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The importance of Collaborative Management and Leadership at Healthcare Institutions

Evelin Trembeczki [1], PhD., István Kobolka [2]

Abstract

The management of healthcare institutions requires a unique set of skills that cover both managerial and clinical aspects. The ideal candidate for a hospital manager remains a matter of debate, as neither managers nor clinicians are provided with the complete skill set during their education and experience. Interdisciplinary approaches may be a solution in overcoming the discrepancies of each profession. Educational programs are being developed to specifically train and prepare future healthcare managers. In this paper, we assess the literature on the advantages and disadvantages of clinician and non-clinician leaders and identify practical means to overcome challenges in hospital management.

Keywords: healthcare management, clinicians, non-clinicians, hospital administration

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Introduction

The organization and management of a healthcare institution requires a unique skill set that incorporates aspects of medicine, team leading, strategic and financial planning, quality management, marketing, law, professional development, and politics.[3]

On one hand, the manager of a healthcare institution must be familiar with the medical specialties and departments of the institution and understand the requirements of a well-functioning healthcare team.[4] Moreover, he or she must recognize the laws and healthcare policies associated with the organization and responsibilities of a healthcare institution to fully integrate the clinic into the existing healthcare system while obeying health-related laws.[5] In addition, a clinic must be represented to the public in a favourable way to highlight its full capacities, and hence, a firm knowledge on marketing strategies is an essential part of the healthcare managers' portfolio.

Therefore, it becomes apparent that a professional who is specialized in only one of these disciplines may not fully encompass the requirements, while on the other hand, neither clinicians nor non-clinicians are fully prepared for such a position based on their education.[6] Specific healthcare management educational programs have been developed to qualify an individual for exactly this job, yet the question remains whether someone without experience on the job as a physician or a manager is sufficient to fully encompass all of the required responsibilities, because experience is a relevant factor for executive decisions[7] An interdisciplinary approach with a collaborative effort of healthcare and non-healthcare professionals could provide benefits for efficient leadership. Nonetheless, the efficacy of such an approach may be hindered by negative perceptions and beliefs of clinicians and

[3] Garman AN, Standish MP, Wainio JA (2020). Bridging worldviews: Toward a common model of leadership across the health professions. Health Care Management Review. 45, Pillay R (2008). Defining competencies for hospital management. Leadership in Health Services. 21: 99-110
[4] Pillay R (2008). Defining competencies for hospital management. Leadership in Health Services. 21: 99-110
[5] Ibid.
[6] Carpenter CE, Proenca EJ, Nash DB (1998). Clinical decision making--what every non-clinician manager should know but was never taught. The Journal of health administration education. 16: 357-75, Fanelli S, Pratici L, Zangrandi A (2022). Managing healthcare services: Are professionals ready to play the role of manager? Health Serv Manage Res. 35: 16-26, Loh E (2015). Doctors as health managers: an oxymoron, or a good idea? Journal of Work-Applied Management. 7: 52-60, Degeling P, Zhang K, Coyle B, Xu L, Meng Q, Qu J, Hill M (2006). Clinicians and the governance of hospitals: a cross-cultural perspective on relations between profession and management. Soc Sci Med. 63: 757-75
[7] Roohi G, Mahmoodi G, Khoddam H (2020). Knowledge implementation in health care management: a qualitative study. BMC Health Services Research. 20: 188, Linnander EL, Mantopoulos JM, Allen N, Nembhard IM, Bradley EH (2017). Professionalizing Healthcare Management: A Descriptive Case Study. International journal of health policy and management. 6: 555-60, White K, Begun J (2009). The Evolution of Healthcare Management Education: How Can Programs Become More Patient-Centric? Journal of Health Administration Education. 26

non-clinicians of each other.[8] The question of which type of professional is most suitable for such a position remains a matter of debate. Therefore, the aim of the present literature review was to analyze the advantages and disadvantages of non-clinicians versus clinicians as managers of healthcare institutions.

Distribution of clinicians and non-clinicians in healthcare management positions

A literature search was conducted in the biomedical PubMed database to identify studies assessing the advantages and disadvantages of clinicians versus non-clinicians in healthcare institutions. Based on the search results, a SWOT (strengths, weaknesses, opportunities, and threats) analysis was conducted to delineate the strengths and weaknesses of both clinicians and non-clinicians on the job. Moreover, an internet search was conducted to find statistical data on the distribution of clinicians and non-clinicians in healthcare leadership roles to assess the current situation.

A gap between the growth in hospital administrator jobs and clinical jobs has been observed in the past 40 years, with administrative jobs growing at a disproportionally larger pace compared to physician jobs.[9] This observation has led to the notion that clinicians are under-represented in management roles and that non-clinician managers may be unsuitable to efficiently fill such positions.[10] At the same time, the limitations of a physician as hospital manager are obviated by the acknowledged lack of management education as part of the medicine training curriculum.[11] Data obtained for the NHS suggests that approximately one third of management roles are filled by physicians or nurses who conduct the role in part-time.[12]

[8] Carney M (2004). Perceptions of professional clinicians and non-clinicians on their involvement in strategic planning in health care management: Implications for interdisciplinary involvement. Nursing & Health Sciences. 6: 321-8, Carney M (2006). Positive and negative outcomes from values and beliefs held by healthcare clinician and non-clinician managers. Journal of Advanced Nursing. 54: 111-9

[9] Chandrashekar P, Jain SH (2019). Understanding and Fixing the Growing Divide Between Physicians and Healthcare Administrators. The Journal of Medical Practice Management.

[10] Ogbeivor C, Ogbeivor PE (2022). Poor Working Relationship between Doctors and Hospital Managers - A Systematic Review. medRxiv. 2022.04.11.22273494, Roberts MV (2008). The NHS needs more doctors in management. British Journal of Healthcare Management. 14: 246-8, Loh E (2015). Doctors as health managers: an oxymoron, or a good idea? Journal of Work-Applied Management. 7: 52-60

[11] Fanelli S, Pratici L, Zangrandi A (2022). Managing healthcare services: Are professionals ready to play the role of manager? Health Serv Manage Res. 35: 16-26

[12] Jones B, Horton T, Home J. (2022) *Strengthening NHS management and leadership*. Available at: https://www.health.org.uk/publications/long-reads/strengthening-nhs-management-and-leadership.

Clinicians

Spehar et al. conducted a qualitative study to assess the subjective experiences of clinicians in management positions at healthcare institutions[13]. Interviews were conducted to learn about the clinicians' path to the role as a manager. The authors identified three different phases for a clinician to become the manager of a healthcare institution: development of the awareness for authority and leadership, obtaining the position, and growing into it.

Overall, none of these clinicians was actively prepared for the role or its challenges, but rather, had been "thrown into it" due to pressure from their surroundings. Loh weighed in on the pros and cons of placing clinicians in leadership roles, and concluded that there are more advantages than disadvantages, with the main advantages being the specialized knowledge of the medical profession and clinical care, the power in healthcare politics, and the bottom-up leadership provided by clinicians as well as their credibility.[14]

A major disadvantage identified by Loh was the lack of management training and competencies, the challenge of balancing the management and clinician roles, and a limited, medical-centred view.[15] Findings by Ogbeivor et al. that a lack of respect and inefficient communication between clinicians and managers also point toward an advantage of an increased credibility and bottom-up leadership of clinician managers.[16] Edwards et al. highlight the distinct values of managers according to their professional backgrounds, with clinicians focusing primarily on the patient outcome, while for non-clinician managers, the outcome is only part of the overall patient experience and a functioning system.[17] Figure 1 shows the SWOT analysis for clinicians in healthcare management roles.

[13] Spehar I, Frich JC, Kjekshus LE (2012). Clinicians' experiences of becoming a clinical manager: a qualitative study. BMC Health Services Research. 12: 421
[14] Loh E (2015). Doctors as health managers: an oxymoron, or a good idea? Journal of Work-Applied Management. 7: 52-60
[15] Ibid.
[16] Linnander EL, Mantopoulos JM, Allen N, Nembhard IM, Bradley EH (2017). Professionalizing Healthcare Management: A Descriptive Case Study. International journal of health policy and management. 6: 555-60
[17] Edwards N, Marshall M, McLellan A, Abbasi K (2003). Doctors and managers: a problem without a solution? BMJ (Clinical research ed.). 326: 609-10

Figure 1 SWOT analysis of clinicians in healthcare management roles; figure composed by Evelin Trembeczki, 2022

Non-clinicians

In contrast to clinicians, non-clinician managers have been specifically trained in strategic planning, finance, and marketing in the course of their education and professional experience.[18] They do, however, lack the experience of daily clinical practice, the interaction with the patient, and the focus on the clinical outcome.[19] In turn, clinicians may attribute the sensed differences between clinicians and hospital managers to a lack of participation by clinicians in managerial meetings,[20] MacIntosh et al. point out that a lack of or insufficient

[18] Aufegger L, Alabi M, Darzi A, Bicknell C (2020). Sharing leadership: current attitudes, barriers and needs of clinical and non-clinical managers in UK's integrated care system. BMJ Leader. 4: 128-34, Aylott J, Godbole P, Burke D. (2017) 'Clinicians Versus Clinicians Versus Managers' or a New Patient Centred Culture That Eradicates 'Them and Us'? In: Godbole P, Burke D and Aylott J (eds) *Why Hospitals Fail: Between Theory and Practice.* Cham: Springer International Publishing, 163-8.

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[20] Carney M (2004). Perceptions of professional clinicians and non-clinicians on their involvement in strategic planning in health care management: Implications for interdisciplinary involvement. Nursing & Health Sciences. 6: 321-8

communication between clinicians and non-clinician managers may corroborate the perceived gap between both professions.[21] Figure 2 provides a SWOT analysis of non-clinicians in healthcare management.

Figure 2 SWOT analysis of non-clinicians in healthcare management roles; figure composed by Evelin Trembeczki, 2022

Interdisciplinary management – the solution?

The available literature on the advantages and disadvantages of clinicians and non-clinicians in healthcare management combined with the SWOT analysis of the present review corroborate the need for an interdisciplinary approach for an efficient management of healthcare institutions. It becomes apparent that physicians not only lack a thorough knowledge and experience in managerial tasks, but also may not necessarily aim to obtain

[21] MacIntosh R, Beech N, Martin G (2012). Dialogues and dialetics: Limits to clinician–manager interaction in healthcare organizations. Social Science & Medicine. 74: 332-9

a role in executive management. The fact that some clinician managers conduct such a role part-time highlights the challenge to combine a clinical job with such a managerial role.[22]

Potentially, the most important task of a hospital manager is to run an efficient clinical system while consistently maintain or improving the patient experience. It is obvious that this task requires a thorough knowledge of managerial skills which can only be provided by a specialized education and training in management.

One should not underestimate, however, the requirement of insights into the daily clinical activities and challenges to run such a system efficiently. This is in line with a study by Vlastarakos and Nikolopulos who determined that 65% of healthcare employees who were questioned on their hospital's administration stated that they would consider a degree in health sciences the most suitable education for a hospital manager.[23]The perception of gaining the respect of the hospital's employee as a non-clinical manager also differed between the managers themselves and the physicians: only 45% of the managers perceived issues with their authority, while 76% of doctors felt that authority-related problems existed.[24]

One solution for the perceived opposition between clinicians and non-clinicians could be a strategy to improve their relationship and tackle issues that lead to management-related problems. Improving the communication between clinicians and non-clinical managers may be such a strategy.[25] Parand et al. suggest a quality management system that could be presented by clinicians to the hospital management in order to make the manager aware of clinic-related medical issues that he or she may not notice due to their lack of clinical experience.[26] In addition to addressing the perceived issues, an interdisciplinary education could be a solution to train professionals that are specifically prepared for a healthcare management position and obtain the required skills.

