denote:

The Central American state of Salvador, with its approx. 6.5 million inhabitants, is the first country worldwide, in which the most famous cryptocurrency Bitcoin was recognised as the legal means of payment. According to Reuters, President Nayib Bukele's proposal was given consent by Parliament. The members of Parliament approved the cryptocurrency while being aware of the fact that their decision might affect the negotiations with the International Monetary Fund (IMF) concerning the development aid. President Bukele claims that the acceptance of bitcoin will enable the Salvadorans living abroad to send payments to their homeland. The economy of Salvador is rather dependent on the flow of money from abroad; these payments represent 22 per cent of the country's gross domestic product, as AFP states.

The president predicts "job creation and helping financially integrate thousands of people into the legal economy because according to him, "70 per cent of the population does not have a bank account and works illegally," as Bukele himself wrote on Twitter. The president expects an influx of investment into the country and publicly promises millions of new users of the cryptocurrency. President Nayib Bukele boldly claims that the use of Bitcoin does not mean any risk and that citizens and companies that would use Bitcoin do not take risks. "The government will guarantee the conversion to the exact value in dollars at the time of each transaction," the president said

on the social network. According to independent analysts, it is the mere political marketing of Salvador President Nayib Bukele, who has made himself and Salvador visible in this way, but practically nothing has changed. The Statutory Representative of the Central Bank of El Salvador reassured the public that the commonly used US dollar remained the de facto number one currency.

China's central bank regulates cryptocurrency trading and has ordered domestic banks to cut off OTC cryptographers' funding channels.

The People's Bank of China (PBoC) issued a statement on Monday stating that it had recently convened a meeting with several domestic banks and mobile payment service providers. These included the Industrial and Commercial Bank of China (ICBC), the Agricultural Bank of China (ABC), the Construction Bank of China (CBC), the Postal Savings Bank of China, the Industrial Bank and also AliPay's mobile payment applications. The PBoC said that speculative activity around the cryptocurrency trade seriously upset the balance of China's financial system and created a risk of illegal cross-border capital outflows and money laundering. It reiterated its 2017 position that no financial institutions should provide banking and settlement services for cryptocurrency transactions.

Amber Group has raised $100 million to expand its cryptocurrency trading platform, and another cryptocurrency company that has received massive investment from venture capital giants is Hong Kong's cryptocurrency trading startup Amber Group.

For the time being, Company China Renaissance has been considered the leader and a number of major financial hedge funds have co-financed. These included Tiger Brokers, Tiger Global Management, Arena Holdings, Tru Arrow Partners, Sky9 Capital, DCM Ventures and Gobi Partners. Coinbase Ventures was one of the first investors in 2019.

Iran bans blockchain association with reference to violations and Iranian Interior Ministry suspends Iranian blockchain association for alleged violations of government regulations and alleged violation of its own statutes, as reports the Financial Tribune. Hamshahri Online reported that the IBA had been ordered to submit to the government detailed financial reports that would reveal more about its cryptocurrency stock exchange trades. Iranian President Hasan Ruhan said at a cabinet meeting that strong regulation of cryptographic services was needed to "preserve and protect national interests." Iran banned cryptocurrency mining last month after the energy-intensive process was accused of a series of power outages in several cities. The ban will remain in force until the end of September 2021.

The British Office of Financial Ethics has restricted the activities of the world's largest cryptocurrency stock exchange Binance. He also warned against advertising that promises high profits from investments in cryptocurrencies and similar assets. In recent weeks, there have been a number of interventions in the virtual world of cryptocurrencies; for example, the Chinese authorities banned their mining. The FCA regulator banned Binance Markets' regulated activities

and warned against the entire Binance Group. In 2021, the FCA published a statement that many companies trading in cryptocurrencies did not comply with British anti-money laundering and anti-terrorist financing rules. As of May 12, 2021, the office allowed the registration of five companies. Another 90 companies have obtained temporary registration, which allows them to operate even when the regulator is evaluating the procedures of companies. Bloomberg reported that Binance was of interest to representatives of the US Department of Justice and the IRS, which deals with money laundering and tax offenses. The German Financial Supervisory Authority (BaFin) warned in April that the cryptocurrency exchange could be fined if it offered digital tokens without a prospectus. A Japanese regulator said on Friday that Binance was operating illegally in the country.

Transactions with cryptocurrencies are also limited by India and Turkey, and concerns about the use of cryptocurrencies have previously been expressed by US Treasury Secretary Janet Yellen and European Central Bank President Christine Lagarde. Most often, they fear that transactions in cryptocurrencies are anonymous and can easily be used for money laundering or terrorist financing.

Tax issues are rather interesting. According to an analysis by Bitstock.com, in the first four months of the year of 2021, Czech citizens bought for about three billion crowns. That is three times more year-on-year. As for the sale of cryptocurrency, it is a question of what methodology to use to calculate the tax. "In practice, the real price is the acquisition price. For tax purposes, the arithmetic average of the acquisition prices is used, or the FIFO method is used, where the difference between the price at the first purchase and the price at the sale is taxed." Assuming that the tax office does not detect the sale of cryptocurrencies is, according to tax experts, incorrect. Today, financial authorities in the Czech Republic know the bank accounts of all cryptocurrency exchanges and operators of exchange platforms and very easily identify financial transactions with cryptocurrencies.

The 2020 Forecast

The forecasts made by linear models (their application ten years ago in 2010 almost flawlessly predicted the development of the social network Facebook in the next decade) in 2020 are interesting, but less usable in practice. It is possible to forecast the development of selected 2 currently most important cryptocurrencies from June 2020: As mentioned, although linear mathematical models do not identify discontinuities (e.g. pyramidal games), they provide interesting stimuli for cryptocurrency price development – Bitcoin and Ethereum. The price for all cryptocurrencies is in US dollars. Input data were taken at monthly intervals from the coinmarketcap.com website, the latest records are from February 2020.

The development of cryptocurrency prices is different for each cryptocurrency for several reasons: Each cryptocurrency provides a different interest for the users and they make use of it more or less; the technological progress is also different for each cryptocurrency; some

cryptocurrencies have different restrictions and regulations in some countries, etc. For each cryptocurrency, a phenomenon called the financial bubble occurs. This means that every time the price of a cryptocurrency significantly rises, the price then rapidly falls. As these are decentralized currencies, it is not possible to say precisely why this phenomenon occurs. One variant has it that this is a random phenomenon, the other that influential investors, who heavily invest in cryptocurrencies, may cause these fluctuations. The most famous financial bubble occurred in 2018, when this phenomenon affected most of the then known cryptocurrencies. This fluctuation, which has occurred with most cryptocurrencies so far, has never been explained and, given the decentralization of currencies, is highly unlikely to be ever uncovered.

Bitcoin: Price Development

Bitcoin is the oldest cryptocurrency, which originated in 2009. The input data available from May 2013 to February 2020 were used, i.e. a total of 82 observations.

Graph No. 1 shows the development of the price of bitcoin over time. The chart shows that the price of Bitcoin was very low in the first years (around $100) without major fluctuations. The first slight fluctuation came at the turn of 2013 and 2014, when the price climbed to $1,000. After this fluctuation, the price returned to around $200. The rapid price increase in 2013 was caused by trades that could take place at that time – the purchase of Lamborghini, space flights, etc. The fall in the price in 2014 was caused by the collapse of the largest existing exchange, Mt.Gox, which managed three quarters of the bitcoin trade.

The currency experienced large fluctuations in 2017, when the price gradually increased and in January 2018 reached its maximum of over $13,000 (note: Data are always from the beginning of the month, during the month the maximum price was around $19,000). The sudden increase in the price in 2017 may have been due, among other things, to greater popularity, as in 2016 a real awareness of Bitcoin began. After this rapid leap, the price of bitcoin gradually decreased again, part of Bitcoin was separated into Bitcoin Cash and part of the users switched to this cryptocurrency.

It did not exceed the $10,000 mark again until July 2019. That year, Bitcoin started the improvements: Bitcoin worked on its technical side, simplified the programming language, worked on better hardware wallet security, and generally tried to accommodate itself more for normal users.

From such a development of the price we can see that Bitcoin has already experienced three financial bubbles – in 2014, 2017 and 2019. From the way the price develops at the beginning of this year, it can be estimated that another financial bubble is to occur this year.
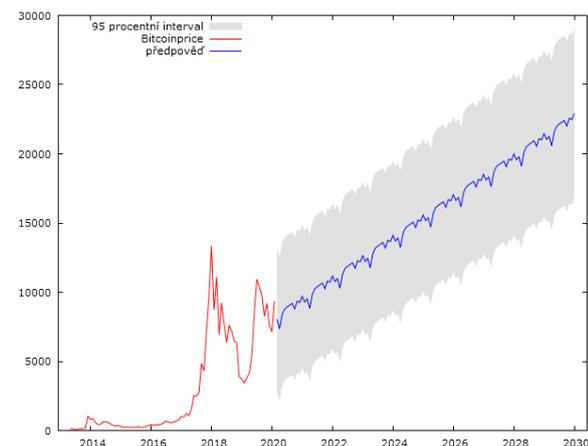
Graph 1: Bitcoin Price Development
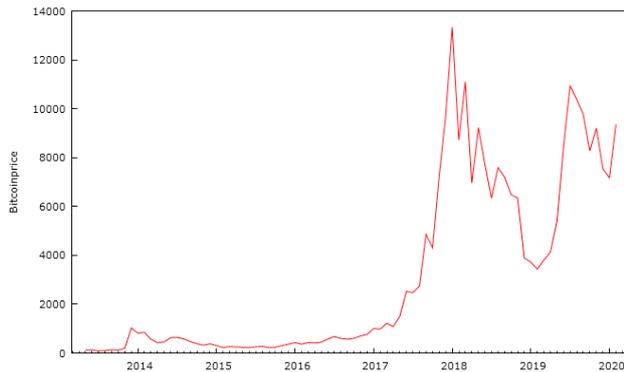
Source: Muchová Lenka master thesis *Crisis Management in the Segment of Cryptocurrencies and Sport*, ČVUT 2022

Bitcoin: Price Development Forecast

The figure below shows a graph of Bitcoin price development until 2030. The red curve shows the actual price development from May 2013 to February 2020. The price development curve until 2030 is shown in blue. As it is a linear model, it assumes a constant rise in price with possible fluctuations and it can be seen from the graph that in 2030 the expected price of Bitcoin is around 27.5 thousand US dollars. One should note that this is only a prediction that works with available data that are highly unstable. Furthermore, neither is it possible to predict whether there will be government restrictions in other countries, nor to predict other factors influencing the price of Bitcoin. The grey area shows the 95 per cent confidence interval. This is the area in which the price of Bitcoin should fluctuate due to other factors.

