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The relationship between human intelligence and artificial intelligence I.

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Abstract

Artificial intelligence (hereinafter referred to as 'AI') as a technology can accelerate the innovation and development of military research. AI is an extensive technology that is connected to other disciplines as well (psychology, cognitive science, information science, systems science, biological science, etc.). Its extensive nature makes it suitable for use in military applications.

Keywords: Artificial Intelligence, Artificial Intelligence Application, Military Artificial Intelligence

Introduction

Once the concepts of intelligence and artificial intelligence have been described by many, this may be the basis for kinding for this article as well. Using the two concepts, in this article, we have made a brief analysis related to the definitions to define the concept of military artificial intelligence. The other main goal was to highlight once again the fact that many people still consider artificial intelligence to be a low level of automation of task execution. Knowing this, it may not be useless for another analysis to promote a uniform interpretation of the concept. Of course, it could not have been the goal to outline the possibility of a final solution, but the questions presented as conclusions could also facilitate development.

The relationship between human intelligence and artificial intelligence

Since the concept of intelligence as the starting point has already been formulated by many, it is not discussed here specifically. Accordingly, we have created just a brief analysis related to the concept in this passage, so that the concept of military AI can be defined. The starting point is human intelligence since it will be the “model” for the artificial intelligence. There are three levels of intelligence that are distinguished:

- computational intelligence (quick calculation and memory skills);
- perceptual intelligence (visual perception, hearing and touching, including computer vision, speech recognition, language and translation);
- cognitive intelligence (comprehension and reaction skills, reasoning and decision making).

All three levels are connected to military objectives. Artillery, technical troops, and military meteorologists can be singled out from the military branches and special forces that perform computational tasks. The perceptual level can be of great importance for any task to be performed in the operation area. For example, it can be connected to sniper-, reconnaissance- and chemical defense teams. The cognitive level also has a manifold connection as it plays a role in all levels of decision making of commanders. In conclusion, we should emphasize that military AI can provide a useful opportunity for all military branches and special forces to develop during the execution of peacetime- and “combat” missions.

Another way to categorize intelligence is technological classification, which includes the following groups:

- searching solution (search technology);
- conclusion drawing (conclusion method and verification strategy);

- machine learning (implicit models or mass sample data).

Searching solution starts with problem mapping and ends with problem solving. Different search technologies can usually be used in this process, but the main question is whether they all can be applied during the execution of military missions. (Such technologies are Breadth-First Search (BFS), Depth-First Search (DFS), Uniform-Cost Search (UCS), Iterative Deepening Search (IDS), Min-Max Search, Alpha-Beta Pruning, Monte Carlo Tree Search (MCTS), Best-First-Search and A* Search.)

In the case of the next group, **conclusion drawing**, the question of it being useful for soldiers should not arise. Each of its three forms (*fuzzy logic, rule learning and expert systems*) contains elements that could help quick and accurate decision making. In fact, in the case of fuzzy logic, we can speak of a whole family of theories that have manifold applications. Applications of fuzzy logic are widely used in automation technology, professional business, medical technology, consumer electronics, automotive industry, etc. Fuzzy logic is often useful if the mathematical description of a given issue is unavailable, or it cannot be formulated, or it can be but only with excessive input, however, its informal, verbal or written description is available. In cases like this, a mathematical formulation or description can be obtained with the help of fuzzy logic that uses the sentences and rules of normal human speech, and those later can be used on computers as well.

The second form is *rule learning*. A rule is a kind of objective guideline or domain concept that has pure semantics and can describe data distribution. A rule can be described with an “if ... then” statement. The rule learning happens by using the already available experiences (data). The machine recognizes a series of rules and distinguishes them from unknown examples. The aim of rule learning is to create a set of rules that can cover as many samples as possible, thus the sequential covering can be a commonly used scheme. Armies always operate based on predefined rules. Having these rules corrected and adapted to different planned missions by using AI could be of great help for commanders when making decisions.

The third form includes *expert systems*. Expert system is a combination of large volumes of program systems, expertise, and experience. It uses AI technology and the computer’s technology to perform its reasoning and decision making. Therefore, expert system is a computer program system that simulates human expertise to solve problems. Its basic components are the knowledge base, the inference engine, and the working memory.

Machine learning is an application of Artificial Intelligence (AI) that deals with systems that are able to learn, i.e. generate knowledge based on experience. In practice, this means that the system

is able to recognize/define regularities/rules on its own or with human assistance, based on sample data and models. This means that the system not only memorizes the models, but is able to generalize based on them, and when the learning process is complete it can make the “right” decisions even in the case of unknown data. Machine learning is basically a type of perceptual thinking in which intuition can be developed by using mass sample data. Using perceptual thinking, commanders are not only capable of evaluating the adversary’s possible movement and positions but can also make quick decisions based on intuition gained from experience. The issue with this is that the process tends to have false judgements when the adversary does the opposite of what was expected. (This can happen in the case of (“human”) decisions made by commanders as well.)

Machine learning includes the following:

- Supervised Learning;
- Unsupervised Learning (data mining);
- Reinforcement Learning;
- Deep Learning.

Supervised learning is one type of the learning process. In this case, many sample inputs and the corresponding, expected outputs are available for the system. The system tries to learn a function that is suitable for mapping the sample data and has an adequate generalization ability. In the case of **unsupervised learning**, the model is not supervised. It works on its own when predicting the results. Machine learning uses algorithms to draw conclusions from unlabeled data. The unsupervised learning algorithms are usually more difficult than the supervised ones, because there is little information. Cluster analysis is a type of unsupervised learning. It can be used to group unlabeled data with the help of algorithms. In the case of **reinforcement learning**, the model learns by receiving reward if getting a right prediction, and receiving punishment if getting a wrong prediction, so it is an independent, self-teaching system. Reinforcement learning follows a specific methodology and determines the best methods to reach the best result. **Deep learning** has been dominant in the last few years of artificial intelligence research, almost the entire discipline concentrates on learning algorithms and learning systems. It seems that this research period of AI that has realized many results can end soon.

Military artificial intelligence

The purpose of this chapter is to formulate the concept of military artificial intelligence based on the previous chapter.

Four facts help us formulate the concept of AI relevant from a military point of view. **First of all**, military AI and artificial intelligence in general cannot exist in a vacuum, i.e. separated from other AI applications. They strengthen each other, take advantage of the effects of their existing advanced abilities, thereby reducing the decision making time frame connected to warfare. **Secondly**, military AIs can affect stability, deterrence, and escalation if the state realizes their functionality and abilities. In the case of nuclear policy, interpreting the adversary's capabilities and intents in a broader sense based on deterrence and strategic calculations is as important as their actual capability. Besides the importance of military capabilities and doctrines, AI has a strong cognitive element as well that increases the possibility of incidental misunderstanding and future escalation resulting from that. **Thirdly**, the increasingly competitive and controversial nuclear arsenal will confuse the destabilizing effects of AI, however, it will increase the risk of escalation of future warfare between major military powers. Developmental and strategic advantages offered by AI-enhanced abilities might prove to be irresistible for strategic rival states that have nuclear weapons. Motivation to exploit the limits of AI increases between rivals which endangers the safety of technological preparedness on the digital battlefield of the future. **Lastly**, in this context, inadequate geopolitical background and the known strategic advantages of AI most likely attract states to transfer technologies. The importance of military artificial intelligence is supported by the words of President Donald J. Trump: "American leadership in AI is of paramount importance to maintaining the economic and national security of the United States".