[22] Jones B, Horton T, Home J. (2022) *Strengthening NHS management and leadership*. Available at: https://www.health.org.uk/publications/long-reads/strengthening-nhs-management-and-leadership.
[23] Vlastarakos PV, Nikolopoulos TP (2007). The interdisciplinary model of hospital administration: do health professionals and managers look at it in the same way? European Journal of Public Health. 18: 71-6
[24] Ibid.
[25] MacIntosh R, Beech N, Martin G (2012). Dialogues and dialetics: Limits to clinician–manager interaction in healthcare organizations. Social Science & Medicine. 74: 332-9
[26] Parand A, Dopson S, Renz A, Vincent C (2014). The role of hospital managers in quality and patient safety: a systematic review. BMJ Open. 4: e005055

A potential pitfall of such an education may be that due to the number of different subjects, the training would, overall, be general in each of the disciplines without conferring detailed knowledge on either medical or managerial topics.[27]

An alternative approach would be to offer specializations for medical students in healthcare management or, vice versa, specialize management students in the intricacies of healthcare organizations. Figure 3 shows a GAP analysis and an action plan to overcome the existing gap between clinician and non-clinician managers.

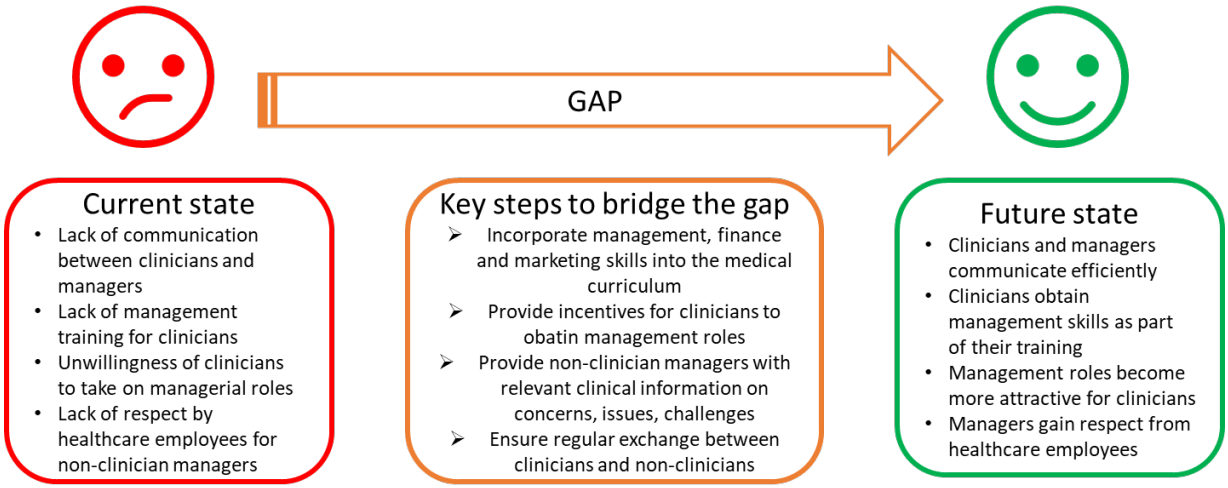

Figure 3 GAP analysis and action plan for an efficient healthcare management

Conclusion

Hospital management requires a complex set of skills that can neither be fulfilled by clinicians nor by managers alone. At present, a gap exists between the communication of clinicians and non-clinicians and their optimal interaction and respect for each other's skills. Current educational curricula cannot prepare a clinician to become a manager or vice versa a non-clinical manager to become a healthcare professional. In light of the discrepancy and observed challenges between clinicians and non-clinicians in managerial roles, strategies to qualify managers of healthcare institutions more appropriately for the job are needed to

[27] White K, Begun J (2009). The Evolution of Healthcare Management Education: How Can Programs Become More Patient-Centric? Journal of Health Administration Education. 26

ensure both a satisfactory patient outcome and patient experience. Interdisciplinary approaches can contribute the necessary medical and managerial skills for such a leadership role and ensure both a patient-centric and economical leadership of a healthcare institution. Dedicated healthcare management degrees are emerging as a potential solution for an optimally prepared professional in a healthcare leadership role, yet at present it remains unclear whether graduates from such programs are sufficiently experienced and specialized to fulfill the intricate requirements of a healthcare institution leader.

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The study of the Hungarian Sport University's football team from the aspect of technical movements.

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Abstract

There is close contact between The Hungarian Sport University Club (TFSE) and the Sport University (previously the Semmelweis University Sport and Sport Science Faculty (TF)), because the students of the University are provided the opportunity to do sports by the Club. The football section has been in operation for the longest time in the University, which didn't reach as significant successes as it had had before, unfortunately. Therefore started us different tests to bring the reasons on light of the unsuccessful time. We emphasized the technical tests among many others, which also can show us a part of the mistakes. We took account and analyzed later individual and team performances at ranked matches using an analyst sheet made by us. We distributed the technical moves to 5 different categories, which are the good and bad execution of the passes, the tackles-interceptions the shootings and the ball losses. The shootings are valid when the shooting arrives into the goal area (six-yards box) or above it. The results showed us that, based on the technical moves, the team performance fell off, but the outcomes didn't have significant difference, except the shooting. We found more connection and proportions between the team and the individual outer and inner factors, that opened new aspects and made further studies possible.

Introduction

During the study the team were playing in the Budapest 1st league, won the Budapest Cup, received many times medals in the league, and won the Hungarian University League (MEFOB) not one time. Those player who became the member of the team as a freshman mostly came from the youth leagues and just completioned their 18 years. The average age of the team was much closer to a youth team (20 years) than a normal adult team.

That's why more aspects needed to be considered during the training from the youths' side than from the adults' sport[1]. We are talking about players, who have few adult matches and little experience. In our opinion the student-footballers who attend to the TF become all-round accomplished, that provides them the further development. The bookish and practical teaching during the college years help them to develop, step forward in the individual and team playing. All that involves that the athletes of the TFSE have to take part much more physical actions than other team's players, and then themselves, before they got into the

university. This makes the players all-round accomplished, and provides a strong motorical skill foundation. However it's also true that they need to find the way, how can be the training and the studying both efficient[2]. To sum up, we can say with a little exaggeration, that the structure works similar to the academic way, due to the fact that the collective learning, the mealing and dorm opportunity is also provided under the University.

Method

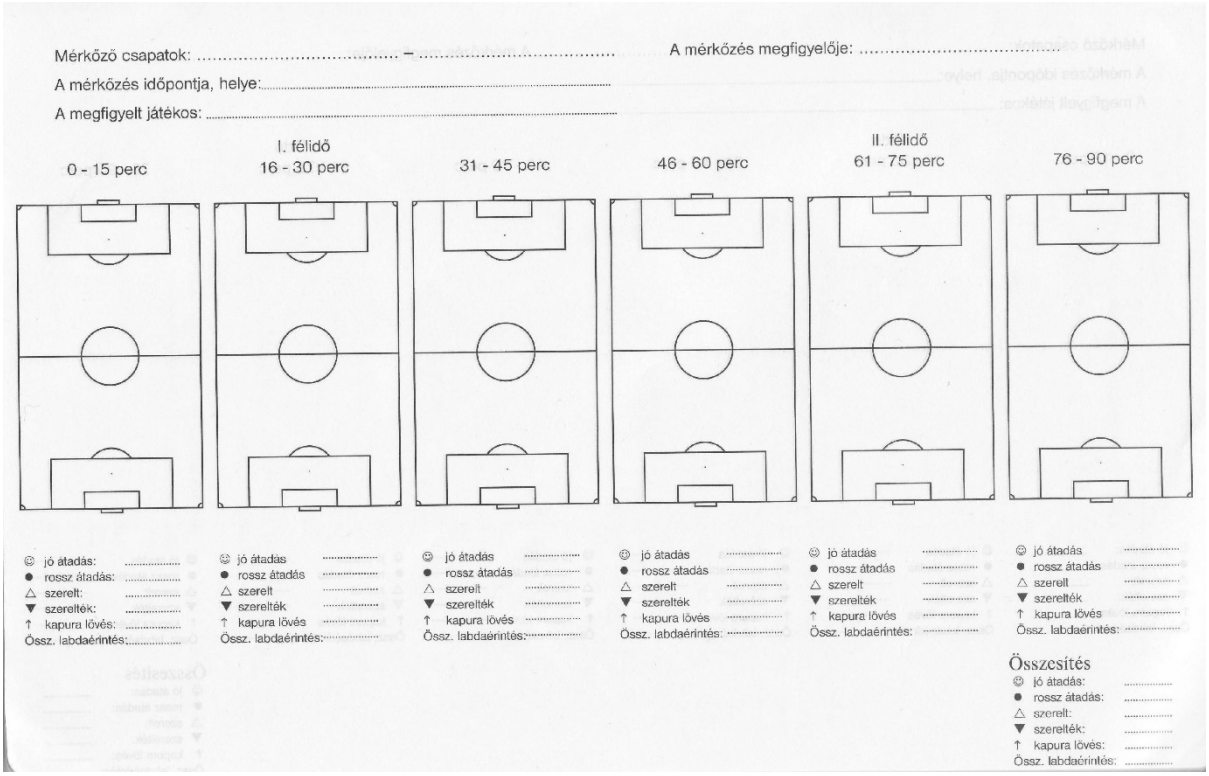
Based on Dubecz's[3] skill complex, the skill can be distributed to different groups, such as conditional, coordination, emotional-affective and cognitive skills. These skills cannot be strongly divided, due to that they effect each other, different areas' development can influence the other area.

Additionally, the coordination skills are in close connection to the technical skills itself. Different technical developer exercise make influence to other coordination and conditional skills too (the variety of the exercises with the help of space, time, dynamics components changing). In the learning phase we distinguish rough and refined coordination phase, where we can ascertain that the peak of an achievement is when the movement is executed well at stake.

In the followings, the presented match analyzer sheet[4] serves the goal we talked about previously, analyze the execution of the technical[5] skills at matches, at stakes.

We were studying the season I. (2006-2007) and season II. (2007-2008) of the Hungarian Sport University Club, in the aspect of how did the executed technical[6] and tactical[7] moves change.

Figure1. Match analyzer sheet



On the header of the sheet we can see the teams and players, moreover there are the match date, where it takes place and the name of the analyzer. Besides the halves, it's also splitted into 15 minutes parts. In these parts we can analyze the players' good (circle) and bad (point) passes, the tackles-interception (white triangle) or the ball losses (black triangle).In addition the shootings' number and the angle is also drawn (arrow), because the help of the symbols, the action is also can be located on the sheet. You can also analyze the performance of the 15 minutes parts, the halves or the full time, so it can be seen to the end, that how many bad or good passes, tackles-interceptions, ball losses or shootings were done.

With these number we can measure the positive changing, development from match to match or from season to season.

It's also worth to mention that the sheet[8] is not only can be used for the technical moves analyzing, but for other tactical factors, such as the set-up of attackings[9].

Our hypothesis: There is a significant difference at the technical moves of The Hungarian Sport University Club team in the course of the 2 years.

In the course of the 2 years 225 sheets were filled, however we need to note the fact that the squad did change through the years, therefore we had to delete the „N"-s, who stopped being the member of the squad in the second year, so the number of the sheets decreased to 209. The results came out by the MO Excel 2003 program's average counting. The statistical counting were done with the same software, used a one-sample t-test, where the significance level is $p<0,05$.

Results

Season average for 2x15 matches played, the summed up technical moves in the season I. is 45.1.

- Good passes: 21,42 .
- Bad passes: 8.3 .
- Tackles-interceptions: 9.46 .
- Ball losses: 3.35 .
- Shootings: 2.57.