If we stick to the prediction (blue curve), it is clear that the maximum price of Bitcoin, which has been so far, will be humbled around 2024, when the price will attack the $15,000 mark. Six years later, the price will be higher by another $10,000. The closest price development shows that the price of Bitcoin will fall in the following months. According to available reports at the time of writing, this fact was confirmed and the price of Bitcoin in March and April really decreased (as seen at the beginning of April 2020, the value of Bitcoin was about $6,650.)

Graph 2: Bitcoin Price Development Forecast

Source: Muchová Lenka master thesis *Crisis Management in the Segment of Cryptocurrencies and Sport*, ČVUT 2022

Ethereum: Price Development

The first available Ethereum price data come from August 2015. There is only a small set of data for forecasting, namely 55 input data up to February 2020.

The red line again shows the development of the price. Until the first half of 2017, the price of Ethereum is in the order of units of dollars. In 2016, Ethereum suffered an affair with an attack on the cryptocurrency The DAO. It can be seen from the graph that at this time Ethereum was not yet of such a high value that this affair and the subsequent disintegration of Ethereum into two different cryptocurrencies would affect it more significantly.

The price increase did not occur until the first half of 2017, when the price rose to over $200. At this time, the ICO project was running, which had its peak phase in the summer of 2017, and billions of crowns were raised for projects within the ICO.

It peaked at the beginning of 2018, when the price of Ethereum was over $1,000. Since then, the price of Ethereum has been declining and has not risen significantly. In February 2020, the price of Ethereum was again below $200.

In connection with Ethereum, we can see one significant financial bubble, which took place in 2018, when the price of Ethereum exceeded the $1,000 mark and then fell sharply.

Graph 3: Ethereum Price Development
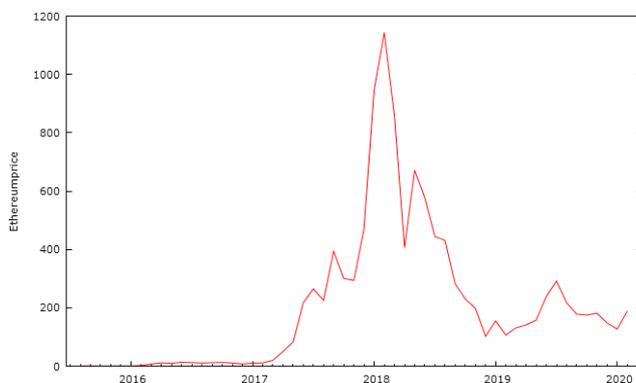
Source: Muchová Lenka master thesis *Crisis Management in the Segment of Cryptocurrencies and Sport*, ČVUT 2022

Ethereum: Price Development Forecast

The forecast of the price development is marked in blue in Graph 4. The low number of input data and at the same time a large fluctuation in prices were also reflected in the forecast. The graph demonstrates a repeated trend of price fluctuations with a constant slight increase. Currently, the price of Ethereum is around 200 US dollars. In ten years, according to this forecast, the price will increase fivefold and will be around a thousand dollars. The limit, which was exceeded in 2018, will no longer occur, unless the currency is within the upper limits of the confidence interval.

The grey zone shows the confidence interval. According to this area, it is clear that the price of Ethereum can range from tens of dollars to less than two thousand US dollars. In recent months,

the price of Ethereum has remained stable, so it can be assumed that in the near future the price will start to rise.

Graph 4: Ethereum Price Development Forecast

Source: Muchová Lenka master thesis *Crisis Management in the Segment of Cryptocurrencies and Sport*, ČVUT 2022
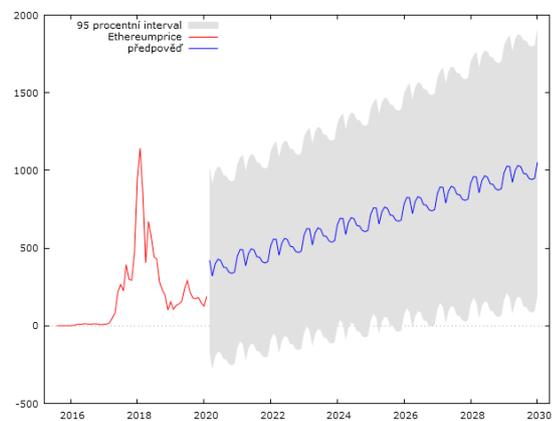
Cryptocurrencies and Sports

The sports industry and sports teams and organizations have also responded to the transfer of many industries to the online space. This shift to accept cryptocurrencies is still evolving, but has already been happening for a longer time in some clubs.

One of the NBA teams, Sacramento Kings, has been accepting Bitcoins since 2014, as a way to pay for tickets and goods. The club was probably a pioneer in this area, and since then many sports teams and organizations have begun to use cryptocurrencies as a modern tool that can make e-commerce easier for their fans and customers.

Famous clubs such as Juventus and Paris Saint Germaine have joined the blockchain-based Socios fan platform. The platform allows participating teams to run their own fan tokens, which can then be used by fans on the platform. Fans can then use their tokens to vote on things, such as club jersey changes, and access exclusive content. There are two types of electoral mechanisms on the Socios platform - binding and non-binding. A binding vote means that the club must accept the result of the vote, while non-binding one can only work on the basis of recommendation.

So if fans vote to change the colour of the jersey, the club will have to keep its promise. Because voices are performed on the blockchain platform, they cannot be manipulated or deleted. This is an interesting use of blockchain and the fact that such famous clubs have decided to get involved is a great support for this industry. Another example of the football environment is the Portuguese Club Benfica, which began receiving cryptocurrency payments for goods and tickets through the Utrust platform in June 2019. This step was mainly due to meeting the requirements of more than seven million fans on social networks. Cryptocurrencies and blockchain-based projects are supported by, among others, Barcelona star Lionel Messi. (Jenkinson, 2019, online)

Betting companies are becoming major sponsors of many sports clubs and are building their own cryptocurrencies, as shown by the example of the California company CashBet, which came to the market with the cryptocurrency CashBet Coin. Arsenal entered into cooperation with this company in 2019.

Another Premier League club, Wolverhampton Wanderers, has an advertising deal with the CoinDeal cryptocurrency exchange. Their logo appeared on the team's jersey during the 2018 - 2019 season and the cooperation continues.

There was also a stir in 2018 over eToro's advertising partnership with seven Premier League clubs, which was paid in full by Bitcoin. The campaign also included the launch of the eToro FC program, which provided community members with educational materials, tutorials and market reports.

In 2019, "crypto ads" were also recorded in the NBA, when, for example, the logo of the UnitedCoin cryptocurrency appeared on Cleveland Cavaliers jerseys. (Jenkinson, 2019, online). Thanks to their growing popularity, cryptocurrencies are also increasingly affecting sports, and their untapped potential is thus increasingly influencing the business strategies of large sports teams. They use blockchain technology, for example, to interact with their fans, and the first transfers of athletes for virtual currencies have already taken place. The trend in this direction is currently set mainly by football clubs.

As mentioned above, in 2014, the American Sacramento Kings basketball team began accepting payments for tickets at Bitcoins; at present, the direct involvement of sports teams in the cryptocurrency market and in blockchain technology is the norm.

More and more sports teams, as most recently, for example, Benfica Lisbon (in partnership with the Utrust platform), are beginning to accept cryptocurrency payments, and the next step is the actual use of virtual currencies by them.

In 2018, two Turkish clubs from the lower league agreed to transfer the player for 0.0524 Bitcoin and 2500 Turkish lira. Soon, the time may approach when it will start to transfer in this way for many times higher amounts, even at the highest level.

An example of the use of blockchain in sports is the Socios platform, which enables direct interaction with fans, in which several well-known European football clubs are already involved - Juventus Turin, Paris Saint-Germain, AS Roma or London's West Ham. Socios allows teams to issue their own digital tokens (some of which can also be purchased directly on cryptocurrency exchanges), which allow fans to vote on club events, as stated above.

In addition, users of the platform also receive access to exclusive promotions and goods. Socios is expanding and Chiliz, to which the platform belongs, is entering into a strategic partnership with the large Binance cryptocurrency exchange in May. According to Socios CEO Alex Dreyfus, Chief Executive Officer, sport is watched by 3/5 producers and has such a large poential, which has been so far largely insufficiently made use of, i.e. the potential in terms of

cryptocurrencies. In addition to football, the platform has not only established cooperation with e-sports organizations such as NAVI, OG or Alliance, but also, for example, it recently concluded agreements with the UFC and MMA.

The growing popularity of cryptocurrencies among sports teams is also reflected in the establishment of cooperation in the field of marketing and advertising. For example, in 2018, London's Arsenal signed an advertising contract with the American company CashBet, which specializes in sports betting in cryptocurrencies and which became its exclusive and official blockchain partner. The agreement was designed to support the newly launched CashBet coin – a home cryptocurrency specifically designed for use on their online gambling platforms.

Another English league club already mentioned above, Wolverhampton Wanderers, is cooperating with the CoinDeal stock exchange, whose logo the team wore on their jerseys last season. EToro has signed sponsorship agreements with seven Premier League teams (Newcastle, Tottenham Hotspur, Brighton, Cardiff, Crystal Palace, Leicester City and Southampton). These contracts were paid in full at Bitcoins. As part of the agreement, the eToro brand appears on billboards or banners on the field and other media. In the USA, cryptocurrencies are promoted, for example, by the Cleveland Cavaliers basketball team (a contract with the UnitedCoin Stock Exchange) or by the American football team Miami Dolphins, making contract with Litecoin, which then became the official cryptocurrency of the team.

Conclusions

Insufficient stability of the analyzed segment will require organizational measures not only in the sports industry, including the deferral of part of the profit from the cryptocurrencies, as reserves for the possibility of an emergency situation in the event of future fluctuations in their price level and other crisis scenarios.

From a general point of view, cryptocurrencies represent a completely new phenomenon, currently moving (2021) along the trajectory of an exponential curve, which gradually changes into a logistic curve. The total number of cryptocurrencies exceeds 2000. Overall, we can divide the attitude of central banks towards them into three categories. The first category includes central banks, which have banned cryptocurrencies in various forms. The second category covers the countries where there are certain regulations and corrections of transactions with cryptocurrencies. Central banks in these countries usually do not consider cryptocurrencies to be real money and treat them as risky assets. These banks include the Czech CNB, which regulates large cryptocurrency transactions. The last category consists of those central banks that are contemplating entering cryptocurrency markets and creating their own national cryptocurrencies, which would then replace the existing national currency in the future. Central banks that are considering this option include Sweden (with the cryptocurrency e-krone). The European Central Bank (ECB) has already dealt with cryptocurrencies, maintaining that national cryptocurrencies will come into existence. The

ECB is working on a system that would preserve the anonymity of users in small transactions, while concerning larger transactions the Bank is working on a system of control and security that would safeguard the transactions for users and thus reduce the risk of attacks.