Military AI applications can be broadly categorized and linked to civil applications. These can be useful primarily in the operational and strategic level of warfare. On an operational level, applications include autonomous weapons and robotics (especially drawing drones), data-driven modeling, analyzing intelligence, mobile missiles, submarines, planting of mines, and moving and observing troops. On a strategic level, applications include intelligence gathering, assessment, reconnaissance, and commanding. In addition, electronic warfare and defensive cyber capabilities can be developed using artificial intelligence to advance communication, C3I systems, enhanced missile defense, automatic target detection improved by machine learning, control systems, conventional precision missile munitions and air defense. Although the potential strategic effects of military AI are usually not spectacular and may not be limited to the use of this technology, the trend



suggests that they may pose a serious problem in the pessimistic approach of examining instability-stability.

Summary

This publication is for two purposes. In the first chapter, we examined the relationship between human intelligence and artificial intelligence. Having established that AI follows human intelligence, it has also become apparent that the technological classification of intelligence can also be applied to AIs. In the second part of the first chapter, we summarized what search solutions, inference methods, and control strategies we can apply to AIs. In the third part of the chapter, we examined the possibilities of machine learning. Our findings provided the basis for further investigation of military AI systems, which we continue in the second part of the publication with the possibilities of task automation and the relationship between automation and AI.

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Post-disaster rehabilitations – Hungarian characteristics

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Abstract

Following the most widespread natural disasters, the Government has often provided ad hoc voluntary financial support to municipalities to assist the affected local populations. The mode of mitigation and the subsidy system were previously regulated by individual government decisions and later by individual government decrees, which have now been replaced by uniform regulations on rehabilitation and reconstruction of buildings.

The author of this paper aimed to analyze the practice of rehabilitation of private and municipality owned buildings and structures in Hungary.

Keywords: disaster, disaster management, compensation, residential property

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Introduction

Due to the geographical location and characteristics of Hungary, climate change is also an increasing threat to society and to the national economy and compels us to take action. [1]

According to multifaceted analyses, significant changes in the temperature and precipitation conditions in the coming decades, the intensification of certain extreme weather phenomena and their increasing frequency will endanger our natural values, the yields, our buildings, the health and quality of life of the population. [2]

It goes without saying that preparation should include the elimination of the consequences of natural disasters, the normalization of living conditions, the uniform regulation on rehabilitation that can be tracked in the long term, and the consistent enforcement of the regulations. Safety and security must also play an increasingly important role in shaping the built environment. [3]

Looking back over the last one and a half decades, the homes of thousands of families in Hungary were destroyed or damaged as a result of repeated natural disasters - primarily floods, inland waters, windstorms, heavy rainfalls. Creating and restoring basic housing conditions often exceeded the financial means of those affected. Following the most widespread natural disasters, the Government repeatedly provided ad hoc voluntary subsidy to local governments to help the affected local population. The mode of mitigation and the system of subsidy and support were previously regulated by individual government decisions and later by individual government decrees. A significant progress was made in establishing a general legal framework for rehabilitation and reconstruction a few years ago. Rules relating to rehabilitation and reconstruction in Chapter XI of Gov. Decree 234/2011 on the implementation of Act CXXVIII of 2011 on Disaster Management and on the Amendments of Certain Acts in Relation (hereinafter: Act on Disaster Management) have established a procedural order and a regulated directional system bound to case-by-case decision-making. [4] [5]

Methods

In this paper, a secondary research was performed by the author. During this secondary research, literature review and report content analysis I was implemented with a focus on the characteristics of post-disaster rehabilitations and benchlearning opportunities connected to Hungary's recent floods.

1. EXPERIENCES FROM REHABILITATION ACTIVITIES IN HUNGARY

Natural disasters, widespread damages and consequences thereof can be found in all known periods of history. Closely related to them there are written memories and records of the circumstances of imputability, responsibility and immunity, or forms of support and assistance, the latter, often found in the sources, linked to the person or persons representing the state power dependent on the social system. Some sources have also mentioned examples that can be found in the following case studies; its elements and lessons have been adopted. It is considered important that some of the examples examined in this paper, related to the expressions vis: force, violence; vis maior (literally greater force), in English Act of God or using the French expression “force majeure”: an irresistible incident, provide a basis for explaining the circumstances following natural disasters. [6]

Even in ancient times, in the Babylonian law one can find in the early records and in the Hammurabi Code, known as the collection of common law and acts, which referred to the consequences of natural or divine disasters, and offered the possibility of exemption from liability, for example, from repaying debt. As agricultural farming was typical in the Mesopotamian areas, agricultural law is naturally widely dealt with. [7]

"If a person is liable to pay interest and his cultivated field is flooded by god Ramman or the flood destroys it or in the absence of water no grain grows, he is not obliged to reimburse the grain in the given year or pay interest of the year in question." The law dealt with the compensation or indemnification of damages caused by animals or those caused by herdsmen in the livestock. [8]

From the beginnings of Hungary, one of the first laws of our statehood already contained examples of replacing destroyed or perished goods. Chapter 7 of the First Book of the Decrees of King Saint László (Ladislaus) already provided for the construction of churches destroyed in war times: Churches perished or burnt in wartime shall be rebuilt by the believers at the command of the king; to buy chalets and dressing gowns at the king's expense; books should be provided by the bishop.

Based on former Government Decisions and Government Decrees and such activities organized by the Ministry of the Interior, the concept of rehabilitation and reconstruction now means the elimination of the consequences of natural disasters and serious accidents. [9]

Residential housing for people who were left without shelter or with homes seriously damaged due to natural disasters, serious accidents – the rehabilitation of privately owned residential buildings, the construction of new buildings, purchase of homes, granting the rent of municipal housing,

placement in homes for the elderly, etc. - with the exception of the elimination of the damages caused by the flood on the Tisza River (Bereg) in 2001, and then by the red sludge disaster in 2010 – were organized by the local governments. Within this framework, the level and the method of support or subsidy for each victim was decided.

The government provided budget subsidy for this municipal activity. The relevant Government Decisions basically reflected the fact, purpose, amount and numerical amount of the subsidy, but they did not stipulate any tasks or request to the local governments, but only gratitude for the protection efforts, or perhaps requesting them to use their own resources to support the victims. Following the flood on the Tisza River (Bereg) in 2001, the mitigation took place in the form of service providing, centrally organized. The role of local governments in rehabilitation and reconstruction was superficial, and was not reflected in the relevant Government Decisions.

2. THE ANALYSIS OF THE LEGAL REGULATION

In order to understand the process of mitigation following natural disasters, it is essential to define the concepts of damage, compensation for damages and claims. As a general rule, the person who caused the damage unlawfully and imputably, that is, the person who causes damage to another, is liable for the damage compensation. In view of the nature of the natural disasters, there is no accountable damaging entity in this case.