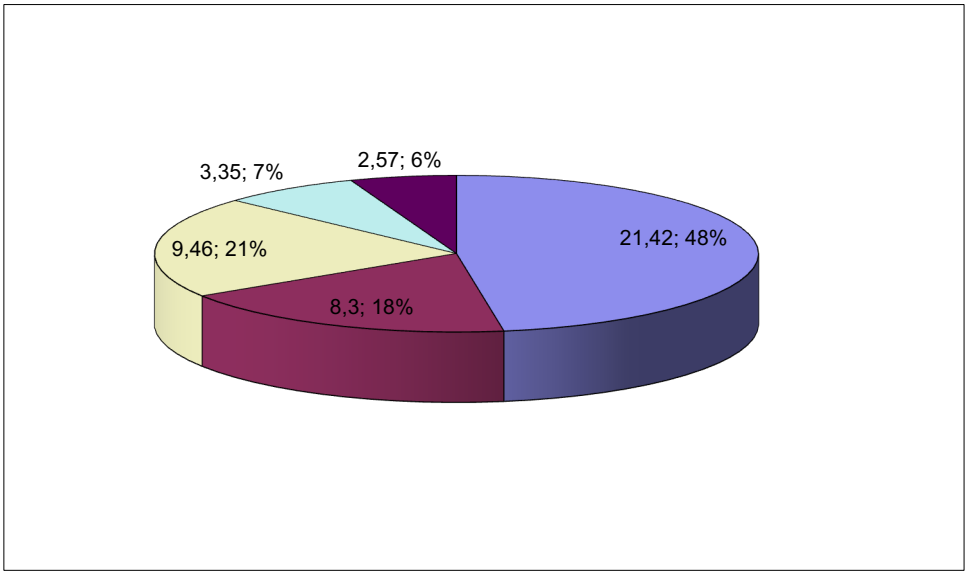


Figure2. The technical moves percentage share in season I.

We can see the good passes, colored blue, make 48% share, 21.42 moves average, and the bad passes, colored bourdon, make 18% share, 8.3 moves average. The yellow painted tackles-interceptions make 21% share, 9.46 moves average, the zian colored ball losses make 7% share, 2.57 average of the full technical repertoire.

In season II., the totalized technical moves decreased to 37.45 average.

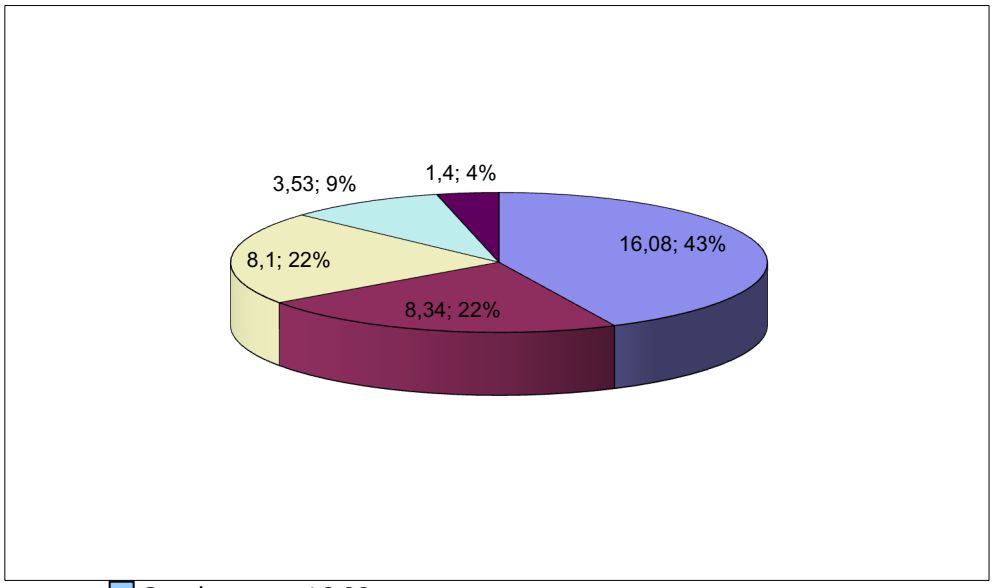


Figure3. The technical moves percentage share in season II.

Discussion

We can read out from the data, that in season II. the team's average results definitely decreased in all category. The good passes based on the blue part decreased by 5%, from 21.42 to 16.08, and the tackles-interception share grew 1 unit, but the number of the moves decreased to 8.1 from 9.46 based on the yellow part. The bourdeu colored bad passes increased 4%, from the number 8.3 to 8.34, but it's surprising that produced only 4% fall in average. The opponents' tackles-interceptions grow 2% in the zian part, from the number 3.35 to 3.53. It is interesting, that the shootings increased in some cases per matches, (purple part), but the totalized and average number fell down with 2%, from the number 2.57 to 1.4. Despite the decreasing, statistically significant difference is just demonstrable at the shooting part, therefore we can declare, that our hypothesis wasn't proved.

Good passes: p=0,052.

Bad passes: p=0,14

Tackles-interceptions: p=0,069

Ball losses: p=0,07

Shootings: p=0,001

Conclusion

Studying the players' team performance experienced we, that the reason of the performance quality-falling were the new signed freshmen[10]. Besides them, the other players developed, correlate to themselves. Hereby build in new players to the team is not an easy task, and even if it's efficient, the progression is in the process. On the other hand, in season II. more injury happened, that also could have negative effect to the team. Unfortunately, we need to count on this factor, due to the fact that in football, injuries are more common than in other contact sports[11], not only by the youths, but by the adults team too. According to our subjective opinion, in the season II. league was stronger than the previous one. We also find correlation between the players' number of lessons and the performance[12]. During the college years, there are more figure subject in the second and third year .They produced a higher proportion of well-performance against those, who didn't have as many as figures.

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Budapest, (Dissertation)

Goalkeepers' distribution – take no risk(?)

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Abstract

In football, the responsibilities of goalkeepers have undergone the greatest change in recent times, when IFAB decided to prevent goalies from using their hands on deliberately kicked passes from their teammates. The change in rules was brought by the many play with the time, which has a peak in the 1990 World Cup in Italy. The measure reformed the game of the goalkeepers. As a goalkeeper, I am well aware that today it is not only the highest levels that require the technical training of a goalkeeper, even with both feet. Since then, however, the public has been repeatedly demanding the goalkeeper not to make passes in the back so that the team does not concede a goal. Are they right to do all this, is there really as much risk in short passes as they think? This question motivated my research the most.

Keywords: Football, Euro 2020, Goalkeeper

Introduction

This research refers to the goalkeeper's tactical solution, what is the consequence of their short or long distributions. Since 1992, we've heard several times the instructions from fans or even the coaches near football fields that "goalkeeper, don't pass in the back because it will get in trouble". Is this sentence just a false conclusion, or are the speakers really right? Would they have been right in the 2020 European Championship matches?

Literature review

To get a deeper view of the problem, we need to look at the evolution of the role [1] of the goalkeeper. While in the first world event following the rule change, the 1994 World Cup, goalkeepers launched an average of 25 actions per match [2.], that number has nearly doubled at the last World Cup in Russia [3.]. While in 2015, although not in the World Cup, but in other national leagues, 69.4% of the distribution of trained goalkeepers resulted a beginning of an attack [4.]. We can see the increased role of the goalkeepers when we have a look on the World Cup 2002, where the 63% of all action started from the goalkeeper. [5]

The 2016-18 Champions League report [6,7] showed that goalkeepers have been used more actively in offensive construction than before, as opposed to the increasingly frequent pressing of opponents, and the repertoire of tactical solutions is expanded by the greater involvement of the goalies.

Aim of the research

The aim of my research is to answer the following two questions projected on the European Championship matches. In matches where the goalkeepers typically tried short passes, did the opponent have more dangerous situations? Furthermore, did the typically long passing of the goalkeepers result more dangerous situations for

the opposing team? I didn't choose the number of the goals as a factor on purpose, because it might lead us to the wrong conclusion, based on the fact that not all mistakes lead to goal.

Method

XG (expected goals) is a statistical indicator that shows the probability of a goal being scored from a shot. Each shot takes a value between 0 and 1, the higher the chance of scoring. The pointer takes into account the distance of the shot from the goal, the angle, who is behind the ball and which part of the body the shoot comes from. What aggravating circumstances are present, such as a defender or a ball arriving at half height? The statistical indicator does not take into account all dimensions, but it is still one of the most widely used parameters today.

In the statistical test, I compared the xG of the opponent in each matches to the distance of the goalkeepers' distribution. I followed the steps below:

1. I plotted the relationship and then examined its shape

2. I have established the strength and direction of the relationship.

3. The significance of the relationship was examined.

Results:

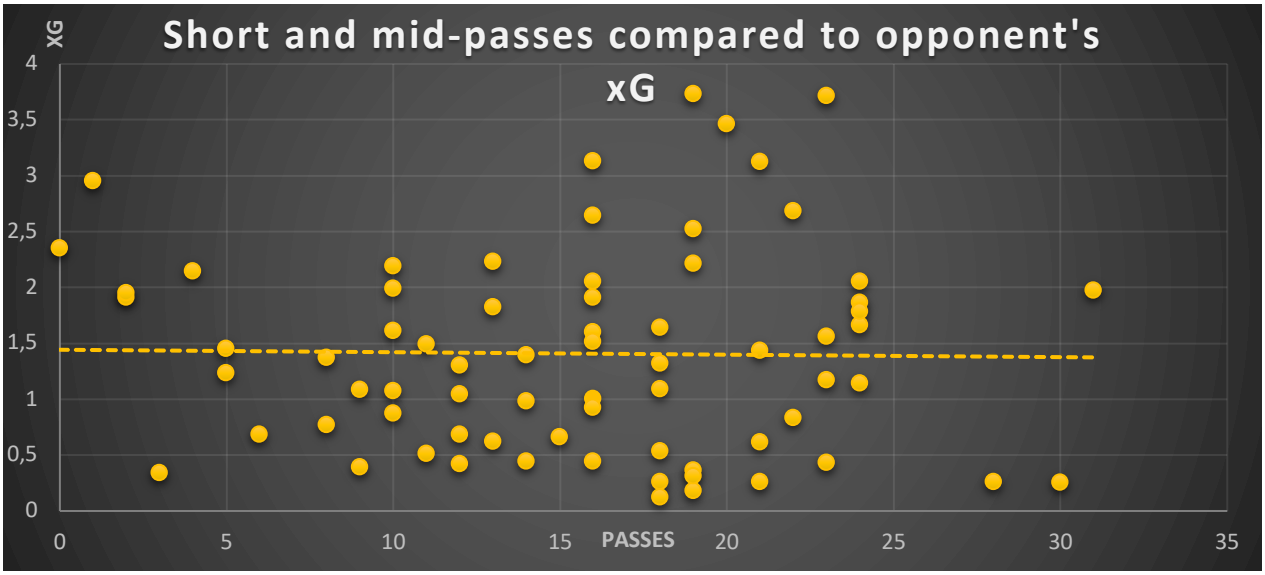

Figure 1. Short and mid-passes compared to opponents

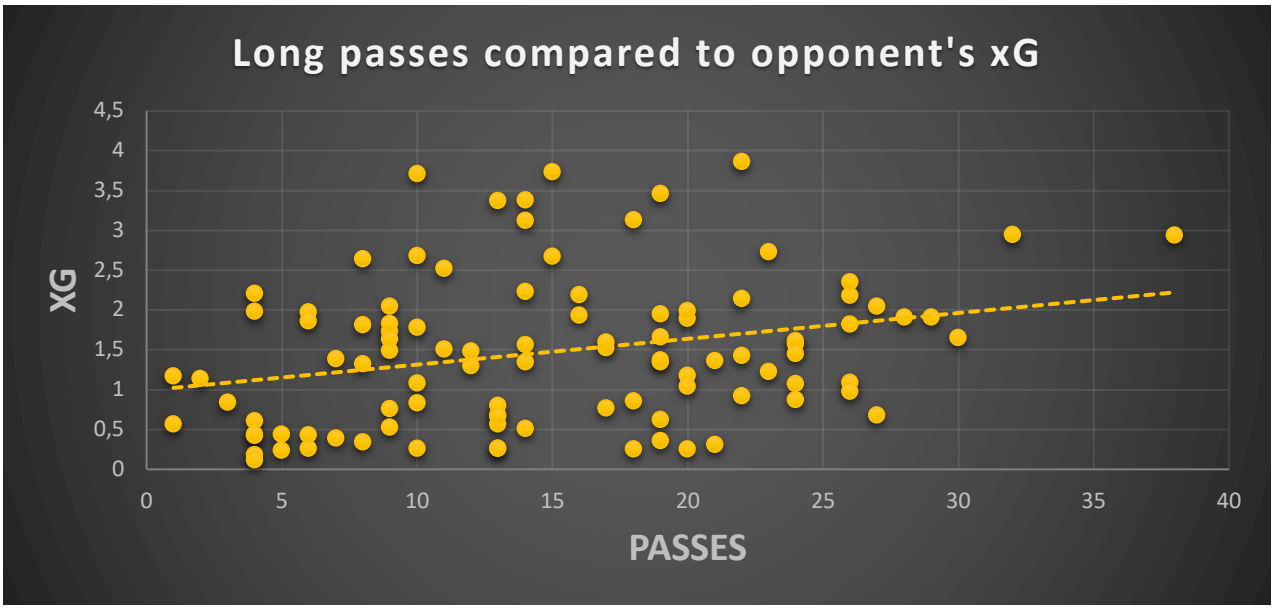

Figure 2. Long passes compared to opponent's xG

On the scatter plot the Y-axis shows us how high was the opponent's xG on the certain match and we can see on the X-axis that how many passes were made by the goalkeeper. The scatter plot clearly shows that there is no tendency between the two data, they take each other's values scattered and irregular. From this, I concluded that there is no close relationship between the two indicators. So my null hypothesis was confirmed, the risks arising from the goalkeeper's short pass play did not resulted more dangerous opportunities for the opposing team at the EC. At the same time, I rejected my alternative hypothesis