Another important aspect is ecology. The popularity of Bitcoin cryptocurrency is growing, so is its price, as well as its demand for electricity. Bitcoin mining currently consumes about 121.36 terawatt hours per year, a fourfold increase over the consumption in 2017 and more than the annual electricity consumption of a country as large as Argentina.

Therefore, if we take into account that one Bitcoin now costs about a million crowns, it makes sense for miners to invest funds at a maximum price of 6.25 million crowns in ten minutes. Because the reward is halved every four years, the price of Bitcoin would have to double in that time in order to maintain energy intensity. The forecast from the scientific journal Nature Climate Change is very interesting as it states that Bitcoin use emitted 69 million metric tons of carbon dioxide in 2017, and a warning appeared that in 2033 emissions might cause the planet to get warmer by two degrees Celsius.

Another new phenomenon will be the expansion and commercial use of quantum computers, which with their virtually infinite speed will allow the decryption of all systems used so far.

For these and many other reasons, it is quite evident that the phenomenon of cryptocurrencies will require substantial changes throughout the legislative and economic systems.

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A cryptocurrency token is a digital asset that can be used in a project. Tokens, unlike cryptocurrencies, need a foreign blockchain through which they can function. One type is a utility token, which is created for use within a decentralized application. In general, however, tokens can also be used for payments. (Tradearena, online)

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The Use of Elements of Artificial Intelligence in Contemporary Military Unmanned Aviation

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Abstract

This contribution analyzes the possibilities of using artificial intelligence (hereinafter referred to as AI) in connection with unmanned systems, which are currently one of the most dynamically developing segments of military and civil aviation. The use of AI in unmanned operation is an obvious milestone in the development of unmanned systems. The current use of AI will be analyzed, especially as one of the means of production and development, training, evaluation and data collection, and last but not least also as the primary control system of the operational flights themselves.

Keywords: artificial intelligence, aviation, unmanned systems

Introduction

AI is such a fundamental topic that it has become a priority for many states, including the European Union. Already today, AI is a part of our lives without even knowing it. It is very often used in the so-called Internet of Things, where it mainly performs analytical functions. However, with very small steps, it also reaches, for example, motoring, where it has already proven its strengths and limits. The absolute use of the potential of AI requires enormous demands on the hardware of the given system. This is currently one of the most limiting factors for several reasons. Currently, new materials are being sought that could provide AI with the possibility of using its potential to the required level. This is also connected to miniaturization, which is necessary for the operation of these systems in practical life. With regard to the current political-economic state of our society, production on a massive scale is very complicated. The reason is not only the lack of electrotechnical material, e.g. chips, but also the lack of will to actively solve this issue. Another factor influencing the faster development of these technologies is their energy intensity, which currently also does not help the positive perception of society.

The last and probably the most important factor influencing the faster implementation of these technologies in practical use is security. Humanity must find a way to use AI technology for the benefit of the given cause, without jeopardizing the safety of not only the operation for which

this system was intended, but also for humanity itself. This theme is richly represented across the entire spectrum of science fiction, and so it also entered the general subconscious of most people. However, the truth remains that inviolable rules must be established for AI, the violation of which must mean immediate determination for the given system.

Artificial intelligence in unmanned aviation

Currently, it is common for unmanned systems to have AI elements, but usually only to a limited extent. First of all, it is used in dangerous airspace, where there is a risk of the plane being shot down. In the event of the downing of an unmanned vehicle, the lives of very expensively trained personnel are not lost.

The limits themselves speak for unmanned systems. All machines are only as strong as their weakest link, and in the case of manned flights, that is without a doubt the pilot. An unmanned vehicle is not limited by the limits of a pilot. For aircraft of all categories, one of the most limiting factors is the maximum take-off weight, which is directly related to the amount of sensors, weapons and fuel carried.[1] When using an unmanned vehicle, the aircraft's systems are lighter on the pilot, the associated controls and especially on the life support systems. When all is added up, the resulting weight savings can be used for the purposes listed above.

Development and production of unmanned systems using artificial intelligence

Artificial intelligence has for a long time played an irreplaceable role in the development of a whole range of fields, and aviation is no exception. Precisely in the development of aircraft parts and aggregates, absolute precision is necessary for the sake of operational safety. In order to achieve it, sophisticated software applications using AI are used.

If we are going to deal with the construction of unmanned systems, even a complete layman can notice a trend that is especially evident in the hulls of modern unmanned aircraft in the last decade. Each weight category of unmanned vehicles has its own specifics, which are particularly evident in the shape of the hulls. Airplanes with a take-off weight of 5,000 kg will have other shapes (picture no. 1). The shape of the fuselage and wings are based on aerodynamic models that were verified by simulations thanks to AI that was able to perform complex calculations depending on the performance of the aircraft and the surrounding environment. Although modern systems differ only minimally in shape, each of them has certain specificities. This fact is precisely due to the specific requirements for different types and types of unmanned vehicles. Any slight change in the aircraft's electrical installation, or changes in weight distribution, would have fatal consequences. AI is also used here, which, thanks to the specified specifications, corrects the aerodynamic shapes of the aircraft, so that their operation is safe and efficient at the same time.[2]

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1 Masutti, A. & Tomasello, F. (2018). *International Regulation of Non-Military Drones*. Cheltenham: Edward Elgar Publishing.

2 Boyle, M.J. (2020). *The Drone Age: How Technology Will Change War And Peace*. New York: Oxford University Press.

Figure 1: MQ-9 Reaper

Source: MQ-9 Reaper, 2022. In: Military.com [online]. USA: Military.com Network, 2022.

It is similar for other components of the unmanned aircraft. A purely reconnaissance vehicle will have other needs, while another will have a vehicle carrying some kind of weapons platform.[3] Although it does not seem like much to the layman's eye, in aviation every detail is decisive.

Staff training using artificial intelligence

Currently, all established unmanned systems of higher weight categories work in the so-called RPAS mode. The term literally means remotely piloted aerial system. It would be a mistake to think that, according to the current legislation, it is possible to move an unmanned vehicle in the common airspace without pilot control, even remotely. Of course, UAS using AI for fully autonomous flight exist, but only as part of experimental operations and in segregated airspaces.[4]

It is therefore clear from the above that the training of air personnel is therefore constantly necessary, and precisely thanks to the elements of AI, it is carried out in a much shorter time and much more efficiently. Simulation technologies have been widely used for several decades, but only with the advent of AI have they become so real that they are practically indistinguishable from reality. Simulation technologies with AI elements are used in almost all branches of training, be it pilots, sensor equipment operators, weapon systems specialists or technical personnel.

The aviation training segment (pilots, operators and specialists) has seen the greatest development of AI in simulation technologies in the long term. These technologies ensure a reduction in the costs incurred for flight training, when a much smaller percentage of training flights must be performed with real flights. At the same time, they also make flight training safer, not only with respect to other air traffic participants, but also in general. In the earlier times, when AI was not used, weapon operators had to act kinetically against practice targets as part of training, which was not only expensive, but also dangerous. Thanks to this, real training

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3 Merrin, W. (2019). Digital War: A Critical Introduction. London: Routledge.
4 Porada, V. & kol. (2019). Bezpečnostní vědy: úvod do teorie, metodologie a bezpečnostní terminologie. Plzeň: 2019.

"disposals" were minimized, which had a negative effect on the readiness of the crews. Thanks to this, inaccuracies and secondary so-called collateral damage occurred more often within combat actions. Thanks to the use of AI, a completely different level of training takes place, where each sub-task is safely mastered without the need for a real flight.

Even in the field of ground technical personnel training, virtual environments are increasingly being used. The advantage over real practice is again a much safer environment, especially at the beginning of training, and a reduction in the economic and time requirements for this training. Using AI technology and elements of virtual reality, it is possible to practice individual procedures for installing or removing various aggregates of the unmanned system from the comfort of the office.

The use of artificial intelligence in the operational use of unmanned systems

As mentioned above, AI is only partially used in practice so far. Technical and legislative limitations have already been mentioned. In aviation, and especially in the military, the moral level is also very important. Even if it were legislatively and technically possible, society is currently not morally ready for the full integration of AI not only into everyday life, but also into the military. Military pilots, not so much adamantly, but still maintain a stamp of uniqueness and accept AI rather reservedly, to say the least.

On the current digital battlefield, AI has an irreplaceable role, especially in the excellent imaging capabilities of the overall situational awareness of the given operational area. For AI to work effectively, it must be connected to command and control systems. Data from these systems are processed by artificial intelligence in real time and then displayed to the end user according to priorities. The pilot/operator thus has, from the comfort of the ground control station, very detailed information regarding not only the airspace, but also the situation on the battlefield, the weather situation, the situation about the enemy, etc. This gives the operator of the unmanned vehicle absolute electronic supremacy on the digital battlefield.[5]

Another way where AI is currently being used is flight safety. Artificial intelligence is gradually being integrated into the on-board computers of the aircraft's control and management. Flight safety is thus raised to a higher level, because it no longer depends only on the pilot, but AI evaluates the pilot's commands, which it subsequently corrects according to the surrounding conditions.[6]

One of the most discussed possibilities for using AI is when performing kinetic operations themselves. Again, this is a moral paradox where up to 90% is taken away with the help of AI. AI is the operator's strong partner in search power, verification and labeling. For legislative reasons, it is still necessary for the so-called positive identification to always be done by a person who also has the design on it. After that, the AI takes over again, when after receiving the command to fire,

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5 May, L. (2018). The Cambridge Handbook of the Just War. Cambridge University Press.

6 Boyle, M. J. (2020). The Drone Age: How Technology Will Change War And Peace. New York: Oxford University Press.

it analyzes the surrounding conditions and recalculates and corrects the command. When using a so-called smart bomb, which can be controlled throughout its flight path, the entire process is also handled by the AI system. The reason for such procedures and only the selective use of AI is the necessity of human responsibility for the act performed. In the event that the entire process was in charge of artificial intelligence without human intervention, it would be responsible for the task performed, and this is currently not legally and morally possible.