The legal basis for modern compensation was laid down by nature lawyers (Hugo Grotius and Christian Thomasius), the general clause first defined by them and was included in most civil codes since the Napoleonic Code Civil. Compensation thus followed the principle of the rehabilitation of the original state, that is, the victim must be put in a position as if the damage had not occurred. One of the basic ways of compensating for damages was that the damaging entity repaired or returned the damaged item, that is, compensated it in kind, or, in the absence thereof, provided monetary compensation. If cash compensation did not appear to be appropriate, different types of compensation in kind may have occurred. [10]

Damage, in its most general form, was a reduction in wealth, of which two types were distinguished, first, when the decrease in wealth was due to the destruction of certain assets, or the loss of a benefit or profit that they could legitimately and thoroughly expect. The obligation to mitigate was already present in Roman law, which meant that the damaged entity was also obliged to participate in the prevention or reduction of the damage and, if he did not do so, had to bear the additional damage himself.

There is no generally accepted technical term for force majeure (*vis maior* in Latin) in Hungarian. No one shall be liable for force majeure, unless a person assumed the occurrence of an incident in a contract, or if a person is imputable that thing (item) was exposed to force majeure. In addition, a late debtor, a thief, a certain specific individual service-provider, a debtor in debt with an unusual business contract or a generic service, and the interested debtor who gave priority to their own things in a disaster during rescue activity are liable for force majeure. In the case of force majeure, the general rule of bearing damage by a proprietor prevailed. It should be noted here that the insurer, guarantor, etc. bears an unconditional liability for force majeure, the insurer is not liable for force majeure, not even for the indemnification of the insurance, because it pays it; it is not a liability issue. Liability is established where delinquency can be ascertained, e.g., the insurer does not pay. In modern legal literature, force majeure is addressed outside liability, in the framework of hazard-bearing. [11]

Liability is usually based on imputability, while hazard-bearing is subject to special regulations. The proprietor is entitled to use the thing and reap the benefits of the thing. The proprietor is obliged to bear the hazards of damages, to indemnify which no-one can be obliged. If the damage was unlawfully and imputably caused by a third party, it will be obliged to fully compensate the proprietor. If the damages were lawfully caused by a third party, full indemnification shall be borne, and if the proprietor has concluded insurance policy for the thing, the loss incurred shall be reimbursed by the insurer.

The proprietor, in a state of emergency, is obliged to tolerate the use or utilization of a thing or the damage thereto to the extent necessary to eliminate the state of emergency. State of emergency is a situation when the life or property of another is in imminent danger and this danger cannot otherwise be prevented. If only their property is threatened, the proprietor shall only be obliged to tolerate the damage if the threatening damage is foreseeable to be significantly greater than the damage, to which the proprietor would be exposed as a result. If the conditions for the state of emergency are met, the damage is legitimate, if not (that is, if any condition of a state of emergency is missing), it is unlawful.

In a state of emergency, causing damage is not unlawful though, however, the proprietor may claim indemnification from a person falling into a state of emergency – and not from the person causing the damage; and from the person who caused an unjustifiably high damages to a property during the elimination of a state of emergency, compensation may be claimed by the proprietor.

The prohibition of dual compensation for damages can be set against the prohibition of abuse of rights. The forms of appearance of the prohibition of dual compensation for damages are the remnant, the value replacing it, and the domain of negligence of the imputable mitigation and damage prevention obligations of the damaged entity. If the property still has a market value, damaged as a result of the conduct of the damaging entity, full compensation for the damage can only be claimed from the person responsible for the damage if the damaged entity concurrently surrenders the remnant to the person liable for the damage. In other words, the amount of compensation is reduced by the value of the remnant. By neglecting the resulting damage, mitigation and damage prevention obligation may not be calculated in the amount of the compensation either, since, by this, the damaged entity would gain benefits due to their imputable conduct. [12]

The basic measure of the distinction between compensation and indemnification is unlawfulness. Indemnification is a means of redressing lawfully caused damages, while the prerequisite for awarding compensation is the unlawfulness of the conduct of the damaging entity. The function of compensation is rehabilitation, the elimination of detriments already occurred, while indemnification protects against some detriments. Indemnification is not an automatic form of redressing, opposite to compensation. The extent of indemnification does not necessarily cover the total damage suffered by the damaged entity. The claim for compensation always precedes the claim for indemnification. Compensation already granted excludes indemnification claims because of the prohibition of dual compensation for damages. Indemnification may be claimed for activities in the public interest and therefore, it is not compensation.

The damaged party is required to act in a manner that would normally be expected in a given situation in the prevention and mitigation of damages. It is significant that only the conduct of or the negligence by the damaged entity that is actually causal in relation to the damage that occurred and may have contributed to the occurrence of the damage is relevant. There is no need to compensate for the part of the damage that resulted from the damaged entity's failure to fulfill this obligation of theirs. In any case, the influence of the damaged entity shall be imputable, only in this case can it be regarded as a mitigating factor on the part of the damaging entity.

3. THE INTERPRETATION OF FORCE MAJEURE AT PRESENT

For an incident to be force majeure, three conditions must be met. One is the combination of irreversibility, the other is the combination of unpredictability and, ultimately, imputability. It may be noted here that in the sources the term force majeure is unclear and its interpretation is controversial in the literature. The Hungarian legislation provides a more precise definition within

the framework of government decrees on the detailed rules for the use of force majeure subsidies, due to the general conditions of force majeure subsidies for local governments and the force majeure subsidy of justified and necessary protection-related expenditures.

The relevant legislation applies the cases of threat of danger from both natural and non-natural forces for the purpose of recovering, in whole or in part, buildings owned by local governments, national minorities or municipalities, support of the rehabilitation of damages caused by force majeure incidents and the partial reimbursement of costs related to the extermination of mosquitoes by the disaster management and the procedure for applying for the assistance. Previous regulations even included the concept of force majeure as an independent concept, according to which an incident caused by natural forces, the occurrence of which, on the one hand, is unpredictable and, on the other, human intervention, is insufficient to prevent it. At the same time as the law changes, the definition of the term can be found not as interpretation, but as the name on which the subsidy is based.

4. METHOD OF MITIGATION

In the Act on Disaster Management, the Government is authorized to issue a decree on the rules relating to the area affected by the damaging effects of a disaster, as well as rehabilitation and reconstruction, as natural disasters are expected to continue in the future. Starting from the extraordinary Danube flood wave in 2013, with ever-increasing impacts, and in the foreseeable future mass damages may occur, which require and may justify state involvement in the creation of basic housing conditions for the masses who are left without shelter

Gov. Decree 234/2011. (XI.10) on the implementation of the Act on Disaster Management, by establishing its rehabilitation regulation, took into account the traditional functions of the state in the narrower sense, as well as its social functions in the broader sense. It did not indicate a specific financial source, the reason for this is undeniable, since, according to the practice so far it has earmarked the coverage of the decision according to the given damage incidents from the budget law of the given year, primarily from the decentralized fund. Rehabilitation activities, by assuming a decision, may incur a guarantor's obligation. [13]

An essential element of the regulation is that it is applied to proprietors of properties damaged not only by natural disasters but also by other man-made disasters. However, the relevant regulation does not regulate the amount of the subsidy and the mortgage or the duration of the prohibition on alienation and encumbrance. This is because, for the reasons already explained, state mitigation is outside the scope of civil law, so, its extent depends on the Government's ad hoc decision and the capacity of the budget. Consequently, it would not have been appropriate to lay down in the

Regulation a cogent set of rules on the level of the subsidy. At the same time when defining the amount of mitigation assistance provided by the state, it is justified to establish a value-based mortgage and a prohibition on alienation and encumbrance.