According to my alternative hypothesis number two, in matches where the goalkeepers tried more long passes, the opponent had more dangerous positions to score. The trend line shows that there is an increasing trend among the recorded values. Therefore, I further investigated the relationship between the two variables using the statistical test, the Pearson correlation coefficient.

At a degree of freedom of 48, the value of t is - t = [r * (√n-2)] / (√1-r˘2) - 2,006. (The value of t in this case represents the standardized difference between our correlation coefficient and 0).

With a significance level set to 5%, the critical value from which the relationship is already significant is 2.011. The science of statistics allows for minimal deviations, so I dared to round up the 5 colonial deviation. The correlation coefficient is a number between 0 and 1 that shows the strength of the relationship. Using the Korrel function, I obtained a value of 0.28 after my calculations, which indicates a weak and positive relationship.

Conclusion

At the European Championship, it was typical that:

1. The short and medium passes of the goalkeepers did not affect the opponent's chances of scoring.

2. There was a significant, positive and weak relationship between the goalkeepers' long passes and the opponent's goal positions.

Thus, the stereotype surrounding the goalkeepers, according to which they are less skilled with their feet and the construction of short passes starting from the defensive third, has not been proven.

Limitations

The results obtained during the research should be treated with due care as not all variables were taken into account. For example, extra-time matches, goalkeeper pass accuracy, team tactics (pressing, ball control), the development of the match (red card, disadvantage) and the examination of the goalkeeper's character are not negligible technical qualifications or risk-taking.

Summary

Thus, the research showed a relationship between the two variables, but it is not certain that one follows from the other. In my opinion, the positive, weak relationship stems from the fact that the goalkeeper's long balls are much more inaccurate and the situation from them is less predictable, so indirectly the teams give up control of the match and are more exposed to the opponent, individual skills and good luck. It is not the purpose of my research to stand for any particular style of play. However, different styles require a goalkeeper with different qualities. Teams that, due to their styles, prefer long passes over construction from behind are prepared to defend against more dangerous attempts by their opponents, such as by goalkeepers, who control the penalty area with their position and claims to prevent the opponent from scoring.

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Effectiveness of goalkeeper's 1v1 defense techniques in football.

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Abstract

Goalkeepers use 4 types of techniques to counter attackers in one-on-one situations. “Reaction-save” is the only technique where the keeper does not get close to the attacker and the ball. The two most used methods were the “reaction-save” (48%) and the “star shape” (21%). The least used methods were “diving” (15%) and “block” (16%). The most effective method was “block” with its’ 52,38% efficiency. Following that the “star shape” method with 50,90% efficiency and “diving” with 48,64% efficiency. Interestingly, the most used method is the least effective, only 44% efficiency. In the Italian and English leagues, the most common technique is the “star shape” method. In England it was used 45% percent of all saving attempts and in Italy that percentage is 58%. German keepers' favourite was the “star shape” method with 44% of usage. The “reaction-save” was used 38% of the times in the Bundesliga. Interestingly, in the Seria A the second most common method was “diving” technique with 27%. The same technique has only 1% of usage in Germany and 10% in England. “Star shape”, the second most effective method was used the least in Italy with 10%, then England with 23% and the most in Germany with 44%. With regards to the effectiveness of the keepers, Premier League is the leading league where keepers save every other one-on-one situation. Keppers in the Serai A prove to have the same efficiency with successfully countering 49% of all attempts. Bundesliga keepers have the worst efficiency with 42,25% which is a relatively big difference.

Introduction

Nowadays, football as sport has gradually become a discipline, therefore, all aspects have been thoroughly researched. In a professional football match every little detail is mapped out to the maximum, therefore, there are not many situations where improvisation is affective. Meanwhile a

goalkeeper is facing different, unexpected, and new situations all the time, which also means that there are less studies [1] written [2] about goalkeepers [3] than about field players.

In terms of preparations for the trainings, goalkeeper trainings are completely different than normal team trainings [4]. While on team trainings[5] the coach mostly builds [6] the practice session[7] on previously obtained knowledge [8], a goalkeeper trainer usually uses their experience due to the lack of research in that field to improve their players. Just like 1 on 1 chances against the goalkeeper, where the attacker faces the goalkeeper alone. We specifically targeted the situations where both players have space and time to make up their minds about the next step.

Methods

Throughout this study we focus on matches from the 3 top leagues, the Seria A, Bundesliga and the Premier League. During the first 18 rounds of the 2020/21 season, we examined 522 games where our focus were mainly on the goalkeepers and one on one situations against an attacker.

Saving methods

We have noticed 4 different methods regarding one-on-one situations: block, star shape, reaction-save, diving. All aspects have their own specific features so we can easily identify them.

The “block”:

The goalkeeper is on one knee sideways, hands stuck out to the side to cover as much from the goal as possible. The skill to know when and where to use this method is more important than the actual implementation of the technic.

The most important aspect is the distance between the goalkeeper and the striker. A keeper must be able to recognise, if an attacker shoots from further than 1-2 meters than this method will not be affective. Although within 2-meter radius this method is more than likely to “block” the attempt.

The “Star shape”:

Compared to the “block” method, the “star shape” technique is substantially harder to execute properly. The main goal is the same, to cover as much of the goal as possible. The “star shape” method is much more dynamic series of motions. This movement can be also found in other sports like Handball and Futsal. Using this method, the keeper is on one knee just like the “block” technique but his leg which is not kneeing is stuck out strait to the side. The upper part of the body is straight as an arrow with the arms stuck out to the sides same as the “block” method.

In case the attacker having the ball runs towards the keeper with great speed which would cause imperfect ball control the keeper using the “star shape” position has a high probability to save the attempt.

The “reaction-save”

This saving method does not have specific body positioning as this method is built on the “on-the-line" saving technique. The keeper waits within a close radius (max 5-7 meters) from line in starting position for the attacker to shoot and decides the next move according to the quality of the attempt. These situations usually require the keeper to slide or dive or if the ball is shot near to their body, then split can be used as well.

This method is mostly powerful when the attacker can freely run to the goal and have a lot of time on his hand to finish the attack or when the keeper thinks that a defender can contest the attempt.

The “diving”

Gaining momentum is crucial to execute properly the “diving” technique. The aim is to counter the attacker with placing the keeper's body and hand in front of the ball to get a hold of it. The body's centre of gravity starts from a low position to able to quickly slide or dive in the direction of the ball.

Nowadays, this method is being put aside but if the situation requires it the keeper should definitely use this technique. This is technique is very risky, therefore, the “diving” is not used that much but if the attacker makes a mistake and loses control over the ball the method can be very effective.

Results

Frequency of techniques:

As an average there is around 1 occurrence in two matches in all top leagues. Precisely in the Italian first division it is 0,56 per game, meanwhile in England and Germany the number goes under 0,5. In England it is 0,49 per game and in Germany it is 0,44 per match.

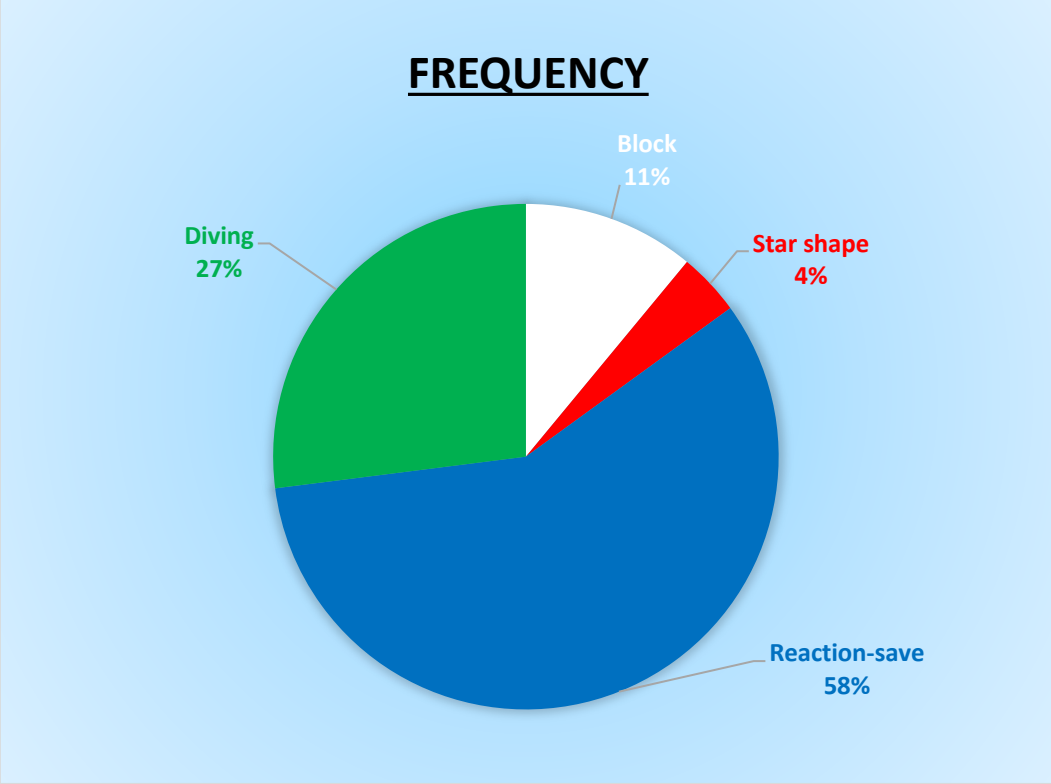

Figure1: Seria A frequency

As per the above chart, keepers playing in Seria A used the “reaction-save” method 58 times which means more than twice a game. The second most used method is “diving”, after that come the “block” method used 11 times and the least favourite is “star shape”, which was only used 4 times by keepers in the Seria A. The method “reaction-save” is a being used a bit different in the Seria A than the other top leagues, as the keepers usually run out to 10 to 16 meters. Interestingly, the technique “diving” is

also used when the attacker seems to be in control of the ball, which means that he could take the shot in a second. The same strange thing happened with the "block" method, where the keeper went down on both knees just like hockey players do, although, it seemed to be surprisingly affective. The "star shape" technique was significantly less times than in other leagues, only 4% of all occasions.