Partial ingestion of AI is in virtually every discipline of operational flights. The UAS must be taken as a whole, including AI, without which it would either not be functional at all, or its capabilities would only be at a mechanical level. Data throughput management using AI can serve as an example. Data is the basic building block not only of today's digital world, but also of the battlefield. The drone is controlled by the data flow, on the other hand, the data from it must be processed and displayed. The aircraft can further transmit different data to different customers and can also fulfill the function of signal retransmission. It is also one of the sources of the technological and informational datalink of manet networks, which ensure complete data coverage of the dedicated area. These different kinds of signals need to be sorted, addressed and evaluated, and that's exactly what AI algorithms do best.[7]

Use of artificial intelligence within the objective evaluation of the flight

The use of AI is far from ending with the landing of an unmanned vehicle. After each flight, the flight must be objectively evaluated. In the days of the computer prehistory, specially trained personnel had to analyze the recording devices that were on board manned aircraft. With more powerful technology and software tools, various specialized applications took over this role, but they worked with clearly defined limits, after exceeding which they only reported a change state. At present, and not only in the case of unmanned vehicles, the full potential of AI is being used in this segment. The analysis of flight data occurs already in flight, while the pilot/operator is alerted when the limit load is exceeded and can adjust the flight parameters due to the severity of the exceedance. This will ensure a reduction in the possibility of damage to the hull or other aggregates. Since the evaluation unit is on board the aircraft, after landing only the required data is transferred to the server, where the data is further processed.[8]

Every pilot has to evaluate his flight and even here, after the flight, AI finds its application. Because there is an incredible amount of data, it is quickly processed and especially understandable interpretation. The pilot/operator can play back this data on a synthetic training simulator designed for this purpose, not only with flight data, but also with meteorological and operational data. AI will ensure excellent data readability without the need for additional specialists.

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7 May, L. (2018). The Cambridge Handbook of the Just War. Cambridge University Press.

8 Masutti, A. & Tomasello, F. (2018). International Regulation of Non-Military Drones. Cheltenham: Edward Elgar Publishing.

Use of artificial intelligence in data collection

Data collection in this case means collection from sensor outputs from the drone. Here, the situation is similar to the objective flight evaluation data. It is necessary to mention that the output from the sensors does not have to be only FMV or a picture. It depends on the parameters of the mission and the equipment options of the unmanned vehicle, but there are many other options. SAR radar, SIGINT, ELINT, COMINT, CBRN, photogrammetric data are just the basic ones that we can encounter in military drones.[9] It is practically impossible for a person to carry out their complex processing, diagnosis and interpretation in the shortest possible time.

Without AI, analysis processes would take such a long time that the data obtained would no longer be valid at that point. Combining individual outputs from different sensors is such a complex discipline that practically only powerful hardware with applied AI can ensure clearly readable outputs, in real time.

Artificial intelligence also plays its role in data archiving and manipulation. Previously, if professionally trained personnel did not know how to work with MS Access or similar specialized database software, it was practically impossible to sort, archive and continue to handle such a large amount of data. Now AI is taking over this role again. The data is properly marked, described, sorted, archived and prepared for further use using complex algorithms.[10]

Artificial intelligence as a security element

As mentioned earlier in the text, the comprehensive use of AI is mainly hindered by concerns about security breaches. This means in particular that if we were to entrust absolute control over unmanned systems to artificial intelligence, there would be a lack of authority to take responsibility for its actions. However, this does not prevent the use of AI in the security segment in another partial way.

Concerns have often been voiced in the unprofessional mainstream media in recent years about what will happen if an unmanned vehicle is secured, or possibly taken over by an adversary. Whether this has happened in the past or not is not the content of this work. However, the fact is that technically it is technically possible, in the case of interference it is even very simple. However, taking control of an enemy's unmanned vehicle is not an easy task. Not only is the C2 of the unmanned system highly encrypted, but precisely thanks to AI, the complete takeover of the unmanned means is close to zero probability. Certain safety standards are applied in modern unmanned systems, of which there are a huge number. These protocols for different types of signals (see the chapter Use of artificial intelligence in the operational use of unmanned systems) are very difficult to operate with these numbers and multiple redundancy. Everything takes place

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9 May, L. (2018). The Cambridge Handbook of the Just War. Cambridge University Press. ISBN 9781316606629.
10 The U.S. Army Is Using Virtual Reality Combat to Train Soldiers, 2019. In: Futurism [online]. USA: Camden Media, 22.3.2019.

in secret and thanks to AI the pilot/operator practically does not know that something like this is happening in the background of the applications.[11]

Forecasting the development of self-learning in artificial intelligence

Artificial intelligence is becoming part of our daily lives, so it is essential to set rules. Europe's growth and prosperity are closely linked to how we use data and related technologies. Artificial intelligence can make a significant difference in our lives, for better or for worse. Data-driven governance, preventing misinformation and cyber-attacks and ensuring access to quality information. As robots can be used for dangerous jobs, AI can also improve workplace safety and offer new job opportunities in a growing and evolving AI-driven industry.

Benefits

In the military, AI could be used for defensive and offensive strategies against hacking and phishing (techniques for obtaining sensitive data in electronic communications) or to target key systems in cyber warfare.

Negatives

The combination of the military and autonomous AI in the form of autonomous weapons can have fatal consequences for society. However, it may not only be autonomous weapons, but also drones and robots. Drones can detect targets such as armoured vehicles. However, there is disagreement about whether the technology is reliable enough to ensure that the machines do not make mistakes and kill non-combatants.

In the area of research and development, given the tendency towards future restrictive regulation, it is appropriate to focus more on the development of sophisticated intelligent defence systems. These should be able to counter and prevent not only conventional threats but also intelligent threats. It can therefore be assumed that most nations are retreating from this technology and are aware of the potential impact on humanity.[12]

Conclusion

The use of artificial intelligence, not only in military unmanned aviation, is a natural evolution of this aviation discipline. The partial use of AI within individual subsystems is practically the only possibility to currently process, sort and analyze enormous amounts of data in real time. These actions must be performed not only during all phases of the flight of the unmanned vehicle, but also during pre-flight and flight preparation. Streamlining occurs when AI is used during development and financial savings during the production process.

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11 Affirmative Target Identification: Operationalizing the Principle of Distinction for U.S. Warfighters [online], 2016. USA: SSRN.com

12 KRAUSOVÁ, Alžběta, Ján MATEJKA, Alex IVANČO, Veronika ŽOLNERČÍKOVÁ a Tomáš ŠČÉRBA. *Výzkum potenciálu rozvoje umělé inteligence v České republice: Analýza právně-etických aspektů rozvoje umělé inteligence a jejích aplikací v ČR.* 2018.

Accepting the existence of AI is one of the basic prerequisites for its expansion into all areas of life. With a higher percentage representation of AI in everyday life, the issue of morals, which currently keeps the growth of AI within socially acceptable limits, will also gradually disappear. A reasonable compromise is only partial use of AI technologies until humanity is morally and legislatively ready for technology controlled only by artificial intelligence.

Although AI is currently considered to some extent as an element of active protection, and not only in the unmanned area, for full control over security systems, some kind of code must be developed, which will be an insurmountable parameter for individual AI systems.

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List of terms

Unmanned vehicle – an unmanned aircraft that can be remotely controlled or fly autonomously using pre-programmed flight plans or more complex dynamic autonomous systems (Droneweb.cz, 2021).

Unmanned System – a system consisting of an unmanned aircraft, a control station, and any other element necessary to enable flight, such as communication links and launch and return equipment. There may be multiple drones, control stations, or launch and return devices within an unmanned system (Ministerstvo dopravy ČR, 2022).

Smart Bomb – a type of precision-guided munition. Like a regular bomb, it falls on the target solely by gravity. The munition has movable control surfaces that allow it to change its flight path in response to operator commands or other means of guidance (Britannica, 2019).

Aircraft – a device capable of deriving the forces that carry it in the atmosphere from reactions of the air that are not reactions against the earth's surface. (Ministerstvo dopravy ČR, 2013).

Airplane – a powered heavier-than-air aircraft, deriving lift in flight mainly from aerodynamic forces on surfaces that remain stationary relative to the aircraft under given flight conditions (Ministerstvo dopravy ČR, 2013).

Manet network – a type of ad hoc network that can change location and configure itself on the fly. Because MANETS are mobile, they use wireless connections to connect to different networks. This can be a standard Wi-Fi connection or another medium such as mobile or satellite transmission (Tech-lib.eu, 2010).

Positive identification – reasonable certainty that the target/entity planned to be attacked is a legitimate military target (SSRN.com, 2016).

Retransmission – retransmission, remote signal transmission (SCS.AZ.cz, 2017).

List of abbreviations

AI – Artificial Intelligence

C2 – Command and Control

CBRN – Chemical, biological, radiological and nuclear

COMINT – Communication Intelligence

ELINT – Electronic Intelligence

FMV – Full Motion Video

MS – Microsoft Office

RPAS – Remotely Piloted Aerial System

SAR – Synthetic Aperture Radar

SIGINT – Signal Intelligence

UAS – Unmanned Aerial System

USA – United States of America

Statistics and Its Limits and Possibilities in the Process of Knowledge

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Abstract

This paper is a reflection on the incorrect use of statistics. It describes situations in which it is appropriate to report sample data without using statistical methods. An example is a research on the new sport called jumping.

Keywords: statistics, base set, sample, range of data, jumping

Introduction

Not only among statisticians, but also among the general public, we can hear the phrase (no doubt with some exaggeration) that "there are lies, especially reprehensible lies and statistics". This over a hundred-year-old statement about statistics seems to be saying that statistics is an extremely subtle form of lying. Interestingly, to this day it is not clear who the author of this malicious statement was. It is most often associated with the name of the English politician Benjamin Disraeli.

Interestingly, this questioning of statistics as a tool of knowledge is often associated with the opposite approach; in fact statistics (or rather their results) are at the same time regarded as unquestionable and difficult to refute evidence of the truth of any phenomenon. After all, statistics work with numbers, and what is more accurate than a numerical figure? Therefore, anyone who wants to convince someone of something often presents statistical data and analyses.

We witness this in politics, in economics as well as in other fields of human activity, when various statistical data are presented as evidence of the truth of the ideas presented. And we often see a situation where those who want to challenge the analyses and analyses presented are based on the same statistical data. Thus, two different claims based on identical data are pitted against each other. The layman thus gets the impression that the words about false statistics are so true.

If statistics had remained as a methodological tool of knowledge only in the world of exact science, this problem would probably not have arisen. However, the whole matter is more complicated; statistics are used every day in public space, on television, radio, in the press, in public speeches, etc.

This rightly raises the question of where to look for the causes of this contradictory attitude towards statistics? We believe that there are several reasons. First of all, what is not actually statistics is often considered to be statistics. Even Prof. Ragnar Frisch, Nobel Prize winner in econometrics, in his foreword to Helmut Swoboda's book Modern Statistics, states that he often encounters that even among experts, in strictly scientific works, professional statistical terms are sometimes used inaccurately. In the public space it is especially among laymen that statistical concepts and figures are used incorrectly or excessively.