5. THE STUDY OF THE ELEMENTS OF REHABILITATION

The definition of rehabilitation subsidy for private individuals presupposes a benchmark that quantifies, on the one hand, the amount of the extent of subsidy and the extent of subsidy is compared to the damage value, established and paid by the insurer, and it takes into account the numerical value of the damaged entity's social situation and own funds.

There are several ways of calculating subsidy in connection with rehabilitation carried out so far. One way of doing this is to determine the percentages of municipal allocations, such as the value of damage to the property of individual victims in the case of the 1999 or 2006 mitigations, and other conditional municipal allocations, which may be modified by the municipal social decree. The other method of calculation is the sum of the damage value per square meter damaged, which may be the difference between the damage value and the actual rehabilitation value.

The use of calculation methods is made more difficult by the fact that proprietors' subsidies for privately owned residential properties can be provided by means of social and housing subsidies, in accordance with local regulations of the municipalities. The calculation may also be complicated by the differences between the construction characteristics of the rehabilitation work, the disorderly ownership, the property registered and the actual conditions.

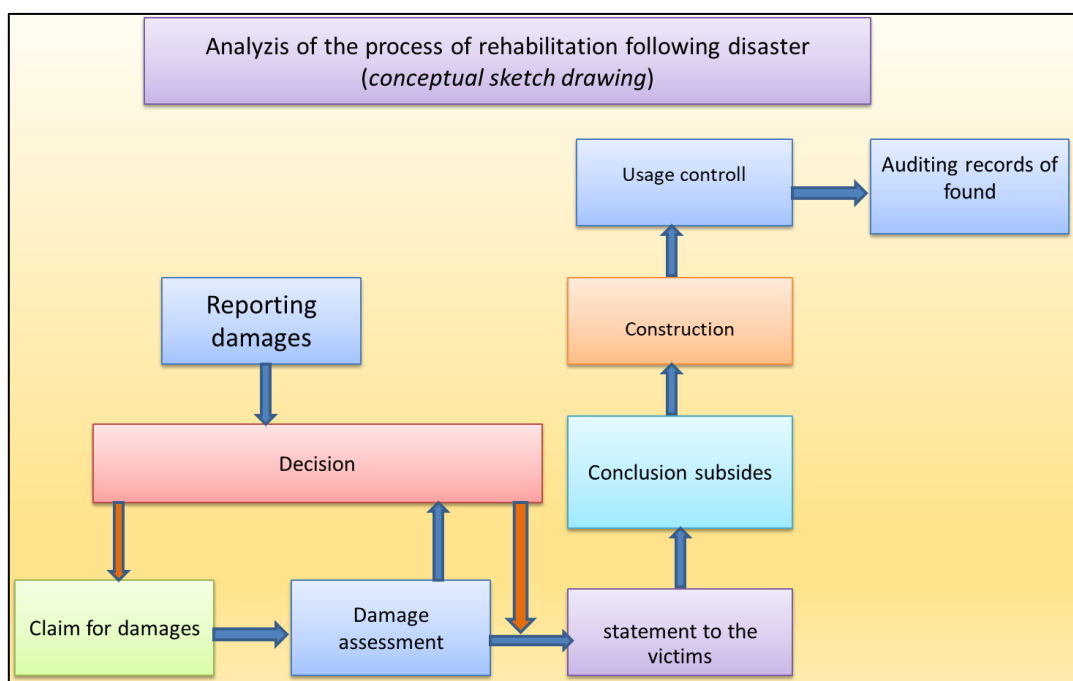


Figure 1: Analysis of the process of rehabilitation (done by the Author)

The basic aim of rehabilitation of damages caused by natural or other hazards is to normalize daily life, at least to reach the pre-disaster conditions. The purpose of the rehabilitation of damage to municipal-owned buildings follows the principle of self-governance, to achieve the ability to re-perform mandatory municipal duties. The purpose of rehabilitation of damages to privately owned residential properties is to provide basic housing for the persons in need.

Taking into account the mitigation practices so far, the main purpose of the subsidies remained to provide the living conditions of the persons in need, whose properties were classified as residential property at the time of the accident, in terms of ownership. Non-residential buildings, residential but other properties, rented properties, non-residential premises' rehabilitation, privately owned but not habitable residential properties are still excluded.

6. SUBSIDY OF THE REHABILITATION MUNICIPAL PROPERTIES

A different approach is needed for the procedural order stipulated by Gov. Decree 9/2011. (II.15) on the detailed regulation of the use of force majeure subsidies. The subsidy fund is designed to deal with damages caused by extreme weather, and currently provides subsidy for the rehabilitation of damages caused to municipal property.

The force majeure subsidy covers, in whole or in part, the costs of protection justified and necessary in the event of a natural disaster, in case of buildings, structures, cellars or embankment owned by the local government or a public service-providing building owned by the state. Partial subsidy is allocated for the rehabilitation of damages caused by force majeure and for covering the costs of mosquito extermination by the disaster management. The EBR42 system, developed specifically for this purpose, supports the notification and submission of claims and the transmission of the results of on-site inspections electronically.

The EBR42 Municipal Information System is a web-based process tracking system developed and operated by the Ministry of the Interior to support the operation of municipalities, support tenders and applications, and performs financial-controlling-accounting tasks. In most cases, force majeure subsidies of municipalities were needed to eliminate the consequences of floods and inland waters. An important consequence of excess water is the development of mosquito larvae in general and the mass proliferation of mosquitoes that threaten the well-being and public health of the population.

Conclusion

There is no responsible entity for the occurrence of natural disasters or for the elimination of their consequences. Taking into account the nature, the members and the functions of the definition

of the State, laid down in the Fundamental Law, it can be ascertained that the State is not liable for natural disasters. According to the ownership rules contained in the Fundamental Law, the property of local governments is public property, which serves to fulfill their duties. The property of the State and local governments is national property, the proprietor may act for the benefit of their own property.

The need for predictability and forecastability of hazard factors and disasters, as well as for the transmission of data as fast and accurately as possible, is present in all periods of history. The technical tools for forecasting and their subsystems, the analysis of data, the definition of the content of information in relation to natural phenomena are indispensable in today's integrated organizations and the system of disaster management [14]; its social necessity is indisputable, since all citizens and persons have the right to learn about the applicable rules of protection, and have the right and duty to contribute to disaster management.