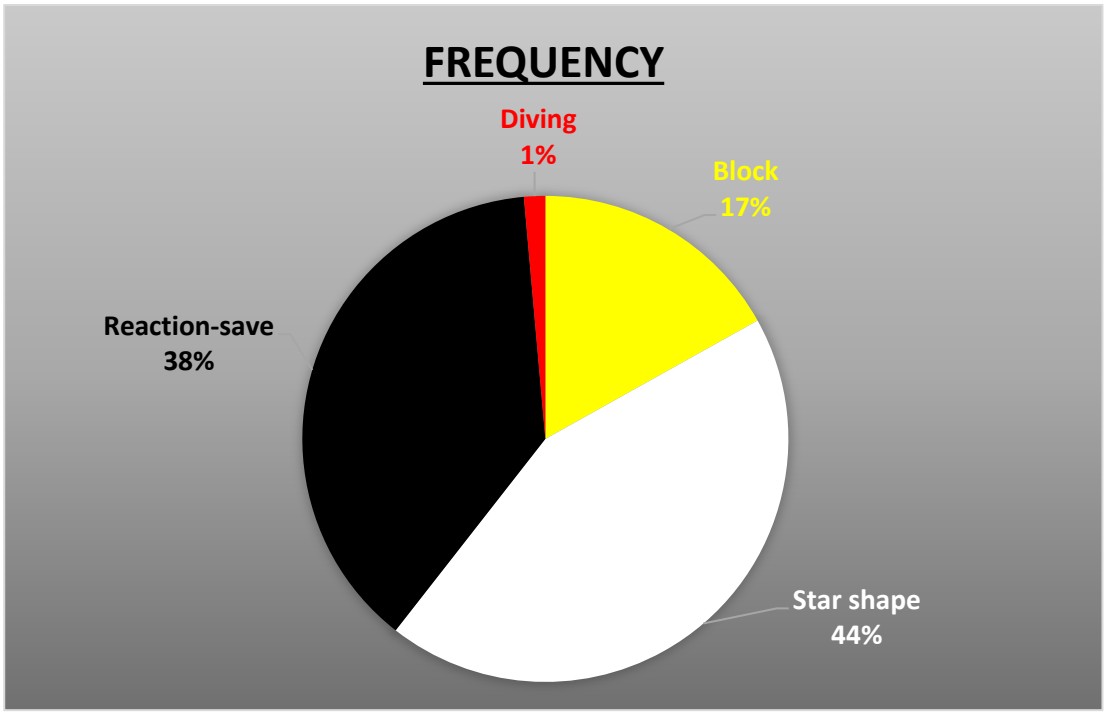

Figure2: Bundesliga frequency

In Germany looking at the first 18 rounds, there are significantly fewer one-on-one situations than the other top leagues. The Bundesliga has only 18 teams rather than 20 in the other top leagues, which means one less game per round. Calculating that into my research there was only 0,44 one-on-one situations per game. The smaller number must be a consequence of the more disciplined, structural teams which means that German teams defend better the Italian ones. In the German league the "reaction-save" is not as used as in the Italian league. It is only used 37% of the times, which is 27 times out of 71. Meanwhile in Italy the "diving" method is a keepers' favourite, in Germany it is the exact opposite. The usage of the "block" method is proportionally the same in the Bundesliga as in Seria A. Out of 71 times this method was used 12 times. For some reason the "star-shape" technique is the keepers' favourite in the German top league with its' 44% usage (31 times out of 71).

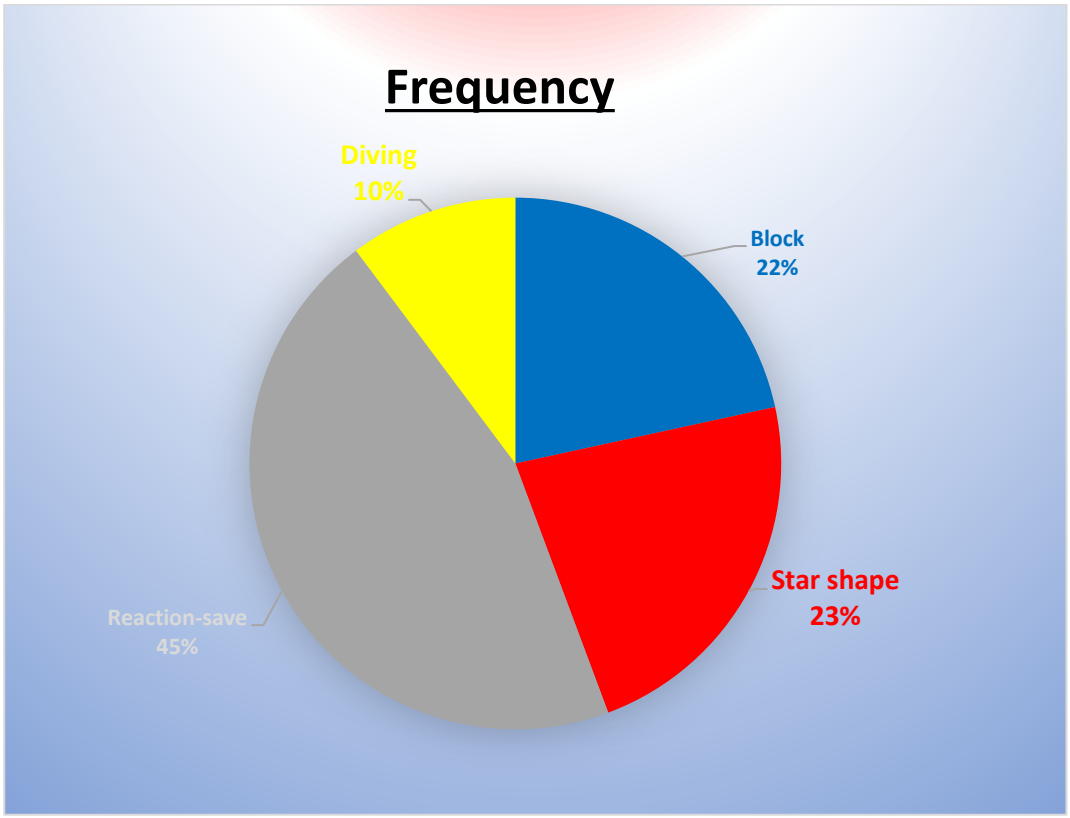

Figure3: Premier League frequency

Some might say the Premier League is the most intense league in the world where the most expensive, most exceptional and best players play every weekend. This league gives home to the Spanish, Danish, Brazilian, French and of course the English national teams first choice keepers. I believe we can say that the if we would like to watch the top keepers compete than the Premier League is the right choice. There were 88 one-on-ones over the 180 games that I examined. The "reaction-save" was the most popular method within the Premier League keepers. Altogether it was used 40 times which means a 45% usage, almost every 2nd. The "diving" save was used 9 times which means 10% out of all. The "block" technique was used the most in the Premier League out of the three top leagues. 22% of all one-on-one situations was contested by the "block" method (to be exact 19 times out of 88). The "star-shape" technique was used 20 times out of 88, that is 23% of all saving attempts.

Efficiency of the methods:

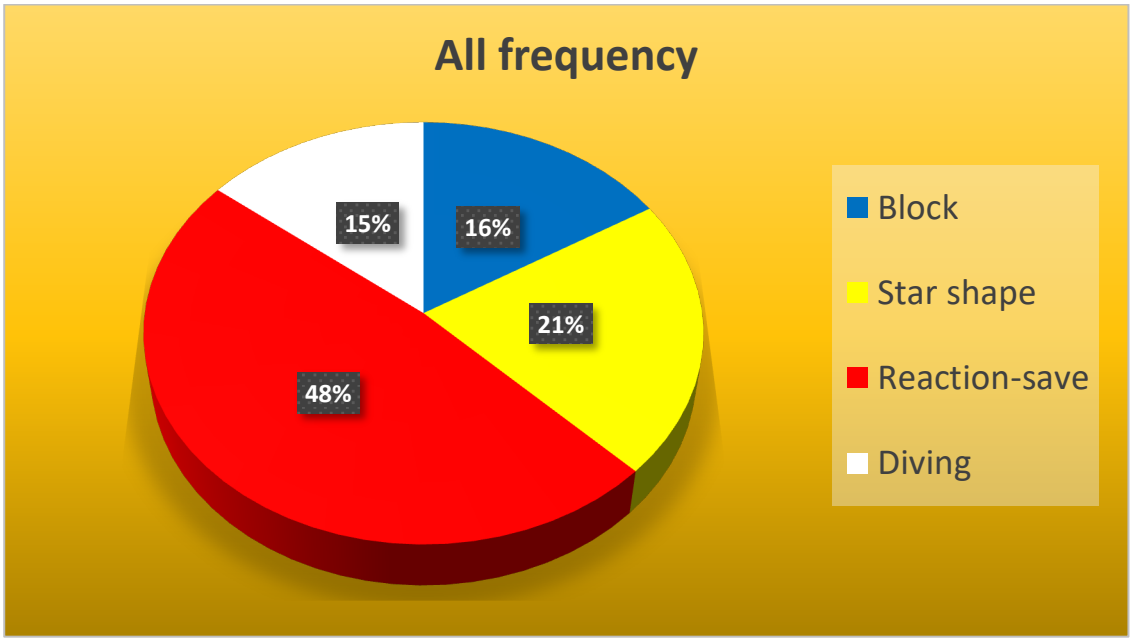

Figure4: All frequency

Out of the 522 matches that I included in my research, keepers had to use one of the four techniques 259 times. During this period “reaction-save” was outstandingly the most used method, as this was used 44% of all one-on-one situations, which means 125 times. Following the “reaction-save”, the “star shape” technique was used the second most, exactly 55 times (21% of all one-on-one situations). The “block” and the “diving” technique was used around the same percentage, exactly 16% and 15%. The “diving technique was used 37 times altogether. From the 37 times it was used 27 times in the Italian league, which is lot more than the other leagues, preciously 73%.