Another reason is the little knowledge of the tools and possibilities of statistical methods. In order to fulfil its desired goals as a tool of knowledge, a number of assumptions and conditions must be met. This is often not the case in practice. The basis of all statistics is relevant, true and telling data obtained by exact, scientific methods. The real demands of practice (to get some 'data' quickly) often do not allow these assumptions to be met.

A substantial part of the work that is supposed to result in the assessment of a problem by statistical methods starts absolutely outside statistics. Somewhere something new is discovered and there is an interest in finding out more. Ideas are therefore generated by experts in the field. Their frequent conclusion is to collect data about the "new thing" with a plan to provide the data to a person knowledgeable in statistics, asking for careful processing. Already at this stage, respect for the fact that the sample data should reflect reality (the underlying population) is often lost; not to mention, for example, that the insufficient size of the sample data often makes it impossible to use an appropriate statistical method.

Emphasizing that a certain type of scientific result "must" result in the use of statistical methods leads in our opinion to a devaluation of statistics.

As valuable as the correct application of statistics to "correctly" obtained data is certainly a scientific article that presents unknown information about a "novelty" in the field, and contains sample data accompanied by plausible information why exact statistical methods cannot be used to process these data (the data are scarce; it is not known whether the assumptions of the application of existing statistical models are met, etc.). If the data are few for statistics, a complete presentation of the data will certainly enrich the work. And the author or authors with the described approach prove their statistical erudition much more strongly than those who, for example, "look for an estimate of the mean in a model in which the mean does not exist".

Equally valuable will surely be articles that present data that do not allow the use of statistics in the form of summaries taken by descriptive statistical methods.

As an example of the absence of statistical treatment of data, we present research on the effect of a six-week Jumping intervention on selected somatometric, physical fitness parameters. The

research population included 23 women and 4 men from the South Moravian Region, which included both physically active individuals and individuals who were almost inactive. Before and after the intervention, the cohort underwent a stress test and baseline and post-intervention diagnosis of somatometric parameters (body height, body weight, BMI, muscle mass, fat mass and total body water mass) was performed.

The study was conducted from September 2022 to December 2022 and from January 2023 to March 2023. Informed consent was obtained from all participants. The Harvard step test was used to measure physical fitness. It is based on the principle of a directly proportional relationship between cardiorespiratory fitness and the rate of return of heart rate to baseline values in the recovery phase (Heller, 2018). Input and output somatometric parameters were measured using the InBody 270.

Participants were divided into three performance groups according to the frequency of leisure-time physical activities. The intervention consisted of one-hour Jumping lessons three times a week for six weeks. Each session began with a standardized warm-up exercise for the lower and upper body muscles (gluteus maximus, quadriceps femoris, hamstrings and brachialis) and a five-minute stretching session. The Jumping lesson was prepared with standard choreography consisting of rhythmic bipedal, single leg and alternating leg Jumping (Svobodová, 2008).

All three co-authors are of the opinion that the research design is meaningful and will provide new perspectives on jumping, although the results of the research cannot be processed statistically due to their diversity and small numbers. They will therefore, of course, only be presented and commented on in the final report.

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Hooliganism in Football

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Abstract

Hooliganism has been an unwanted and life-threatening phenomenon for several decades, making watching sporting events uncomfortable and enjoyable. This article presents the essence of this phenomenon in football, compares it with the activities of ultras movements and provides an overview of the most notorious hooligan activities in Slovakia and their impacts. It then offers, for comparison, the most notorious tragic hooligan activities that have occurred around the world and their consequences. Different measures are being taken in different countries around the world to combat this phenomenon, but these are not globally applicable due to inconsistencies in legislation and different cultures. The shortcomings and inconsistencies of the organisers of sporting events also play a role in allowing this phenomenon to take place.

Keywords: hooligans, football, ultras, tragic activities, riots

Introduction

For some people, hooliganism is becoming a collective combat sport. For more than 20 years now, hooligan attacks have been escalating at a staggering rate and causing major problems for all organisers of sporting events.

How did the word "hooligan" actually originate? Its origins are not exactly proven, but it is certain that as early as the late 19th century and early 20th century the term began to be used in the UK to refer to a man who causes trouble or a boy off the street who commits criminal acts. In the 1920s, the term spread to the whole of the European continent. However, it only became associated with football in the 1960s. Its increasing development in Europe was recorded between 1970 and 1980. At that time, aggressive gangs began to appear in England, causing numerous incidents. Before the appearance of these gangs, incidents during football matches were sporadic, but with their arrival, violence in stadiums became regular. Their credo was 'hitting each other'. English hooligans in particular used various football events organised abroad, such as the World and European Championships, but also international cup and friendly matches, to provoke fights. The Belgians, the Dutch and the Germans in particular were very grateful opponents.

The turning point came after the drama at Brussels' Heysel Stadium in 1985, where the European Champions Cup final between Liverpool and Juventus took place. English fans instigated violence in the stands and the terrified Belgians and Italians began to retreat from the bullies, creating a crush in a small area. The crowd crowded against a concrete wall with a fence separating them from the pitch. The wall collapsed and the front rows were trampled by an avalanche of people trying to escape from the English hooligans onto the field of play. Thirty-nine people died and the drama was the catalyst for the fact that hooliganism had become a real danger and a social problem across Europe.

Over the years, there has also been a change of venue for the violence. In the early days of hooligan activities, stadium stands were the main places where fights took place. Later, many security measures were taken at these, and so the fights moved to the vicinity of the stadiums and subsequently to cities, means of transport and other public spaces. Hooligan gangs even organised fights with each other outside the venues where football matches were taking place. The international dimension of hooligan violence gradually spread to the national level.

Methodology

Characteristics of the research population
The research set was selected by the method of selection of the most famous and most dangerous pathological riotous activities of hooliganism movements during football matches, both in Slovakia and in the world, and this selection was based mainly on the analysis of the number of victims not only in the stadiums where the matches took place, but also outside them.

Research methods and techniques
The following research methods and techniques were used in the research:

The exploratory method was used in the selection of the objects under study, forming the research database. This empirical method was used in synergy with the logical method of quantitative and qualitative analysis, with the supporting criterion of selection being the analysis of the number of victims not only in the stadiums where the matches took place, but also outside them, as well as other criteria. The second selection criterion for the quantitative analysis was the amount of damage caused by the hooligans' actions in the stadiums, in the cities where the matches took place, but also during the movement of the members of the hooligans' movement to the venue of the football match, or after the end of the match, and during the subsequent fights between the 'fans' of the respective rival teams.

The method of deduction used in the selection of the objects of the research set was used to determine the level of dangerousness of the weapons used in the individual matches presented and the insufficiency of the measures taken by the organizers at the stadiums and the access points to the stadiums.

Qualitative analysis of the failure to handle dangerous and life-threatening situations after the problems caused by the riotous crowd played a role in the selection.

Qualitative analysis was also used in the selection of examples of activities of ultras fan groups, with the aim of the analysis being the originality of the support tools of selected ultras groups from Slovakia that had a "spark" of an idea for stimulating support for their football team.

Implementation of the research

The research was carried out on a database of selected objects, based on the selection criteria described above, and the method of induction of the shortcomings found in the individual objects studied was used to deduce at least a partial proposal of relevant measures that could be taken to improve the management of dangerous situations during sporting events.

Data processing

The data under study were processed by the method of comparison according to the criteria described above, for the period between 1985 and 2021. The methods of case-by-case analysis and subsequent synthesis were used to identify a set of more optimal techniques that could serve as a blueprint for adopting more effective measures.

Definition of hooligans and ultras

Hooligans (sports hooligans) are troublemakers among the fans of football clubs. Vandalism, fights and disturbances between different groups of fans of rival football teams are now common during matches, as well as before and after matches, in stadiums, on transport vehicles and on the streets of cities. These pathological phenomena usually require the intervention of police units. Hooligans are in fact gangs formed with the intention of engaging in fights with members of hooligan groups who group themselves under the club banner of the rival team.[1] Spectator violence at football matches can be characterised as a planned and demonstrative use of force, as racist and extremist displays and disturbances carried out by an organised group of football hooligans. Football hooligans together with ultras, other fans and spectators form a specific spectator community. However, the subculture of hooligans is also not homogeneous, each of the groups has its own specific characteristics, which in the case of hooligans means that they, unlike ordinary fans, identify more with their group than with the football club.[2]

Ultras are a special category of fans of football clubs who actively participate in their club's matches in order to support it in a fanatical way. This type of fan is different from hooligans or Bara Brava. Ultras are organised in non-profit associations to support their chosen football club and encourage it with slogans and visual animations.[3] An essential part of the ultras' activities, choreo, or choreography, is supposed to be the most beautiful expression of affection for the club. It can be made up of pole, two-handed or sector flags, balloons, cartons of paper, or various types

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1 https://sk.wikipedia.org/wiki/%C5%A0portov%C3%BD_chulig%C3%A1n [Available online: 12.10.2022]

2 https://spaeds.sk/wp-content/uploads/2015/12/zbornik_smolenice.pdf [Available online: 18.10.2022]

3 https://fr.wikipedia.org/wiki/Ultras_(supporters) [Available online: 12.10.2022]

of pyrotechnics. The preparation of a huge choreo is usually time-consuming and costly, and no one can guarantee that its presentation to the fans will be successful.

Ultras follow a few principles:

- never sit down during a match,
- they cheer their players on no matter what the result,
- attend as many games as possible on their own and their opponents' pitches.[4]

The difference between hooligans and ultras

In terms of terminology, it is necessary to distinguish ultras from hooligans. While the aim of ultras is to use vocal chords, chorus and other means to cheer up their team (and also to verbally or graphically insult the opponent or other "enemy" the main interest of hooligans is to provoke fights and forceful confrontations with other groups or with the police, organizers and sometimes even with random spectators not belonging to the hooligan gangs.

The increasingly frequent violence in the stands of football matches today puts ultras, in addition to hooligans, in the spotlight. This term is not just a milder version of 'hooligans', it is a distinct phenomenon, although the lines between the two terms can sometimes seem very thin. More than their origins – England for hooligans and Italy for ultras – the difference between the two terms is linked to violence. Violence is at the heart of the activities of hooligans, many of whom were banned from football stadiums, especially after the dramas of the 1980s and 1990s, but whose presence in stadiums in Eastern Europe continues to be tolerated.

For the ultras movement, violence is only accepted as part of its activities, it is not its core activity. In the case of the ultras, it is about supporting their team by all means, which include organised travel to follow the team to its matches, chanting, but most importantly the choreography of support by the fans with flags, banners, coloured smoke screens, flares, drums and unified chanting. For most ultras teams, urban rivalries, club colours, crests, symbols and overall iconography are of paramount importance. The goal of the ultras is to be an actor in the match. It is their way of life, an intense personal investment within a collective that has principles and a determined interplay to support their football team.