The procedural rules set out in the relevant regulations in force serve well the aim, in case of private housing and municipal buildings, to create the basic housing conditions for people without shelter or living in damaged properties, the remediation of problems arising on the basis of past practical experience in the rehabilitation of municipal-owned public buildings. At the same time, the regulatory area is completed by defining guidelines on the possible prevention.

In the case of natural disasters, taking into account decisions on mitigation to date, the concept of mitigation can be defined as a contribution made through budget subsidy, based on the Government's welfare service function and its ad-hoc equity decision-making power. The purpose of the subsidy is to provide housing for proprietors living in the damaged residential buildings at the time of the incident, and to ensure the continuous operation of public utilities in their facilities.

Rehabilitation tasks can and must be prepared for. Although the guidelines for rehabilitation in Hungary are in separate legal sources, but they can be found. Significant progress has been made in establishing a general legislative framework for rehabilitation and reconstruction. [15]

Rules on rehabilitation and reconstruction related to private property, stipulated in Chapter XI of Gov. Decree 234/2011. on the implementation of the Act on Disaster Management, established a procedural order and a controlled management system bound to decisions that do not exclude individual liability and the need for self-care (insurance, own and other resources). Gov. Decree 9/2011. (II. 15.) on the detailed rules for the use of force majeure subsidies may be available as a fund to support and subsidize the rehabilitation of municipally owned buildings to facilitate continued institutional operation. Placing the Act on Disaster Management on a new foundation provided an



opportunity for exercising of preventive authoritative duties, and for exercising control and supervision powers, and for enforcing and complying with the guidelines of the regulation.

For this, the possibility of establishing a separate National Rehabilitation Financial Fund and a coordinating organization may be envisaged, in coordination with spatial planning, construction and heritage protection policies, for further research. The present paper took into account the Hungarian guidelines, based on which the statutory guidelines and procedures for rehabilitation were developed. An important step forward concerning further research is the mapping of international practice, especially for individual EU Member States. It is particularly important to further develop tertiary education in this field, which can be acquired at the Institute of Disaster Management, Faculty of Law Enforcement, University of Public Service.

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Analysis of the extra time of matches in the knockout phases of the Champions League and the Europa League

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Abstract

For analysing and illustrating our hypotheses, we examined the extra time of the matches in the knockout phases of the tournaments called the Champions League from the 1992/1993 announcement and the UEFA Cup (later the Europa League) from the same announcement. Based on the analysis of the matches examined, we created diagrams and tables to find answers to our assumptions. Out of 7,529 matches played over 27 years, a total of 4,052 matches were played in the group stages, compared to 3,477 in the knockout phases. Out of 3,477 matches in the knockout phases, in 162 the advancing team advanced by away goal(s). The 5 % ratio seems to be extremely low, so the question arises as to whether the importance of away goals should be examined year after year. Out of 3,477 matches played, 121 were not decided in normal time, in these cases 2 x 15 minutes of extra time followed. The 3% rate can be said to be extremely low, which shows that clubs in a significant proportion of duels strive to decide the duels by the results of the two matches. Out of 121 matches, the home team won in 33 matches compared to the 30 matches won by the visiting team, and the remaining 58 matches were decided by penalty shootouts. The combined data of the two announcements clearly show that in case of extra time, the teams will play for the penalty shootouts. In contrast, the number of home-guest successes is highly balanced.

Keywords:

Introduction

There have been a lot of research and testing on football and its various fields in recent times, whether we look at the technical [1], tactical [2] or conditional [3] factors of youth training, or we consider the same areas in the case of adult football[4] [5] [6]. Henceforward, all these are grouped according to different world tournaments [7] [8]. In this study, the matches of the Champions League and the Europa League will come under scrutiny.

The group stage matches of the Champions League and the Europa League are followed by the match-rematch knockout phases matches. Based on the result of the two matches, the advancing team is announced, except when the final outcome of the two matches is a draw. In duels resulting in a draw after the two matches, the away goal rule (by which we mean: in case the match-rematch result in a draw, the team scoring more goals when the opponent has chosen side is favoured by this rule) governs which team advances. In other cases, if no decision is made based on the two matches, there may be extra time, previously called sudden death, which may have three outcomes. In one case, one of the teams scores more goals than their opponent and wins the duel, in another case, the extra time ends in a draw and the match goes into penalties shootouts because no goal has been scored, or one of the teams advances with a goal scored away. The raison d'être of the extra time has been questioned several times over the years, but the extra time is still alive on the basis of the tournament announcements currently in force. Out of the three possible outcomes, the rule of the away goal scored in extra time is the most unfair. We believe that extra time is due to two matches, not just to the result of the second match, so the away goal rule should no longer apply in extra time.

Hypothesis

We were looking for the answer to the question which team is favoured by extra time. The team playing home or maybe the visiting team, who has a big advantage due to the goal scored away or both teams prefer, due to the pressure sudden death and play for penalty shootouts.

We have formulated three main hypotheses:

1. *In extra time, the team choosing which goal to attack has more chances to advance.*
2. *In extra time, the visiting team has more chances to advance due to the away goal rule.*
3. *In 70% of extra time, teams strive to achieve penalty shootouts.*

Methods

For analysing and illustrating our hypotheses, we examined the extra time of the matches in the knockout phases of the tournaments called the Champions League from the 1992/1993 announcement and the UEFA Cup (later the Europa League) from the same announcement. Based on the analysis of the matches examined, we created diagrams and tables to find answers to our assumptions.

Observation aspects:

- how many matches ended in extra time in the knockout phases;
- what percentage of matches followed by extra time ended with home success;
- what percentage of matches followed by extra time ended in guest success;
- what percentage of matches followed by extra time ended in penalty shootouts.

Results

The table, compiled from 7,529 matches played over 27 years (Table 1), shows clearly how the two most prestigious Cups in Europe resulted in the knockout phases following the group stages over the years. Following the table, I visualize on a diagram the ratio of the home and away victories of the matches played in the knockout phases of the tournaments, on the basis of which I can get an answer to my hypotheses.



Champions League	Total matches:	Group matches:	Matches in the knockout phases	Advanced with more goals scored:	Goals scored away:	Decided in normal time:	After extra time.:	Replay:	Home success:	Guest success:	Decided by penalties:
92/93	74	44	30	28	2	29	1	1	1	0	0
93/94	75	24	51	49	2	50	1	0	1	0	0
94/95	61	32	29	28	1	29	0	0	0	0	0
95/96	61	48	13	13	0	13	0	0	0	0	0
96/97	61	48	13	13	0	13	0	0	0	0	0
97/98	85	72	13	11	2	12	1	0	1	0	0
98/99	85	72	13	13	0	13	0	0	0	0	0
99/00	157	144	13	12	1	12	1	0	1	0	0
00/01	157	144	13	11	2	12	1	0	0	0	1
01/02	157	144	13	12	1	13	0	0	0	0	0
02/03	157	144	13	9	4	11	2	0	0	1	1
03/04	109	96	13	11	2	13	0	0	0	0	0
04/05	125	96	29	25	4	26	3	0	1	0	2
05/06	125	96	29	26	3	29	0	0	0	0	0
06/07	125	96	29	24	5	27	2	0	1	0	1
07/08	125	96	29	25	4	25	4	0	1	0	3
08/09	125	96	29	26	3	28	1	0	0	0	1
09/10	125	96	29	27	2	29	0	0	0	0	0
10/11	125	96	29	28	1	29	0	0	0	0	0
11/12	125	96	29	24	5	25	4	0	1	0	3
12/13	125	96	29	27	2	29	0	0	0	0	0
13/14	125	96	29	27	2	28	1	0	0	0	1
14/15	125	96	29	26	3	27	2	0	0	1	1
15/16	125	96	29	25	4	26	3	0	1	0	2
16/17	125	96	29	28	1	29	0	0	0	0	0
17/18	125	96	29	27	2	29	0	0	0	0	0
18/19	125	96	29	25	4	28	1	0	1	0	0