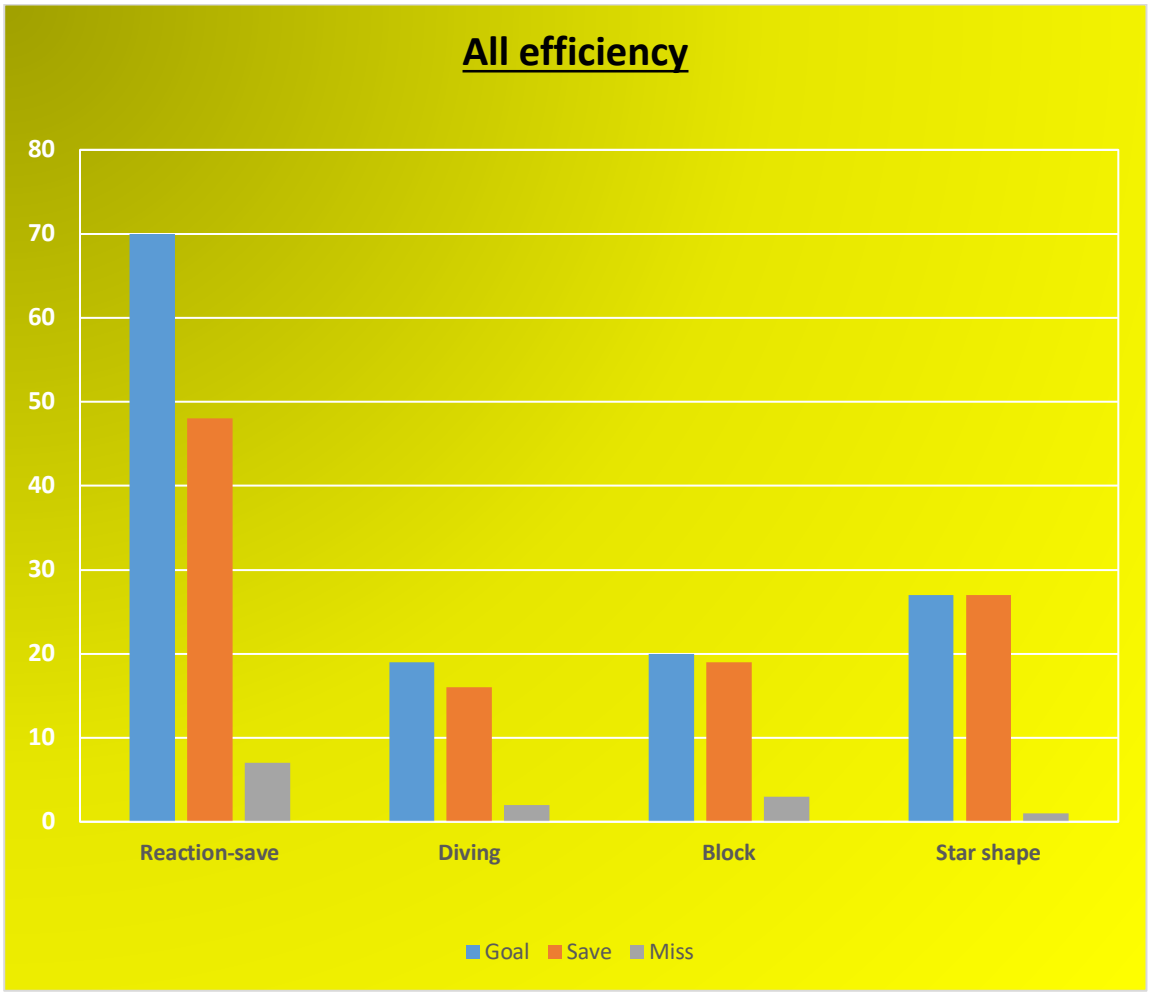

Figure5: All efficiency

As per the above chart, the most used method is the “reaction-save”, despite its’ popularity it is the least efficient. Saving attempts using this method was successful 48 times (+7 times misses) and but conceded 70 times, which means 44% saving efficiency. Despite the fact that the “diving” technique was used the least it was more efficient than the most used “reaction-save” method. From 39 attempts keepers saved 18 times and conceded 19 goals, which is an efficiency of 48,64%.

Evan though the “block” method – similarly to “diving” - was used significantly fewer times than the most used “reaction-save” method, it is still the most effective with its’ 52,38% efficiency. The “star shape” method takes second place both in efficiency and usage. Out of 55 attempts keepers conceded 27 goals and saved 27 times with one shot missing the target, which means that this method has a 50,9% efficiency.

	Goal	Save	Miss	Penalty	Efficiency
Reaction-save	70	48	7	0	44%
Diving	19	16	2	3	48,64%
Block	20	19	3	0	52,38%
Star shape	27	27	1	0	50,90%
Summed up:	133	110	13	3	47,49%

Table1: Total

Summary

It is clear that keepers use 4 types of techniques to counter attackers in one-on-one situations. Namely: "reaction-save", "block", "diving" and "star shape". Examining the four methods the below listed bullet points can be highlighted.

- "Reaction-save" is the only technique where the keeper does not get close to the attacker and the ball.
- The two most used methods were the "reaction-save" (48%) and the "star shape" (21%).
- The least used methods were "diving" (15%) and "block" (16%).
- The most effective method was "block" with its' 52,38% efficiency. Following that the "star shape" method with 50,90% efficiency and "diving" with 48,64% efficiency. Interestingly, the most used method is the least effective, only 44% efficiency.

With regards to the difference in quality, the following distinctions can be made between the top leagues.

- In the Italian and English leagues, the most common technique is the “star shape” method. In England it was used 45% percent of all saving attempts and in Italy that percentage is 58%.
- German keepers' favourite was the “star shape” method with 44% of usage. The “reaction-save” was used 38% of the times in the Bundesliga.
- Interestingly, in the Seria A the second most common method was “diving” technique with 27%. The same technique has only 1% of usage in Germany and 10% in England.
- “Star shape”, the second most effective method was used the least in Italy with 10%, then England with 23% and the most in Germany with 44%.
- With regards to the effectiveness of the keepers, Premier League is the leading league where keepers save every other one-on-one situation. Keppers in the Serai A prove to have the same efficiency with successfully countering 49% of all attempts. Bundesliga keepers have the worst efficiency with 42,25% which is a relatively big difference.

To sum it up, it cannot be declared that one technique would be a better than another one as in football there are so many factors contributing to the whole picture which creates a lot of completely different scenarios, therefore, a top keeper must know all 4 techniques and must know when to use [9].

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AI and sports

Négyesi Imre-Tóth János

Abstract

The technology of Artificial Intelligence (hereinafter referred to as AI) has evolved a lot in recent years, and it has become clear that it can bring significant changes in many areas of life. These also include the field of sports. This article examines the role of AI in sport and sport-related industries. Through examples, we demonstrate how beneficial AI has played and continues to play in the extent to which the development of the sector can be aided by the use of more modern methods in addition to traditional methods.

Keywords: Artificial Intelligence, sports, AI applications, innovation

INTRODUCTION

The concept of artificial intelligence is changing sport. This statement is now supported by a myriad of facts, as many measurements and quantitative studies have been conducted in relation to sports. Innovation has thus become unavoidable in sport and is a key contributor to the development we can experience inside and outside the playing field, all to support all players in making the best of their sport. Research into the use of artificial intelligence may be important for mentors and players to take the game to the next level, but referees and officials expect help from the new technology. Last but not least, fans and fans want more customized apps that can help them get even closer to their favorites. Let's look, from a slightly technical perspective, at what results have been achieved so far in the past and what further directions we can follow.

Artificial intelligence affects almost every major professional game. Over time, more dedicated fans can be gained through progressively customized apps. Organizations now understand the need for AI consciousness to most likely influence the sports industry through the use of information in innovation. For industry, the information available through MI can be business-critical. At the same time, new technologies can also help prepare players and broaden the range of supporters. Accordingly, let's review some of the applications you already use and their benefits.

CURRENT SITUATION (CHATBOTS)

There are many applications that are widely used in this industry. One such application is the already known Chatbot, which is now described from a technical point of view.

Artificial intelligence has undergone tremendous development in recent years and is becoming more and more widespread in practice. Many people, when they hear the term artificial intelligence, usually think of a science fiction movie. However, the proliferation of chatbots has begun to break this “myth” as Chatbots have actually been around for decades. Robots partly simulate human actions, and Chatbot is essentially software that can simulate and mimic human conversation.

WHAT IS A CHATBOT AND HOW DOES IT WORK?

At first, we might think that Chatbot is a way for users to have simple conversations with a program. The truth, however, is that these programs can be incredibly useful in performing certain tasks, such as in sports. More advanced Chatbots can connect to multiple predefined databases at once. In practice, this means that they are able to pass on different information on demand, tailored to users ’preferences. Since Chatbots are designed to learn about user information and preferences, if you ask a question, you will provide the answer by learning from the connected database and our location data. Some even more advanced Chatbots not only manage multiple databases at once, but are also connected to several different applications.

There are usually a lot of misconceptions about a novelty. One of these common misconceptions is that Chatbot is a program that communicates with one person in a similar way as another person would. This may be the end goal, but with current technology, it is not yet feasible. The other common misconception is that Chatbots only communicate with text and voice. The technology now allows users to interact with chatbots through a graphical interface.

However, it is true that it is sometimes difficult to distinguish between an application and a chatbot, as there is not much difference between them at first. However, the difference becomes clear when we start communicating with the chatbot, as the chatbot interacts with us and provides answers to our questions. In short, Chatbot is another way for users to interact with computer programs. More than an application, as applications can be seen as

a further development of websites where communication is one-way, but in the case of chatbots, this communication will already be two-way.

So the concept of conversation is key for chatbots. Chatbots can and do talk to people, but as already mentioned, their options are limited. It is not yet up to the standard when two people are talking to each other. Their advantage, however, is that chat bots are available 24 hours a day, 7 days a week and have access to a wide variety of information. In many cases, they are faster than humans and more accurate. Chat bots have the ability to take over people's work in certain tasks. They have quick access to the information and can display it in seconds. This can be a very useful addition to certain jobs, such as customer service and chatbot is essentially software that can simulate and mimic human conversation.

TYPES AND FIELDS OF APPLICATION OF CHATBOTS

Here's what types of chatbots there are and what areas they can be used in. There are two basic types of chatbots:

- Scripted type: This is the simplest type of chat bot, because conversations with this type of chat bot can only take place in predefined ways and directions. For each question that arises, we get a pre-programmed answer. The chatbot cannot deviate from this in any way.
- Intelligent type: The use of artificial intelligence allows them to give more flexible answers to users 'questions. The chatbot learns from each conversation and the next time you use these experiences to answer questions. However, artificial intelligence also has its limitations. The chatbot does not understand more complex contexts and ambiguities, nor is it able to shape the conversation, it only provides answers.

Despite the limitations of chatbots, they can be used in a wide variety of areas.

The possibilities are almost limitless, so here are just a few areas:

- Taking restaurant orders;
- Delivering promotions to users;
- Marketing campaign that interacts with users;
- Assistance in web stores;
- Easier handling of customer service issues;
- Theater ticket, flight ticket booking.

CHATBOT DEVELOPMENT DIRECTIONS

Chatbots have revolutionized people's lives in countless areas and their development remains unbroken. It is predicted in the coming years that chatbots will soon be ready to fully simulate human behavior and thus free up a lot of human resources in the lives of companies.

In the ever-increasing online competition, serving the needs of those interested, potential customers or existing customers is placing an increasing task on companies. Thanks to the various rating systems, there is an immediate trace of a customer being dissatisfied with the service, so every company strives to provide the highest possible standard in this area.

But how can you be constantly available 24 hours a day and handle incoming requests in countless areas? The answer, of course, is to be found in chat bots, which are tirelessly helping to build a higher user experience for companies with ever-increasing intelligence.

So let's see what are the areas where serious development in chatbot technology and applications is expected next year:

1. Talking robots

I don't have to introduce voice-based digital assistants to anyone. Apple, Amazon, Google, and dozens of other smaller companies are competing with each other to provide homes with devices supported by chat bots that can answer multiple questions without relying solely on voice recognition without typing.

Self-employed digital assistants still face serious challenges and their developers are constantly working to enable their voice recognition and intelligence to respond as accurately and effectively as possible.

Recently, voice-based digital assistants have already moved into cars and home TVs and are expected to "subdivide" additional electronic devices with their help next year.

2. Information security and personal data protection

Concurrent with the proliferation of voice-based digital assistants mentioned in the previous section, concerns about the use of personal data have emerged and scandals have erupted that have provably abused conversations that the device has "eavesdropped on" in our homes.

As chatbots evolve, all companies involved in the industry must work to ensure that personal and corporate information is protected in addition to technological advances.

3. Development of text message based bots

Sending text messages is still the most common form of using chat bots. The Messenger-based chatbot is appearing on more and more businesses 'websites and is one area that, due to its popularity, is facing great development.

4. Artificial intelligence controlled chat bots

Artificial intelligence-enabled chat robots provide personalized services to customers. Several banks already use advanced chat robots that can provide a powerful response to a wide variety of customer requests. With predictive analytics, the chat robot can perform complex banking processes, such as managing savings, making transfers ol, and so on also able to guide customers.

In the future, artificial intelligence will reach even higher levels and the service will be available at ever lower prices to more and more industries.

5. Higher level of speech comprehension

Speech comprehension still poses serious challenges for chatbot developers. Different speech speeds, pitches, ambient noises, and language dialects make it difficult or impossible for the chatbot to understand the text.

In the future, we can expect that technology will continue to evolve in this area and chat bots will recognize human speech with a lower error rate.

6. Chat bots based on customer behavior

Chat bots have the special ability to store and analyze the result of a conversation with a customer.

In the future, we can expect this level of data collection and analysis to reach even higher levels, allowing chatbots to provide even more effective answers to incoming questions.

7. Closer to human behavior

The biggest challenge for chatbots remains that most people are reluctant to communicate with a robot. And from the moment you realize you're not communicating with one person on the other side of the line, you'll either reject or test artificial intelligence with harder questions.