Unlike hooligans, ultras in most cases group themselves into official associations that attempt to be valid external members of the club and return support to the club for their performances in the form of celebrations. This movement came to the European states from Italy, where the Tifosi emerged. In Italian, TIFOSI literally means those who are infected with Typhus disease, referring to someone who acts in a hot tempered manner.[5] In France, for example, this fan movement only came to France in the early 1980s in the form of the first association of this type, which supported Olympique Marseille and whose name was Commando Ultra. As for the origin of the word 'ultras', it is necessary to go back to

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4 https://sk.wikipedia.org/wiki/Ultras [Available online: 12.10.2022]

5 Guttmann, Allen (2007). *Sports: The First Five Millennia.* University of Massachusetts Press. p. 192.
   ISBN 9781558496101. Retrieved 5 August 2016. Source: https://en.wikipedia.org/wiki/Tifosi

the 1960s in Italy, where the term is associated with the ultra-royalists of the Ultrà Tito Cucchiani of Genoa, who at that time wanted to put their ideas into practice by violence.

THE MOST FAMOUS HOOLIGAN ACTIVITIES IN SLOVAKIA

ŽILINA – match Dukla Banská Bystrica vs Sparta Praha
The football match that took place on 19 June 1985 in Banská Bystrica between the home team Dukla and Sparta Praha had a disastrous prelude on the Hron express train from Prague to Zvolen. The incident that took place on this train is considered the first manifestation of football hooliganism on the territory of Czechoslovakia.

This football match was much more important because it was the venue where Prague Sparta was to play its last league match, which was crucial for Sparta. It was at the top of the table and shared the first place with Bohemians Prague before the match. Both teams had the same number of points and everything was open in the last match of the season. This was the reason why many Sparta fans wanted to support their football team with their presence at the stadium. Around 400 Sparta Prague fans travelled to Banská Bystrica on the Hron night train. Already at night in Prague, when boarding the fast train, many of them were under the influence of alcohol and the rampant drinking continued on the train. Fortified by alcohol and strong talk, they smashed windows, tore out seats and dismantled the entire interior of the carriages. They threw seats, backs, doors, bottles, broken parts of toilets, sinks and mirrors out of the windows. The fans also threatened other passengers and the conductor, who was threatened with being thrown out of the window. The latter locked the passageways to other carriages in front of them and asked for help at every station. Despite her reports, Public Security intervened against the hooligans only in Žilina, when several carriages had already been completely destroyed. About 30 people were detained there. The rest continued to Banská Bystrica, where the rioting continued until the start of the match, which Sparta eventually lost 0:1.

But since Trnava also beat Bohemias 1:0 in Prague, it was Sparta who won the title due to a better score.[6]

Although the rampage of the Prague fans did not claim any human lives, the material damage caused to the wagons was nevertheless very great. Moreover, the arrested rioters did not get to the match itself and so could not take part in Sparta's celebrations.[7]

DUNAJSKA STREDA – Corgoň Liga football match DAC Dunajská Streda–Slovan Bratislava
On Saturday, 1 November 2008, it was already busy at 10.50 at Bratislava's Nové mesto train station, where the train to Dunajská Streda departed from. Hundreds of Slovan Bratislava fans were chanting various slogans and more than a dozen of them were even chanting anti-Hungarian

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6   https://www.extrastory.cz/fanousci-sparty-zdemolovali-v-roce-1985-vlak-stat-neumel-vcas-zasahnout [Available online: 21.10.2022]

7   https://www.ceskatelevize.cz/porady/10195164142-vypravej/bonus/8228/ [Available online: 17.10.2022]

slogans. Police officers were also present on the platform, who boarded the train and escorted the fans to the stadium upon their arrival in Dunajská Streda. Their march through the city was not without injuries and local police officers had to intervene. The fans threw smoke bombs and other pyrotechnics and provoked various incidents with ethnic Hungarians living in southern Slovakia. The moments before the match were accompanied by mutual provocation. Shouting of ethnic taunts on the one hand and singing of the Hungarian anthem and waving of both Hungarian and Hungarian flags on the other.

The match between DAC Dunajská Streda and Bratislava Slovan, which started at 13.30, was attended by about a thousand Slovan fans, more than 5 thousand home fans, including about 150 radical DAC supporters from Ferencváros, and about a thousand police officers. On the part of the organisers, instead of the promised 200, no more than 80 actually attended the match, and firefighters and paramedics were not even provided. In the 17th minute of the match, the police had to intervene in the home sector and were directly physically attacked by the home fans, who started throwing stones from the stands. The injuries sustained during the intervention were mainly due to the organisers who ignored the warnings of the police and left all the exits from the stadium closed, with no one even standing near them. As a result, a crowd was created in the sector during the crackdown, injuring around 60 fans. Subsequently, at the request of the police, the organisers opened the gates and the rioters were pushed out of the stadium by the police. The match resumed after a 13-minute stoppage. It is important to note that during the match, Slovanists also went on a rampage, throwing flares and smoke bombs on the pitch.

The DAC Dunajská Streda stadium had the highest ever attendance for a club match on that day, up to 16,000 spectators. Although the home side lost 0:2 and were knocked out of the UEFA Cup, no fan will forget the afternoon of 1 November for the rest of their lives. The match even sparked a change in the law, which banned the use of foreign national symbols at home matches in two years' time.[8]

ŽILINA – match MŠK Žilina vs Hajduk Split
Žilina police had their hands full on 30.7.2009 before the first match of the 3rd preliminary round of the UEFA Europa League 2009/2010 between home team MŠK and Croatian Hajduk Split. About a thousand Croatians arrived in Slovakia despite the fact that according to the UEFA Disciplinary Commission's regulation from 2008 Croatians were strictly forbidden to enter stadiums in Europe and the organizers and security staff of MŠK had a regulation not to allow anyone with the colours of Split or Croatia to enter the premises of the football stadium in Žilina.[9]

According to police statements, Hajduk supporters destroyed restaurants, smashed shop windows and vehicles on the way to the stadium. They also attacked police officers, throwing stones and various other objects at them and trying to get into the match, which kicked off at half past seven and ended in a 1:1 draw. The riot police, however, quickly dealt with these troublemakers, and

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8 https://www1.pluska.sk/sport/video-peklo-stadione [Available online: 08.10.2022]

9 https://myzilina.sme.sk/c/4955711/fanusikovia-hajduku-utocili-v-ziline-minister-sa-za-nich-ospravedlnil.html [Available online: 14.10.2022]

pushed some of them into the railway station building, where they spacified them. More than 50 police officers and dozens of fans of the Croatian football club Hajduk Split were injured in the police intervention. Hospitals also treated 18 Croatian fans, who suffered broken heads, cuts and bruises. Subsequently, the competent authorities decided to expel 219 Croatians, who will not be able to enter Slovakia or the countries of the European Union for five years.[10]

In the return match on 6.8.2009 in Split, 25 thousand home fans were waiting for the Žilina footballers at the Poljud stadium. Also in Croatia the police had to deal with riots and 28 people, 6 of them Slovaks, spent the night behind bars. Four were there for illegal pyrotechnics, one for alcohol and one for using illegal signs. The police caught them at the gate before entering the stadium. They randomly gave them a blow job, as they had more than half a half a millilitre in them, so they didn't get to go to the football. The Slovaks were fined an average of 750 kuna (€100). Croatians also spent the night at the police station. They were caught for alcohol and for going to the stadium with batons. However, none of the Split fans who threw cannonballs at the stadium were arrested.

After the draw in Žilina, the game in Split was extremely important for both teams. Žilina eventually won 1:0 in Split, thus eliminating the home team from further promotion. Hajduk's coach had a heart attack and the home fans also wanted to attack the club's management, who eventually resigned after the match. Despite this, the police had to intervene against the home rioters after the match.[11]

SLOVENSKY GROB – match OŠK Slovenský Grob vs FK Inter Bratislava
On Sunday 18 August 2013, during the championship match between OŠK Slovenský Grob and FK Inter Bratislava in Slovenský Grob, an incident took place that shocked the whole of Slovakia. During the match there was a riot between fans of both clubs in the stadium. After the riot, which was also attended by the police, an Inter fan attacked a supporter of Slovenský Grob while still in the football ground. The incident then moved to the front of the pitch, where the perpetrator, armed with an iron machete, injured a 46-year-old man from Slovenský Grob. After the attack, he gave the weapon to another of the initiators involved in the incident, who used it to threaten the people present at the scene of the incident. After a few minutes, the perpetrators fled, leaving the machete at the scene. The injured 46-year-old man had to be treated by a doctor.[12]

In the words of FK Inter Bratislava president Jozef Mihál: "...the riot was initiated by four persons in particular who are not fans of our club, do not claim to be fans of our club, nor do they travel with our fan club to matches. They also came to Slovenský Grob separately from the fans, who were paying attention to what was happening on the pitch during the whole match, not outside the stadium. Therefore, it is not true that the home supporters attacked the away camp. It was the

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10 https://sportnet.sme.sk/spravy/v-ziline-pred-zapasom-s-hajdukom-zasahovali-policajti/?page=2 [Available online: 25.09.2022]

11 https://www.cas.sk/clanok/126771/video-hajduk-split-vs-msk-zilina-co-vsetko-sa-dialo-v-chorvatsku/ [Available online: 01.10.2022]

12 https://www.ta3.com/clanok/35429/na-zapase-slovensky-grob-inter-bratislava-sa-utocilo-macetou [Available online: 02.10.2022]

act of individuals who came to the venue with the intention of going on a rampage and venting their passions. They were not interested in football, they were just making a living out of football."[13]

Following this incident, the management of the Inter Bratislava football club took action to prevent similar dangerous acts of hooliganism, fights and vandalism at sports grounds and issued a lifetime ban on all four of the players involved in the Slovak Grob incident from attending the club's home matches. At the same time, it undertook to inform the officials of the opponents where FK Inter Bratislava will play in the future of this ban so that they could also take similar action.