Champions League	Total matches:	Group matches:	Matches in the knockout phases	Advanced with more goals scored:	Goals scored away:	Decided in normal time:	After extra time.:	Replay:	Home success:	Guest success:	Decided by penalties:
92/93	74	44	30	28	2	29	1	1	1	0	0
93/94	75	24	51	49	2	50	1	0	1	0	0
94/95	61	32	29	28	1	29	0	0	0	0	0
95/96	61	48	13	13	0	13	0	0	0	0	0
96/97	61	48	13	13	0	13	0	0	0	0	0
97/98	85	72	13	11	2	12	1	0	1	0	0
98/99	85	72	13	13	0	13	0	0	0	0	0
99/00	157	144	13	12	1	12	1	0	1	0	0
00/01	157	144	13	11	2	12	1	0	0	0	1
01/02	157	144	13	12	1	13	0	0	0	0	0
02/03	157	144	13	9	4	11	2	0	0	1	1
03/04	109	96	13	11	2	13	0	0	0	0	0
04/05	125	96	29	25	4	26	3	0	1	0	2
05/06	125	96	29	26	3	29	0	0	0	0	0
06/07	125	96	29	24	5	27	2	0	1	0	1
07/08	125	96	29	25	4	25	4	0	1	0	3
08/09	125	96	29	26	3	28	1	0	0	0	1
09/10	125	96	29	27	2	29	0	0	0	0	0
10/11	125	96	29	28	1	29	0	0	0	0	0
11/12	125	96	29	24	5	25	4	0	1	0	3
12/13	125	96	29	27	2	29	0	0	0	0	0
13/14	125	96	29	27	2	28	1	0	0	0	1
14/15	125	96	29	26	3	27	2	0	0	1	1
15/16	125	96	29	25	4	26	3	0	1	0	2
16/17	125	96	29	28	1	29	0	0	0	0	0
17/18	125	96	29	27	2	29	0	0	0	0	0
18/19	125	96	29	25	4	28	1	0	1	0	0
Total:	3114	2452	662	600	62	634	28	1	10	2	16



Europa League	Total matches:	Group matches:	Matches in the knockout phases	Advanced with more goals scored:	Goal scored away:	Decided in normal time:	After extra time	Replay:	Home Success:	Guest Success:	Decided by penalties:
92/93	125	0	125	122	3	122	3	0	0	1	2
93/94	125	0	125	121	4	119	6	0	5	0	1
94/95	125	0	125	117	8	119	6	0	3	1	2
95/96	125	0	125	122	3	121	4	0	0	3/2*	1
96/97	125	0	125	121	4	121	4	0	1	1	2
97/98	125	0	125	119	6	122	3	0	2	1	0
98/99	125	0	125	125	0	122	3	0	0	0	3
99/00	205	0	205	198	7	200	5	0	0	1	4
00/01	205	0	205	199	6	197	8	0	2	4	2
01/02	205	0	205	200	5	200	5	0	0	1	4
02/03	205	0	205	196	9	197	8	0	0	5	3
03/04	205	0	205	205	0	199	6	0	1	1	4
04/05	141	80	61	58	3	59	2	0	0	1	1
05/06	141	80	61	57	4	59	2	0	1	1	0
06/07	141	80	61	59	2	58	3	0	1	1	1
07/08	141	80	61	57	4	58	3	0	0	0	3
08/09	141	80	61	57	4	57	4	0	1	1	2
09/10	181	120	61	57	4	58	3	0	1	2/1**	0
10/11	181	120	61	56	5	61	0	0	0	0	0
11/12	181	120	61	57	4	60	1	0	1	0	0
12/13	181	120	61	59	2	59	2	0	1	0	1
13/14	181	120	61	59	2	58	3	0	1	0	2
14/15	181	120	61	60	1	60	1	0	0	0	1
15/16	181	120	61	59	2	59	2	0	0	1	1
16/17	181	120	61	59	2	59	2	0	0	1	1
17/18	181	120	61	57	4	60	1	0	0	1	0
18/19	181	120	61	59	2	58	3	0	2	0	1
Total:	4415	1600	2815	2715	100	2722	93	0	23	28	42



Champions League / Europe League:	Total matches:	Group matches:	Matches in the knock-out phase	Advanced with more goals scored:	Goal scored away:	Decided in normal time:	After extra time	Replay:	Home Success:	Guest Success:	Decided by penalties:
92/93 - 18/19	7529	4052	3477	3315	162	3356	121	1	33	30	58

Table 1: Table compiled from 7529 matches played over 27 years



: the highest value in the column

: the lowest value in the column

* : in 2 out of 3 cases, the guest advanced with a goal scored in extra time

** : in 1 out of 2 cases the guest advanced with an away goal

UEFA Champions League:

Since the 1992/93 announcement of the Champions League, a total of 3,114 table matches have been played by Europe's outstanding club teams, out of which 662 have been played in the knockout phases. The ratios show well that more than two-thirds of the matches take place in group stage. It is a characteristic of the group stage matches that in many cases elite clubs only want to get through them with half steam so that they can then make a lasting impression in the major knockout phase. The organisation system has changed several times over the years, but since the 2004/2005 announcement the ratio of group stage and knockout phases matches has remained unchanged, with 96 table matches per year and 29 matches in the knockout phases.

Out of 662 matches in the knockout phase, 62 games ended with the advancing team scoring an away goal. The 10% advancement rate due to a goal scored away seems to be very high. The justification of the away goal rule is being disputed by many nowadays, so the idea of abolishing it returns year by year. Year after year, it can be observed that in the 29 matches, there are almost always 2-3 matches where one of the teams advances due to scoring more away goals. The 2006/2007 and 2011/2012 tournaments stand out from the tournament announcements held during the examined 27 years, while in both cases one of the squads advanced due to more away goals in 5-5 matches.

Out of 662 matches played, 28 were not decided in normal time, in these cases 2 x 15 minutes of extra time followed. 4% of the matches went into extra time, which currently means 28 matches. Based on the numbers, teams do not prefer extra time. They try to decide who should advance based on the two matches so that they are not forced to put in extra strain both physically and mentally.