Many development companies are working to endow chat robots with human-like behavior, but this area is still in its infancy, however, in the future we are quite sure to see big changes in this area.

8. Adaptive chat bots

An adaptive chatbot is software that can analyze the data received and provide an answer based on the specifics of the company and industry.

In most cases chatbots are optimized for a specific area or task and, as they are incapable of learning on their own, they improve their knowledge and intelligence with constant updates.

The future, however, lies in chat bots that are self-learning, meaning that they automatically develop themselves and adapt to the given environment.

9. Chatbots in call centers

Call centers have also discovered chatbots for themselves as they realize that by using these virtual assistants, they can reduce their costs and increase their efficiency. Next year, progress in this area will not stop either and we expect that automated call centers without human intervention will soon replace the current ones so that the majority of customers are unlikely to even realize that they have not spoken to a single person.

In summary, the use of chatbots in the lives of companies clearly increases customer satisfaction. As a result, the number of companies using chatbots is growing exponentially. However, growing demands pose serious challenges for development companies and it is true that technology is still in its infancy in many areas. Capital inflows into the industry, on the other hand, allow us to know the current shortcomings behind us in a short time and thus open up new areas of application that we do not even dare to think about now.

ARTIFICIAL INTELLIGENCE AND SPORT

There were a number of applications that are widely used in this industry. In the field of sports, chatbot is an application used to answer fan questions. They store the history of all games and sports in general and link the app to Facebook Messenger. This will ensure that search engines can connect through Facebook and get relevant information. This app was appropriate to increase the understanding of the history of the sport and among the fans and so over the years it has helped to raise the entertainment, along with the associated economic benefits.

The next area is the mechanization of game news. AI technology has now evolved so much that essentially robots control sports media. The baseball league, for example, has gained this advantage in recent years. The benefit of AI is that the technology makes it easier to interpret and transmit games to media interfaces without necessarily going there with

cameras. In the field of sports, the control of media coverage can be implemented (automated) with the help of AI.

Significant progress has been made in exploiting the benefits of AI in American sports. Artificial intelligence in the sports industry can be used to track player performance and help improve player strength with injury suggestions. AI can therefore be used to improve game design, from the chat robots already mentioned to the layout of ideas for games dealing with different applications. In addition, AI can now help prepare preliminary forecasts for the games, which can also help develop methodologies.

Of course, the use of AI in sports can only take place in a regulated way. The regulation of artificial intelligence should ensure that artificial intelligence is used ethically and not diverted from the theft of malicious counterparties, such as personal information. Regulation should also cover cases such as unintentional bias, and AI can also be used to resolve social prejudices in society.

Fraud cases can also be linked to sports, the detection of which can be the biggest benefit of using AI. Misleading in sports, for example, can occur when AI is used to support one player against others. In the sports world, AI is already heavily relied upon to rank athletes, store their data, and share data. AI is used to evaluate the performance of athletes. The scams that occurred also used AI to get players doped. Once sport policy needs to ensure transparency and accountability, the use of AI may also be useful in reducing cases of abuse and fraud.

Finally, just a few more areas from the sport area where AI can be used:

- Appropriate training of match officials.
- Improving player performance.
- AI assistant coaches.
- Automated video highlights.
- Coaching.
- Computer referee.
- Intelligent ticketing.

CONCLUSIONS

The bottom line, then, is that using AI changes sports in more ways than we could ever do. AI and IoT now define every aspect of the sport in every possible way. AI has made it possible, through statistics and analysis, to redefine the strategy and mode of play so that it can be implemented on the field. AI has increased accuracy in the sport as scores, player movements, and fan habits can be easily calculated using AI. AI has improved the way

sports events are broadcast and learned what the audience wants to see and experience on the field. AI can also give players and fans insight into the expectations of game strategies. Robotic relationships after a while increasingly promote greater fan devotion and commitment .In this respect, man-made reasoning in sports will not be very different from the applications used in media and programming. Organizations are increasingly understanding the need for AI, so that AI is more than just information, AI can really help competitors achieve their goals.

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Assessment of the Legislation for the Application of Emergency Power Supply Equipment in Disaster Management

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Abstract

The legal regulation of emergency power supply equipment for disaster management purposes is of fundamental importance for public safety, population protection, and the operational continuity of critical infrastructure. The effective and safe operation of such equipment can only be ensured within a well-defined legal framework, particularly in extraordinary situations such as natural disasters, industrial accidents, or the collapse of primary energy supply systems.

This study reviews the key elements of the relevant national legal framework, emphasizing regulations concerning the installation, operation, maintenance, and coordinated use of such equipment. It also highlights the need for legal harmonization, prior authorization processes, and the legal conditions for operational deployment. Deficiencies in regulation not only jeopardize supply security but also pose liability and safety risks, necessitating a multidisciplinary approach to ensure effective disaster response.

Keywords: disaster management, emergency power supply, legal regulation, operation

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1. Introduction

In the 21st century, continuous and reliable electricity supply is a fundamental prerequisite for the functioning of modern societies. Hungary, too, is increasingly experiencing the impacts of global changes driven by an evolving security environment. Consider, for instance, the ongoing Russian-Ukrainian conflict in a neighboring country, the rising number of terrorist acts within Europe, or illegal migration. These changes and unprecedented security challenges naturally prompt states to respond through the creation and amendment of legislation, establishing a solid foundation for effective defense measures. Critical infrastructure, such as hospitals, water supply systems, communication networks, or transportation hubs, is entirely dependent on the availability of electricity. Annex 1 of Act LXXXIV of 2024 on the Resilience of Critical Entities categorizes critical infrastructure into sectors and subsectors, along with their associated essential services. This classification clearly indicates that one of the key sectors is energy, with electricity as a subsector encompassing numerous essential services, such as electricity distribution and transmission system operations. The annex underscores that many sectors and their essential services cannot function without the electricity system, highlighting its critical importance.

In the event of unexpected incidents, such as natural disasters, industrial accidents, or sabotage, the normal power grid may be damaged or fail, making the deployment of emergency power supply equipment crucial for minimizing damage and protecting human lives.

Power outages are a common occurrence during disaster situations. A major storm, earthquake, or flood can damage traditional electricity networks, with high-voltage transmission lines being particularly vulnerable components that, when significantly damaged, may lead to power outages lasting days or even weeks. During such events, the provision and operation of essential public services (water supply, wastewater management, telecommunications, transportation, healthcare) are severely disrupted. Without electricity, for example, a hospital cannot operate life-saving equipment, or a police or fire department communication center may be compromised if a constant power supply is not ensured.

Emergency power supply systems—such as diesel generators, mobile power plants, battery-based units, and solar systems—ensure the availability of electricity during emergencies. These devices are capable of temporarily powering entire facilities, such as hospitals, shelters, logistics centers, disaster management command centers, or even entire city districts.

Mobile generators play a particularly important role in disaster management, as they can be quickly transported and commissioned. For instance, in a flood-affected settlement, these generators can power pumping stations, reducing water damage and enabling the restoration of municipal services.

Based on the above, it can be stated that a stable, reliable, and sustainable solution must be found to ensure continuous power supply in disaster situations, which are particularly vulnerable to disruptions. A weather-independent, synchronized, high-capacity mobile diesel generator system could be an effective solution. However, even with the appropriate resources, equipment, and machinery, the question arises: under what regulations will these be operated and deployed? Who will be responsible for managing the equipment fleet during peacetime or for its use during a disaster? From a disaster management perspective, it is advantageous for the system to be operated at the level of the transmission system operator, but it is clear that the coordinated involvement of multiple ministries is necessary for seamless task execution. The legal regulation of this issue can be examined by dividing it into two parts: one part addresses the establishment, operation, and integration of the equipment into the system, while the other focuses on its emergency and disaster management applications. The legal framework exists, and by interpreting and applying the relevant regulations appropriately, a mobile generator system can be effectively deployed in disaster situations. This study explores the use of emergency power supply equipment in disaster management through the lens of these regulations.

2. Integration and Legal Regulation of Synchronized Diesel Mobile Generator Systems in Disaster Management

2.1 The Importance of Prevention and Preparedness, and Equipment Documentation

A cornerstone of the defence administration system is prevention and preparedness for disaster mitigation. A critical component of this is the availability, maintenance, and operational readiness of appropriate emergency power supply systems. However, the existence of such systems alone is insufficient; the following conditions must also be ensured:

- Proper maintenance, service support, and fuel supply,
- Documentation system,
- Training of operating personnel,
- Continuous supervision (inspection and testing).
- Regular testing of equipment prevents failures or operational and user errors from being discovered only during critical situations.

Decree No. 16/2008 (VIII. 30.) NFGM on the safety requirements and certification of machinery addresses the documentation requirements for equipment. According to Section 1.7.4 of the decree: “Every machine must be accompanied by an operating manual written in the official community language(s) of the

Member State(s) in which the machine is placed on the market and/or put into service." The operating manual (machine logbook) must include all provisions related to the use, maintenance, repair, commissioning, and safety measures of the machine. Technical documentation verifies that the machine complies with the requirements outlined in the decree. Based on this, the documentation system must be provided during equipment procurement, with additional documentation created as needed for specific uses, as stipulated by the internal regulations of the operating entity.

2.2 General Characteristics of Synchronized Diesel Mobile Generator Systems

The essence of synchronized diesel generators is their ability to operate in sync with the existing power grid, automatically adjusting to the grid's frequency (typically 50 Hz), voltage, and phase angle. This enables seamless power takeover during outages or operation as a supplementary energy source when connected to the grid.

Key Advantages:

- Rapid response: Can be started within seconds.
- Mobility: Easily transportable, even in challenging terrain.
- Scalability: Multiple generators can operate in parallel, allowing the system to be tailored to performance needs.
- Grid integration: Coordinated operation with existing infrastructure, such as hospital or command center systems.

2.3 Integration into the Disaster Management System – The Risk Mitigation Plan

Given the strategic role of electricity in disaster situations, it is critical that supplementary and alternative energy sources, such as mobile generator systems, are properly integrated into the disaster management system from a technical, organizational, and legal perspective. Synchronized diesel generators are particularly significant in this process, as they enable coordinated operation with existing grids, providing more flexible and secure power supply.

The use of synchronized diesel generators must be considered early in the disaster management planning process. Integration is necessary in the following areas:

1. Planning and Preparation

- Site designation: Pre-determining the installation sites for generators is essential. It is advisable to distribute them nationwide to enable rapid regional deployment.

- Capacity assessment: Determining the energy needs of specific sites to ensure generators of appropriate capacity are provided.
- Fuel reserve storage: Fuel reserves must be stored in secure, accessible locations to ensure continuous operation.

2. Training and Exercises

- Personnel training: Operators must have precise knowledge of starting, operating, and maintaining synchronized systems.
- Regular testing: Multiple trial runs should be conducted annually to verify proper operation.
- Exercises: Comprehensive drills, including the use of generator systems, should be conducted every 1–3 years in accordance with risk mitigation plans to maintain response capabilities.

3. Operational Functioning

- Automatic control: Modern systems automatically switch over during power outages, reducing the risk of human error.
- Remote monitoring and supervision: Continuous monitoring of network connections facilitates rapid troubleshooting.

Emergency power supply systems must be an integral part of disaster management, embedded within the infrastructure. Act CXXVIII of 2011 on Disaster Management and Related Amendments (Disaster Management Act) defines risk mitigation planning and assigns it to the scope of civil protection. The implementation of this act is detailed in Government Decree No. 234/2011 (XI. 10.), which distinguishes six levels of planning: municipal (district), workplace, regional (capital), central, county, and the consolidated plans of local professional disaster management bodies. The decree clearly mandates the existence of plans across various state and organizational entities, which must include the system of disaster management tasks and measures, their implementation procedures, the allocation of personnel, material, and technical resources, and the protection of infrastructure and material assets essential for survival. Accordingly, emergency power supply equipment intended for disaster management use must be included in risk mitigation plans, specifying the conditions, responsible parties, and protocols for their use. This integrated approach ensures that responses in emergencies are not ad hoc but follow pre-established procedures.