BRATISLAVA – Mass brawl of football hooligans in the city centre
The opening match of the Champions League qualification between Slovan Bratislava and Montenegrin club Sutjeska Nikšić was played on 10 July 2019 at Tehelno Polje in Bratislava. The match was attended by 11 thousand fans, including about 50 supporters from Montenegro, and the match, despite the fact that the police present were expecting riots, took place without any security incidents.[14]

That evening, dozens of football fans fought in the centre of Bratislava. It was a brawl of football fans from abroad, who threw tables and chairs at each other and destroyed equipment in cafés and restaurants. On Ventú Street, they demolished the terraces of bars and restaurants, from which frightened customers tried to escape. Police arrested 107 people and charged 80 of them with rioting. According to the police, they were fans of Cracovia Kraków and Ajax Amsterdam on one side and Levski Sofia on the other. The hooligans from Cracovia in Poland also came to support the hooligans from Ajax in the Netherlands, with whom Cracovia has an affiliation. Originally, these football hooligans came to Slovakia to support their teams because the next day, 11.7.2019, Cracovia Krakow played a Europa League match in Dunajská Streda and Levski Sofia in Ružomberok.[15]

TRNAVA – Fortuna League match Spartak Trnava vs Slovan Bratislava
On 17 October 2021, a football match for the lead in the Fortuna League between Spartak Trnava and Slovan Bratislava took place in Trnava. Already during the day, the police forces in Trnava were on alert, as approximately 500 fans of Slovan Bratislava were expected to arrive in Trnava. A significant number of them arrived by train and the movement of the under-strength fans from the station to the stadium was accompanied by dozens of riot, traffic and criminal police officers. The police also took several security measures and traffic restrictions around the stadium.

The match kicked off at 5 pm. After about a quarter of an hour of play, fans of both camps stormed the field of play where heavy physical confrontations took place between them. After the scuffles, several of the hooligans had to be treated by medical staff on the pitch. The crowd

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13 https://www.finance.sk/spravy/finance/126810-inter-bratislava-sa-distancuje-od-chuliganov-na-stadione/ [Available online: 12.10.2022]

14 https://www.ultras-magazine.com/slovan-bratislava-sutjeska-niksic-10-07-2019/ [Available online: 1.10.2022]

15 https://dennikn.sk/1523950/v-centre-bratislavy-sa-bili-desiatky-futbalovych-fanusikov-hadzali-stolicky-a-demolovali-restauracie/?ref=inc [Available online: 02.10.2022]

of struggling fans of both clubs, which had been agitated by the fights, dispersed only after the arrival of the police and the organisers on the field of play. The situation in the stands calmed down only after the police, using rubber bullets and detonators, cleared the away supporters' sector and pushed them out of the stadium. Several of them were injured when they were pushed out of the sector. In the end, the football match was prematurely terminated and the conclusion of the investigation showed that the situation was not handled by the home organizing service, which had left the sector of home radical fans unattended before the incident.[16]

THE MOST FAMOUS TRAGIC ACTIVITIES OF HOOLIGANS IN THE WORLD

ARGENTINA

June 23, 1968 in Buenos Aires – 74 fans did not survive a stampede as they tried to leave the stadium after a match between River Plate and Boca Juniors, and another 150 were injured in a stampede to escape a fire in the stands when youths among the home club's fans threw burning papers into the stands of opposing fans.

During the 2002 season, five deaths occurred during football matches in Argentina and dozens of knives and firearms were used. The first incident in the year in question took place between fans of BOCA Juniors and their local rivals, River Plate. The match was abandoned prematurely and one person was shot. Every major and minor league football club has an organisation of hooligans, known as Barras Bravas (tough gangs). BOCA Juniors is one of Argentina's most famous football clubs and boasts the largest group of local hooligans. Their leader, Rafael "Rafa" di ZEO, claims to have at least 2,000 members and describes himself as the team's number 12 player.

On 12 September 2005 in Buenos Aires, Argentine footballer Carlos Ezcurra was seriously injured trying to end a clash between fans and police officers who were trying to calm a riotous crowd. The San Martin player was hit by a stray rubber bullet from one of the police guns during a stoppage in a second league match against Godoy Cruz, damaging his lung. The conflict erupted when disgruntled spectators began throwing rocks onto the field at 0:3 and someone also threw a rock among the opposing team's fans. The two camps started to beat each other.[17]

An investigation into football hooliganism in Argentina has identified 40 cases of murders during matches in the last 10 years. Between the 1930s and 2002, as many as 152 people died in incidents at football matches in Argentina, making football violence a national crisis in Argentina.

BRAZIL

Compared to other footballing powers, Brazilian fans are more moderate. Still, Brazil has struggled for years with violence among football fans. Already in the 2015 season, on February 9, a meeting of well-known football clubs was marred by tragedy when a fan, only 16 years old, was shot dead, probably

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16 https://sport24.pluska.sk/futbal/slovensko/foto-skandal-nevidanych-rozmerov-chuligani-bili-derby-hracej-ploche-ukoncili-zapas [Available online: 11.10.2022]

17 https://www.cas.sk/clanok/216211/masaker-na-futbale-na-stadione-zomrelo-74-ludi-a-tisice-sa-zranilo/ [Available online: 12.10.2022]

by police forces, during clashes between fans and police in Porto Alegre. Fans of Brazilian football club Gremio Porto Alegre stormed the playing field after a 1:3 home loss to Palmeiras Sao Paulo and destroyed the technical equipment of a video assistant referee. Subsequently, Gremio fans clashed with the police in the car park outside the stadium and supporters of the two rivals fought in the stands.

Seven people were killed and 40 others seriously injured at a football stadium in Salvador, Brazil, on 25 November 2007. The tragedy took place shortly after the end of the match Bahia – Vila Nova (0:0), the result of which meant that the home team was promoted to the second highest Brazilian league. After the final whistle, a mass euphoria broke out in the stadium and one of the stands was unable to withstand the onslaught of excited spectators. Part of the stands collapsed and several hundred spectators fell from a height of 15 metres along with concrete blocks. It is the biggest disaster in the history of Brazilian football and has also raised doubts about the country's readiness to host the 2014 World Cup. The stadium, which was built in 1951, was home to around 60,000 people at the time of the tragedy.[18]

PERU

On 24 May 1964, a heavy clash of fans erupted at the National Stadium in Lima after Uruguayan referee Pazos disallowed the home team's equalising goal in the Peru–Argentina Olympic qualifier. The toll was terrible – 318 dead, 500 injured. According to the information available, this was the most tragic event of its kind in the world.[19]

EGYPT

In a clash between fans of two Egyptian football clubs after a match in Port Said, Egypt, on 1 February 2012, 79 people died and at least 1,000 were injured. The violence erupted just seconds after the final whistle of the match between local club Al Masri and one of Egypt's top clubs, Al Ahli, which unexpectedly lost the match 1:3. Fans of the home club ran onto the pitch and attacked the visiting players and their supporters. The stadium went up in flames. Although the players found protection in the dressing rooms, the enraged fans chased them, as well as members of the management team, into the bowels of the stadium, several of them wielding knives, which explains why most of the injured complained of stabbings. A frenzy broke out on the playing field. Many of the unfortunates suffocated or were trampled by the crowd. Shortly after the Port Said match, the Egyptian federation cancelled all league matches for 2012.[20]

CROATIA

Football hooliganism only emerged in Croatia in the 1990s after the civil war that resulted in the breakup of the Yugoslav federation. The two most famous fan clubs that cannot quite be classified as hooligans are Torcida (the ultras of Hajduk Split) and Bad Blue Boys (the ultras of Dinamo

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18 https://sportnet.sme.sk/spravy/tragediou-poznaceny-stadion-v-salvadore-zlikviduju/ [Available online: 10.9.2022]
19 https://www.bbc.com/news/magazine-27540668 [Available online: 12.9.2022]
20 https://pt.wikipedia.org/wiki/Trag%C3%A9dia_de_Porto_Sa%C3%ADde [Available online: 27.9.2022]

Zagreb). The bigger tensions among Croatian fans during football matches arise mainly against Serbian opponents and during matches against Bosnia and Herzegovina.[21]

ENGLAND

England, due to its traditions, is not only among the football superpowers, but also among the superpowers of hooliganism. Even local football derbies are also derbies of ultras' fan clubs. The biggest boom of this sporting malaise occurred in England in the 1960s. Sports hooliganism is part of the lifestyle of some groups of young people. Gangs of hooligans follow their football teams to every match, and at every game there is a reason to start a fight between fans of rival sides.

The Hillsborough tragedy happened on 15 April 1989 at a football stadium in Sheffield, England, during the FA Cup semi-final match between Liverpool and Nottingham Forest, when police let several thousand other Liverpool fans into the crowded stands. A huge crush broke out in which 96 people were trampled and more than 700 were injured. The worst tragedy in the history of English sport, and one of the worst sporting tragedies in the world, led to the adoption of extensive security measures at football stadiums in the UK.

May 11, 1985 should have been a great day at Bradford City's stadium, yet it can be considered a very tragic one. The home team had secured promotion to the Second Division and against Lincoln City it was to be a celebration of triumph in the Third Division. The Valley Parade stadium was known for its outdated construction, including the wooden roof of the main stand. At 3.40 p.m., television commentator John Helm noticed a small bonfire in the stands. Due to adverse wind conditions, the entire grandstand was ablaze within minutes. 56 people did not survive the massive fire and more than 250 others were injured.[22]

RUSSIA

On 20 October 1982, a UEFA Cup football match between the local Spartak and the Dutch Haarlem took place at the Luzhniki Stadium in Moscow, ending in a 2:0 home win. It was very cold in Moscow that day and temperatures were around minus 10 °C at the time of the match. Despite the freezing temperatures, there were about 16,500 spectators in the stadium for more than 80,000 spectators. A few minutes before the end of the match, when Spartak were leading 1:0, the home fans started to leave the stadium due to the unbearable cold and the favourable result of the home team. Moreover, shortly before the final whistle, the police tried to escort some unruly young hooligans out of the stadium. It was at that moment that the home team scored the second goal, which sparked a crowd frenzy and the spectators who had left the stadium early began to return in droves. As only one stand was open for spectators during the match due to the bad weather, where all the spectators were crowded, there was a clash on the icy staircase leading to this stand between the spectators leaving and the spectators who started to return in droves after the goal. There was a

21 https://hnonline.sk/sport/438172-pozrite-si-najvacsie-futbalove-tragedie-v-historii [Available online: 28.9.2022]
22 https://hnonline.sk/sport/438172-pozrite-si-najvacsie-futbalove-tragedie-v-historii

crush on the narrow staircase and the fall of a young girl, who wanted to put on a shoe that had been forcibly removed, caused a chain reaction of falls. Confusion ensued and the spectators, unable to withstand the pressure of the mass of several thousand, tumbled over each other, most of them being trampled by the maddening crowd and not even having enough oxygen to survive in the unbearable crush. According to official figures available at the time, 66 fans died and an equal number were injured. Unofficial sources, however, reported that as many as 340 people died and hundreds more were injured during Spartak Moscow's match against Haarlem. This football match in Moscow is considered one of the biggest disasters in football history.[23]