Out of 28 matches, one match was replayed, ten matches were won by the home team and two by the visiting team; the remaining 16 matches were decided by penalty shootouts. As it can be seen in the previous chart, 28 matches went into extra time, 57% of which were decided by penalty shootouts, the home team won in 36% and only in 7%, i.e., in the case of 2 matches, the visiting team advanced. The 57% rate stands out, which shows that teams no longer take risks in extra time, but rather wait for "sudden death" and trust themselves to fortune.

UEFA / Europa League:

Since the announcement of the Champions League in 1992/1993, a total of 44415 main table matches have been played by Europe's elite club teams, out of which 2815 have been played in the knockout phases. Compared to the Champions League, the UEFA Cup / Europa League tournament resulted more often in knockout phase matches. Matches played in the knockout phases account for

more than half of the tournament announcement. Like the Champions League, the organisation system has changed year by year. In this case, we can also talk about a specific name change. The announcement has remained unchanged since the 2009/2010 season in terms of group matches and knockout phase matches. Every year, 120 matches are held during the group stages, compared to 61 matches played in the knockout phases.

Out of 2815 matches in the knockout phase, in 100 matches the advancing team managed to advance by scoring an away goal. As I have already mentioned in connection with the Champions League, the rule of the away goal is disputed even today. In connection with the examined announcement, only 4% of the matches were won with an away goal. In my opinion, it is also due to the fact that the balance of power between clubs is not so balanced in the European Cup tournament, which is considered to be the second in ranking, and it often happens that the team with more modest ability can manage to join the duels in the knockout phases.

Out of 2815 matches played, 93 were not decided in normal time, in these cases 2 x 15 minutes of extra time followed. In terms of the number of matches played, in 3%, i.e., in 93 cases the matches went into extra time, which proves to be an extremely low number. In my opinion, this is also due to the big differences between the teams, as the high-quality teams decide the outcome of the match already in normal time.

Out of 93 matches, the home team won in 23 matches compared to 28 matches won by the visiting team, and the remaining 42 matches were decided by penalty shootouts. In the 93 matches, similarly to the Champions League, the ratio of 45% stands out here as well, which means the ratio of penalty shootouts compared to the balanced 25% and 30% outcomes for the home-guest successes. In this case, the teams meeting in 93 matches will most likely represent a balance of power, which the value of up to 45% penalty shootouts can be attributed to, because the greatest teams take no longer risk here and wait for the final game.

Based on UEFA Champions League and UEFA / Europa League data:

Out of 7,529 matches played over 27 years, a total of 4,052 matches were played in the group stages, compared with 3,477 in the knockout phases. Examining the data of the two tournaments together, it can be clearly seen that club football lovers can watch almost the same number of matches in both the group stages and the knockout phases (Figure 1).

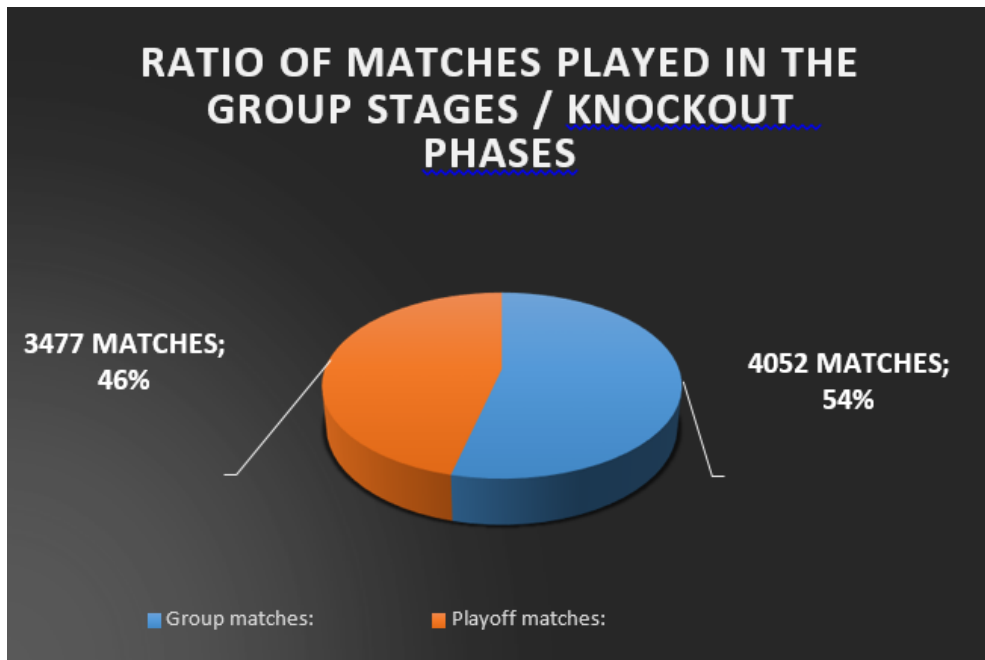


Figure 1: The ratio of matches played in the group stages / knockout phases

Out of 3,477 matches in the knockout phase, 162 games ended in a way when the winning team advanced with an away goal. The 5 % ratio seems to be extremely low, so the question arises as to whether the importance of away goals should be examined year after year. Of course, it is always a question of point of view. It is important for the teams that drop out of a tournament due to an away goal. Representatives of those clubs generally support the abolition of the away goal rule (Figure 2).

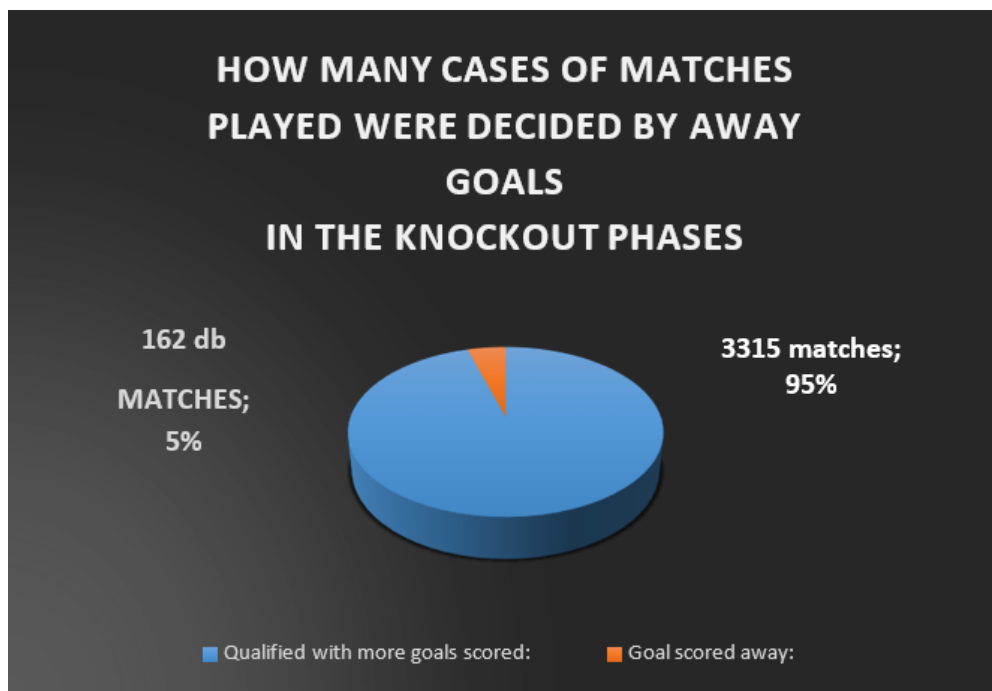


Figure 2: Matches decided by away goals in the knockout phases

Out of the 3,477 matches played, 121 were not decided in normal time, in these cases 2 x 15 minutes of extra time followed. The 3% rate can be said to be extremely low, which shows that the clubs, in a significant proportion of the matches, strive to decide the duels based on the results played during the two matches (Figure 3).