The aforementioned decree also requires risk mitigation plans to specify the participants involved in defense efforts, typically including law enforcement agencies, the Hungarian Armed Forces, and designated personnel from the National Tax and Customs Administration.

3. Analysis of the Legal and Regulatory Framework in Hungary

The use of synchronized diesel generators in disaster management is governed by several laws and regulations, primarily outlined in the Disaster Management Act (Act CXXVIII of 2011) and regulations concerning electrical safety and energy regulation.

1. Disaster Management Act (Act CXXVIII of 2011)

This act defines the tasks of disaster management and the tools applicable during defense efforts. It mandates that municipalities and certain state organizations prepare to maintain essential services, ensuring the protection of vital assets and critical infrastructure during emergencies, which may include securing emergency power supply.

2. National Fire Protection Regulation (OTSZ – Decree No. 54/2014 (XII. 5.) BM)

The OTSZ establishes fire safety regulations for the installation of electrical and mechanical equipment. The risk of fire ignition and spread must be minimized, with particular attention to ventilation, storage of flammable liquids, and fuel.

3. Electricity Act (VET – Act LXXXVI of 2007)

The VET has been amended in line with the EU's "Clean Energy Package," which introduced and regulated the role of aggregators. High-capacity synchronized emergency generators do not fully qualify as aggregators under the VET but are critical energy tools for system security and emergency supply. When connected to the grid, they are subject to detailed technical and permitting requirements regulated by the Hungarian Energy and Public Utility Regulatory Authority (MEKH) and the Hungarian Transmission System Operator (MAVIR).

4. Environmental Regulation

The use of diesel-powered systems must comply with emission standards, such as the EU Stage V standard, and noise pollution regulations. Regulation (EU) 2016/1628 establishes environmental requirements for non-road mobile machinery (NRMM), defining Stage V emission standards applicable to newly marketed engines and equipment.

4. Introduction of Practical Examples

Numerous examples worldwide demonstrate the critical role of synchronized mobile generators in disaster response. Below are some domestic and international cases.

4.1 Domestic Examples

- *Power Supply for Temporary Healthcare Units During COVID-19 (2020–2021):*

During the pandemic, field hospitals and mobile testing stations were established. High-capacity mobile generators were deployed to power these facilities. The Kiskunhalas mobile pandemic hospital relied entirely on generators for its initial energy supply.

- *2013 Danube Flood:*

The Danube reached record levels in several cities. The Disaster Management Agency deployed mobile generators to power temporary pumping stations, water transfer systems, and defense coordination points, operating in sync with local grids to ensure uninterrupted power supply.

4.2 International Examples

- *2021 Uttarakhand Floods, India:*

During devastating floods caused by cloudbursts, diesel generators played a critical role in powering relief camps and healthcare facilities, supporting continuous rescue and recovery operations in hilly regions.

- *2017, Puerto Rico and U.S. Virgin Islands, Hurricane Maria:*

Diesel generators supported prolonged recovery efforts following hurricane damage, providing more reliable and stable power than the damaged electrical grid.

- *2012, U.S. East Coast, Hurricane Sandy:*

During and after the storm, emergency diesel generators were vital in maintaining the functionality of hospitals, emergency call centers, and other critical facilities. Their rapid deployment and fuel availability made them the primary emergency power source. Over 1,400 Caterpillar diesel generators were deployed to power critical infrastructure, including the New York Stock Exchange, ensuring the continuity of essential services and communication systems during outages.

Image 1: CAT High-Capacity Mobile Generator

- *2004 Indian Ocean Tsunami, India:*

Immediately following the tsunami, diesel generators were deployed to relief camps, providing essential power for lighting, medical equipment, and communication systems.

5. Disaster Management Application

The deployment of synchronized diesel mobile generator systems in disaster management can occur in two scenarios: either the government establishes an operational task force to decide on resource utilization, or the Disaster Management Coordination Interministerial Committee activates the National Emergency Management Center via an alert. In both cases, mobilization occurs during a disaster threat or the introduction of a special legal order.

5.1 Special Legal Order

The special legal order is governed by Hungary's Fundamental Law. Article 48 distinguishes between a state of war, state of emergency, and state of danger, detailed from Article 49 onward. During a special legal order, fundamental rights may be restricted to the extent necessary and proportionate to the objective. Typically, the role of the National Assembly may diminish, while the Government gains broader decree-making powers.

A **state of war** is declared by the National Assembly (with a two-thirds majority) in the event of a war situation, imminent threat of external armed attack, or the need for collective defense under alliance obligations. In such cases, the Government exercises control and deploys the Hungarian Armed Forces both domestically and internationally.

A **state of emergency** is declared by the National Assembly (with a two-thirds majority) in response to actions aimed at overthrowing the constitutional order, rebellion, or civil war. It may be declared for 30 days, extendable by another 30 days with a two-thirds majority if the conditions persist.

In the event of war or humanitarian disasters in a neighboring country, or natural and industrial catastrophes, the Government declares a **state of danger**. This may be declared for 30 days, extendable with the National Assembly's authorization by a two-thirds majority. Hungary is currently under a state of danger until November 14, 2025, due to the war in neighboring Ukraine, as per Issue 55 of the Hungarian Gazette of 2025.

5.2 Operational Task Force Management

The Operational Task Force in Hungary is a coordination body established for extraordinary situations, such as pandemics, disasters, or migration crises, to support government operations, public information, and citizen protection. It is not a permanent body defined by law but a temporary task force established by government decree or resolution during a state of emergency or danger. The Fundamental Law's Article 15 provides the basis for its tasks and powers, allowing the Government to create such task forces to address specific issues. A well-known example is the Operational Task Force for Defense Against the Coronavirus Pandemic during the COVID-19 crisis.

The tasks of operational task forces include:

- Coordinating crisis response measures,
- Directing and coordinating the activities of epidemiological, public health, security, law enforcement, and logistics agencies,
- Collecting and analyzing situational information,
- Providing public information (e.g., daily/weekly press briefings),
- Proposing measures to the Government (e.g., restrictions, resource deployment).

The task force typically comprises representatives from relevant ministries and organizations, with its composition and leadership determined by the Government based on the situation. In a disaster scenario involving mobile emergency power sources, the Ministry of Interior, Ministry of Defense, and Ministry of Energy would likely be represented.

It must be emphasized that the task force does not independently enact regulations or make decisions but provides recommendations to the Government. During a special legal order, the Government issues decrees to facilitate rapid crisis resolution.

5.3 Disaster Management Coordination Interministerial Committee Management

The Disaster Management Coordination Interministerial Committee (KKB) is a key player in government-level coordination within Hungary's disaster management system. Its purpose is to align the efforts of various ministries, central agencies, and disaster management bodies to ensure citizen protection and rapid, effective responses during crises affecting multiple sectors or authorities. The KKB must convene at least twice annually, though its chair may call additional meetings, or members may request them. It is typically convened during major natural or industrial disasters, pandemics, or other events threatening national operations.

The KKB is chaired by the Minister of Interior, with a deputy appointed by the chair. Members include ministers and state secretaries from relevant sectors (e.g., agriculture, construction and investment, defense, justice). The chair may invite the President of the National Atomic Energy Authority to participate. Permanent advisory members include heads of central administrative bodies, such as the Director-General of the National Directorate General for Disaster Management (BM OKF), the National Police Chief, and the Commander of the Hungarian Armed Forces. Additional advisory members, invited by the Minister of Interior, may include senior officials, such as the Director-General of the National Directorate General for Aliens Policing, the National Commander of the Prison Service, the Chief Veterinary Officer, the Director-General of the Counter-Terrorism Center, the President of the National Meteorological Service, or the Director-General of the National Water Authority.

The broad membership of the KKB, including permanent and ad hoc advisory participants, ensures that leaders from affected sectors collaborate to resolve crises efficiently. The committee oversees two working bodies: the Scientific Council, which provides scientific support, and the National Emergency Management Center (NVK), an operational body. During a state of danger or disaster threat, the NVK operates via alerts, making decisions to ensure efficient crisis management, executed at national and regional levels. The NVK comprises general and professional working groups and oversees regional defense committees (TVB), which manage local defense committees (HVB) and mayors.

The BM OKF and metropolitan/county disaster management directorates (F/M KVI) also operate operational task forces. The F/M KVI task forces report to the BM OKF task force, which is subordinate to the KKB NVK. The BM OKF task force includes a national on-site command task force, with local on-site task forces operating under F/M KVI authority. These organizations rely on continuously maintained command points for smooth operations.

Image 2: Hierarchy of Disaster Management Operational Bodies

In the absence of a state of danger or special legal order, the KKB NVK conducts semi-annual full-scale exercises, annual theoretical training, and quinquennial system exercises to enhance response methods.

The BM OKF Operational Task Force, the national operational command body for disaster management, operates during emergencies, extraordinary events, disasters, or even peacetime. Its tasks include directing complex disaster management operations, conducting situational assessments, collecting and analyzing information, coordinating county/regional disaster management bodies, and preparing

reports. During a disaster, the deployment and mobilization of mobile emergency generators would be decided by the KKB NVK based on recommendations from the BM OKF Operational Task Force.

6. Assessment of Disaster Management Aspects of the Scientific Problem

The services and facilities of the critical system elements belonging to the electrical energy system have significant disaster protection regulation connection aspects [13]. In addition to the fire protection and civil protection regulations, the industrial safety regulations define a number of tasks for the operators of the critical system components [14].

In addition to critical infrastructure protection, these operators are also involved in the field of protection against major industrial accidents. The fire protection of the system elements of the electrical energy system is a particularly important area of activities dealing with dangerous substances occurring in industry, such as plants producing, processing and storing dangerous substances [15]. During the establishment and operation of dangerous activities, major industrial accidents can occur, the prevention of which is the responsibility of the operator and the task of the state authorities [16]. The presence of hydrocarbons, which can belong to the group of fire and explosive substances, is crucially assumed for the critical system elements of the energy sector. Accordingly, the compliance of petroleum and natural gas products with the rules for the prevention of major industrial accidents involving dangerous substances should be examined [17]. The environmental effects of fires related to flammable materials can occur through the pollution of surface and subsurface waters, the regulation of which is becoming more and more stringent internationally [18].

Further research direction could be the investigation of fire prevention issues concerning potential incidents in industrial buildings and facilities [19]. Beyond that, a number of public safety issues may arise among external risks, which can mainly be caused by the use of explosive materials and devices [20, 21]. This could also include a scientifically valuable investigation of the health protection of the responding firefighter [22].

7. Conclusions

In conclusion, the legal regulation of emergency power supply equipment in disaster management is not only a technical but also a strategic and public law issue. Experiences from global pandemics, extreme weather events, and energy crises have made it clear that the reliable and coordinated operation of these systems depends on a robust legal framework. Clear regulations ensure rapid response, clarify liability, and

enable safe and professional operation during both peacetime and emergencies. Continuous updating of the regulatory framework, establishing legal foundations for inter-agency cooperation, and providing legal support for practical applications are essential for enhancing national disaster management efficiency and guaranteeing population protection.

Overall, high-capacity mobile emergency generators should be a cornerstone of disaster response. However, their use in Europe is not widespread, typically limited to backup power sources. Their role in ensuring public safety, maintaining public services, and supporting uninterrupted damage mitigation operations is undeniable. To maximize their effectiveness and ensure seamless deployment, the relevant regulations must be appropriately interpreted. This study has explored this issue for clarity, detailing the necessary laws, decrees, resolutions, and regulations. It has demonstrated that numerous factors must align to enable the use of such emergency power sources in disaster management. The systems of operational task force management and KKB coordination for activating power sources have been outlined.

Hungary's legal framework allows for the operation and use of emergency power sources, but the large number, complexity, and interpretability of relevant regulations pose challenges. Simplifying and consolidating these regulations, or enacting new legislation specifically addressing the use of emergency power sources in disaster situations, is essential.

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