TURKEY

On 5 April 2000, before the UEFA Cup semi-final football match between Galatasaray Instanbul of Turkey and Leeds United of England in Istanbul, a tragedy occurred when two Leeds fans were stabbed to death by Turkish hooligans. The violence took place the night before the match at 21.00 in Taksim Square in Istanbul when Leeds fans began taunting people from local bars. Locals tried to call the police before the mass brawl broke out. There were reports that a Galatasaray fan ran to a nearby phone booth to call for support from Turkish home fans when he saw Leeds fans arriving. Shortly afterwards, a group of Galatasaray fans, allegedly members of 'The Night Watchmen' gang, arrived in the square, sparking a brawl between the two groups of supporters. This ended in the deaths of two English fans. The first moments of the start of the fight have not yet been clarified. Eyewitness accounts of the brawl are inconclusive. According to one version, the brawl was started by Leeds fans throwing beer glasses at Galatasaray fans and insulting the Turkish flag; according to the other, the brawl was started by Galatasaray fans who threw chairs at Leeds fans and attacked them with knives. Four men were arrested and charged with the murder of the two Englishmen. The deaths led to an angry reaction in England, where Galatasaray fans were banned from attending a second match in England.[24]

ZIMBABWE

On 9 July 2000 at the National Sports Stadium in Harare, Zimbabwe, 13 people were killed in clashes with police in a mass stampede during a World Cup qualifying match between the Zimbabwe and South Africa football teams. When South Africa's Delron Buckley scored his second goal in the 84th minute of the match, his team was already leading 2:0. After scoring the goal, he fell to the ground holding his injured left ankle. At that moment, trouble broke out in the stadium and bottles and missiles began to fly onto the pitch, with an angry crowd chanting slogans of the opposition Zimbabwe Movement for Democratic Change (MDC). Police responded by firing tear gas canisters into the crowd of nearly 60,000 people, who then rushed towards the exits. Thirteen people were killed and four dozen others injured in the crush. Most

23 https://futbal.pravda.sk/ostatne/clanok/136527-pred-30-rokmi-sa-odohrala-v-moskve-tragedia-ktoru-chcel-rezim-utajit/ [Available online: 12.10.2022]

24 Palmer Tom: *If You're Proud To Be A Leeds Fan.* Mainstream Publishing, 2002. 208 s. ISBN 978-1840185744

of the deaths were caused by internal injuries consistent with trampling and crushing of internal organs. On the playground, too, there was mayhem. Players were writhing on the turf, choking and covering their faces in an attempt to get away from the tear gas. The match was abandoned as players from both teams lay face down on the pitch and had to be treated by paramedics before being escorted off the pitch. The police were blamed for the tragedy as they failed to control the crowd and their reaction was described as appalling and totally over the top.[25]

SOUTH AFRICA

On 11 April 2001, one of the biggest sporting disasters in South African history occurred at Ellis Park Stadium in Johannesburg, South Africa, during a match between local rivals Kaizer Chiefs and Orlando Pirates. An additional 30,000 fans tried to get into the fully occupied stadium, which had a capacity of 68,000 spectators. In fact, the organisers sold up to 120,000 tickets for the match. The crowding fans pressed others against the barbed security fences, resulting in 43 deaths and hundreds of injuries. Untrained security guards, unable to control the crowds, began firing tear gas into the crowd, causing further chaos and panic, making the situation in the stadium even worse, which may also have been the cause of some of the deaths. However, the police have strictly denied these allegations. After finding out what was going on, the match was immediately abandoned. The cause of the tragedy was identified as the uncontrolled and uncontrolled entry of fans by the security services.[26]

KONGO

On 29 April 2001, 14 people were killed in a stampede at the Stade Kibassa Maliba football stadium in Lubumbashi, the home stadium of the Congolese football club FC Saint-Éloi Lupopo. During a match against local football rivals Tout Puissant Mazembe, when TP Mazembe levelled the scores, spectators stormed the pitch and a stampede ensued after police intervened as spectators tried to escape physical police action, leaving 14 fans from both clubs trampled to death.[27]

GHANA

On 9 May 2001, fans watched a match between Ghana's two top football teams, Accra Hearts of Oak and Asante Kotoko, at the Accra Sports Stadium in Ghana. Anticipating crowd disturbances, the organisers took extra security measures, including locking some of the entrance gates to the stadium, in order to better control the flow of fans in the stadium area. Hearts of Oak, the home footballers, put themselves in a winning position with two late goals to take the final 2:1 lead. Disgruntled and disappointed Kotoko fans felt the frustration of having the victory 'stolen' from them at the last minute and began throwing plastic seats and plastic bottles onto the pitch. Police responded by firing tear gas into the crowd, causing mass panic and a stampede as fans

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25 http://news.bbc.co.uk/2/hi/africa/826301.stm [Available online: 07.10.2022]; https://opendocs.ids.ac.uk/opendocs/handle/20.500.12413/6305 [Available online: 11.10.2022]

26 https://www.gkstill.com/Support/Links/Documents/2002-ngoepe.pdf [Available online: 10.10.2022]

27 https://fr.wikipedia.org/wiki/Football_Club_Saint_%C3%89loi_Lupopo#Incidents_lors_des_matchs

tried to flee. 127 fans died in the crush. The fact that several exit gates were locked, preventing people from escaping, also contributed to the tragedy. In addition, the capacity of the stadium in the architectural plan envisaged a larger number of exits, but this plan was not followed during construction and fewer exit gates were built than planned. The Ghana Institute of Architects called the stadium, immediately after its completion, a 'death trap'.

Another interesting case is that of Abdul Mohammed, a fan who fainted from tear gas and, because he was presumed dead, was moved to the morgue. After someone stepped on his foot, he regained consciousness and narrowly escaped being buried alive. The final report of the investigation into the tragedy states that this also happened because the medical staff had already left the stadium, as the incident did not happen until just before the end of the match.[28]

The disaster at the Accra Sports Stadium was the worst disaster ever to occur at a football stadium in Africa and at the same time was the fourth football disaster in Africa in less than one month in 2001. The others were in South Africa, where 43 fans were killed on 11 April, in Congo, where 14 fans were killed on 29 April, and in Côte d'Ivoire, where 39 fans were killed on 6 May.[29]

EXAMPLES OF ULTRAS ACTIVITIES

The largest ultras groups in Slovakia are Slovan, Trnava and DAC.

SLOVAN Bratislava

"Slovan players, the spring part of the season is already knocking on the door and as we have already shared 'IN THE NEW YEAR TO GO', we would like to take it to the stands and do what we all love to do. That's why we're declaring that despite ... measures we disagree with, we will be at the stadium!

Slovan didn't invent these rules, so we won't punish them with our non-participation. Whatever the regime wants, it is now up to each one of us to come to the boiler or the stadium and we don't care if it is by legal means or by skill, by jumping the fence or parachuting, etc... We're not going to support any OP + hyperboost and I don't know what mode, but to cheer for our beloved club! ACTIONS, NOT WORDS!!!"[30]

SPARTAK Trnava

During the 2011/2012 Europa League 3rd Preliminary Round return leg match between Spartak Trnava and Levski Sofia, which took place on 4.8.2011, Spartak's ultras fans at the home stadium in Trnava created a cardboard decoration in Spartak's colours all over the north stand, referring to the heartfelt relationship of every "white angel" to his club. It is considered one of the best ultras presentations in history.[31]

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28 https://www.modernghana.com/news/394137/this-day-in-history-9th-may-2001.html [Available online: 12.10.2022]
29 https://www.modernghana.com/news/394137/this-day-in-history-9th-may-2001.html
30 https://www.facebook.com/Ultras-Slovan-official-335858433893813/events/ [Available online: 01.10.2022]
31 https://ultras.sk/video-ultras-spartak-trnava-v-sezone-20112012/ [Available online: 12.10.2022]

DAC Dunajská Streda

The draw of the Europa League gave Dunajská Streda an attractive opponent, the renowned Polish side, Cracovia Kraków. The latter had already announced before the match that it would sell out its away sector and so it did. But the Ultras from Dunajská Streda did not let themselves be embarrassed on the day of the match 11.7.2019 and prepared support for their club in the form of an eye-catching cardboard box.[32]

Conclusion

The radicalisation of football fans into hooligans or ultras is a problem that Europe and Slovakia have been facing for decades. It is a phenomenon that has accompanied almost all football matches, but it has nothing to do with sport. In fact, according to the current rules of football, violence and disorder do not belong in a football stadium and are punishable by expulsion or a ban for the players. Similar rules apply to football hooligans under the European Convention on Spectator Violence and Disorder at Sporting Events and, in particular, at Football Matches[33], which was adopted in 1985. Despite this, Slovakia has recently become a haven for football hooligans, who come here from other countries to vent their passions. It has long been a problem not only for Slovak hooligans, and the excuse that it is much worse abroad does not stand up either. Poor organisational preparedness in Slovak stadiums and a criticised approach on the part of the control authorities have resulted in massive problems. The riot police at problem matches need several hundred to a thousand men to be able to intervene sufficiently and protect people and property. Despite all this, at the moment it looks like hooligans still have an open door at Slovak stadiums.

Discussion

The presented cases of pathological activities of hooligans before, during and after football matches are not only a deterrent example for the organisers, security forces and rescue teams, but also a stimulating incentive for taking appropriate measures at all levels to ensure the smooth running of sporting events. Many such measures are already in practice, but the imagination and especially the "appetite to hit back" or "to duke it out in a physical man-to-man fight" is steadily increasing, and the speed of taking countermeasures is not keeping pace with the speed of innovation of the aforementioned desires of the hooliganists. Recalling and analysing the causes and consequences of known and dangerous cases, caused by members of the hooligans movement in Slovakia and worldwide, can also be a source of deployment of new tools from the field of information and communication technologies, which can help in organising and ensuring

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32 https://www.ultras-magazine.com/dac-dunajska-streda-cracovia-krakow-11-07-2019/ [Available online: 07.10.2022]

33 http://www.ucps.sk/EUROPSKY_DOHOVOR_o_nasili_a_neviazanosti_divakov_pocas_sportovych_podujati _a_najma_na_futbalovych_zapasoch [Available online: 1.09.2022]. The Slovak Republic has been a signatory to this Convention since 1 July 1993.

a smoother implementation of football matches. A network of monitoring cameras, databases of persons banned from entering stadiums, electronic ticket control, access to the stadium only to the relevant sector and control of personal equipment of spectators entering the stadium can already serve as a supporting tool for the organisers of every sporting event. Of course, there is also artificial intelligence, which, based on the conclusions drawn from the presented cases, can create algorithms providing alternatives for the possible development of fan activities during the course of individual sports matches.

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