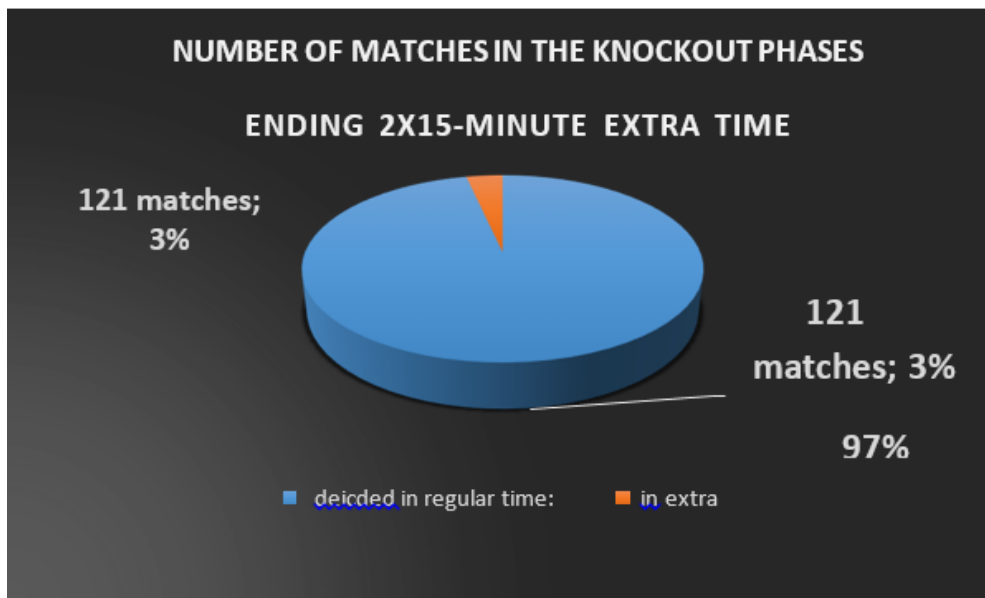


Figure 3: Matches played in the knockout stages followed by an extra time of 2x15 minutes

Out of 121 matches, the home team won 30 matches, the visiting team 30 matches, and the remaining 58 matches were decided by penalty shootouts. The combined data of the two announcements clearly show that in case of extra time, the teams play for penalty shootouts. In contrast, the number of home-guest successes is highly balanced (Figure4).

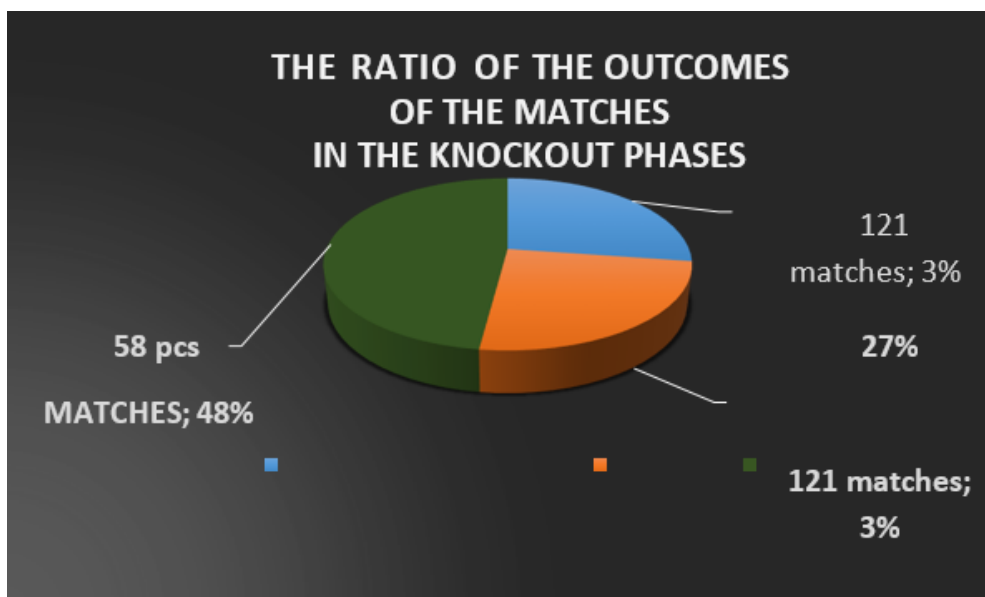


Figure 4: The outcome of matches in the knockout phases

Summary

We arrived at the following answers to our hypotheses:

1. *In extra time, the team choosing side has more chances to advance.*

According to the data of the matches played in the course of 27 years, teams choosing side in the Champions League have a better chance of advancing. According to UEFA/Europa-League match data, the home team has no advantage due to the right to choose side. Analysing the aggregated data of the two tournaments, the home teams benefited from their right to choose side. My assumption that the team choosing side has a better chance to advance in extra time proved to be true.

2. *In extra time, the visiting team has more chances to advance due to the away goal rule.*

According to the survey data, the visiting teams in the Champions League advanced in very few cases, so the advantage of the away goal did not favour the visiting team during the second match. In the UEFA / Europa League matches, the visiting teams may have been pleased to advance several times, but not because of the away goal rule, as this has been applied only 3 times out of 28. Looking at the summary, the visiting teams are slightly disadvantaged because they have to play the second match away, so my assumption that the visiting team has a better chance to advance because of the away goal rule did not prove to be true.

3. *In our opinion in 70% cases of extra time, teams play for penalty shootouts.*

Based on the test data of the penalty shootouts, it can be stated that in the knockout phase matches going into extra time in the Champions League, 57% of the matches are decided by penalty shootouts, so my assumption that the teams play for penalty shootouts in 70% of the cases of extra times did not prove to be true. Analysing UEFA/Europa League data, 48% of the matches were decided by penalty shootouts, so it is not true in this tournament either that 70% of teams hoped for "sudden death". On the basis of the aggregation of the tournaments, 48 % of the matches go into penalty shootouts.

Analysing the facts, we found on the basis of the data compiled to test our assumptions, we are making the following suggestions and giving the following opinions on the subject [9]:

The raison d'être of away goals has been constantly questioned in recent years. Considering the international football and the compiled table, a negligible number of matches have been decided by away goals over the years, so in my opinion, the away goal rule could be applied in the future as well. However, I find the away goal advantage in extra time extremely unfair. However, the data shows that visiting teams cannot take advantage of this rule.

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