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The importance of IT in supporting roller Hockey referees

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Abstract

Technology is increasingly present everyday life. All people are users of technology and the world of sports is no exception. Indeed, there is a strong need for tasks improvement, and, in sports practice, the implementation of technologically advanced tools is a reflection of the execution of that objective, as athletes, coaches, referees, or fans, are involved in that process. However, roller hockey, which is considered an old and traditional sport, is out of sync with this new reality. Thus, the main issue one may tackle is to evaluate the importance of technology according to the perceptions of the different stakeholders involved in the Roller Hockey sport. Using questionnaires, we intend to characterize the perceptions regarding available technologies and potential applications. In this paper, some results of this study (N = 227) are presented, in so that the potential for introducing information technologies to the referee role may be understood.

1. Introduction

With the win in the 2019 World Championships, the Portuguese Roller Hockey team is highly known, both in the national and international sport arenas. This is the most awarded sport for Portugal, nationally and club wise [3].

Science application is one of the most influential changes affecting the evolution of sports around the world, as the ever increasing performance of technology, supported by scientific data, is enabling the implementation of register and analysis frameworks into the sports reality [10].

As Roller Hockey is regarded as a traditional sport but with historical achievements driving the increasing number of fans, it is paramount that it may keep up with the technological evolution in order to emphasize its rigor, ethical and transparency values. Although there are no consistent studies regarding the present characteristics of the Roller Hockey sport, it is common opinion among its coaches that this sport has become quicker, more tactical and each game success more dependent on the superb rink positioning of each team [20].

Therefore, it is vital to understand the perspective and perceptions of all entities involved in Roller Hockey, regarding the importance and urgency of technology implementation, together with the assessment of its impact in the organization, work and data collection activity of the several functions responsible for this sport.

Thus, herewith is presented part of a paper being developed for a master's degree dissertation (on IS Management), which aims to address the following issue: "What is the importance of the information technologies in the support to the referee function in Roller Hockey? This document focus specifically on three sub-items (a) Understand the impact of technology already deployed in this sport, (b) The perceived opportunities of additional features already used in other sports and (c) Evaluate the degree of acceptance of implementing an information system for the referee role.

The results presented result from a questionnaire developed upon a deep literature and practice study, and presented through the online platform Qualtrics to be answered by referees and other stakeholders involved in Roller Hockey.

2. A literature brief review

2.1. Second-order headings

The sport is a global phenomenon which mobilizes numerous sectors of activity and is based in the physical activity that praises competition, usually conditioned by rules and in which one´s morale and character are highlighted [16].

According a researcher at the University of Coimbra, the sport has become one of the most relevant social phenomena in Portugal [1], imbibed in a large and complex associative, institutional, political, economic, mediatic, and ideological network [19]. There is a growing number of athletes, clubs and referees in the country. According to PORDATA site (Portugal contemporary data base), during the span of time from 1997 to 2018, the number of athletes has increased from 271.470 to 667.715 individuals and the number of referees has gone from 9.470 to 15.618. Roller Hockey has experienced the same trend, as the number of registered players has

grown from 1.215 to 2.135. Running alongside this increase of the sports activity, technology is becoming ever more integrated in the daily activities of our society and it has changed both the knowledge acquisition and transmission processes. However, it is compelling the lack of technology applications to sports related knowledge [23]. Although information technology evolution is important for all sectors, it is vital for the sports industry [12]. The development of new technologies and innovation is crucial in sports management, as innovation targets the development, optimization and customization of products, systems and services [16]. Sports organizations will continue to be engaged in effective and efficient technology adoption, which will improve individual, collective and organizational development [5].

The sports performance "limits" have been continuously surpassed along its history. A large contribution for that has come from technology, namely applied to better sports equipment, exercise methodologies sophistication, coaches training enhancement and the superior knowledge of the human organism functioning when practicing sports activity.

The application of technology to the sports environment is increasingly relevant to the evolution of athletes who are seeking for a technical or physical edge that enables them to improve their performance towards the overcoming of individual limits and records breaking [23].

Technology can significantly enhance the quality and speed of the observation and analysis processes, as long as it is used in the proper way [9]. The use of time-consuming methods for data processing can be avoided when he addresses the present technology degree of sophistication [21] and there are three main factors that influence the general adoption of technological innovations: cost, user friendliness and reliability [13]. On the other hand, the technology affects sports in many ways and that its implementation to the sports' world enables the decrease of incidents during the referees' judgment of the players' moves [6]. The efficiency and yield are generated and fed by the technical and technological evolution [8].

There are several sports where technology is already deeply rooted, like football, which is considered the most popular sport in the world [15], tennis and volleyball. The technological possibility spectrum in football is still to be fully tackled [17]. However, there are several technologies already in use: VAR (video assistant referee) – the technology which aims to minimize potential errors incurred by the referee team when judging controversial game situations; LGT (line of goal technology), which purpose is to help the referee team, while not constraining the referees' decision making process to the technological system; and the SCOUT - a software tool that translates the game moves into

virtual interactions, in order to generate statistical data to be used by all the professionals involved in football, such as coaches and physical trainers, together with the enhancement of information to media reporters and fans watching the game in real time on TV [23].

In tennis, the Hawk-eye is the most relevant technology in use, which helps the referee in the decision-making process. This system can capture both the ball trajectory and the positioning of various objects and people from different angles, enabling the mitigation of controversial decisions by the referee team, especially in rather questionable calls [22].

In volleyball, there is a system called Penalty d-Tech, which, based on video cameras, aerials and a chip in the ball, allows the visualization on a screen of the game moves with enhanced detail. In a nutshell, we have seen an increasing use of technology among several areas of sport in recent in years, although not always as a helping tool for the referee teams, but rather more focused on the external users, coaches and other parties involved [14].

2.2. The impact of the technology on Roller Hockey

The Roller Hockey original roots are rather ancient. There are historical records showing that a rudimental type of hockey was practiced in Egypt 4.000 years ago and in Ethiopia around the year 1.000 BC [18]. Other sources report that its origin comes from the discovery of an Egyptian bas-relief where several children are portrayed playing ball with some sort of thick batons [2].

Regarding Portugal, it is common ground thinking that Roller Hockey had its origin from the game of *Choca*. That game was played by five players equipped with a stick (which could or not be curved at the tip), a small wooden ball (or a pine) named *reca*, *choca* or *porca* [2]. It has settled in 1915 with its practicing at Amadora, led by the initiative of an Englishman named Arthur Vleeschover [11].

The Rink-Hockey European Committee (CERH – Comité Européen de Rink-Hockey) has been changing the rules of the game for years, with the purpose of making it more attractive. In 2009/2010, those changes made it become more similar to Ice Hockey, namely by the introduction of rules which create power-play situations, in order to mitigate the referee tolerance towards physical contact among players.

Roller Hockey is regarded to be one of the most complex team sports, as it demands from its players not only high technical and tactical skills, but also psychological preparation and a constant high degree of physical development and improvement [7].

This sport is performed by two teams, with all its players wearing roller-skates to move around, while maneuvering a ball with a tool (stick), not being allowed to influence of the ball with any part of their

bodies, except for the goalkeeper. The goalkeeper has, on top of the roller-skates and the stick, a specific outfit geared for the task. The Roller Hockey is a situational sport, as its technical execution is rather contingent upon the agonistic conditions of the competition and the opponent's positioning on the rink [20].

Roller Hockey is considered a traditional [11], fast-moving sport, with the need for players to possess specific physical characteristics. There is a limited number of rudimental technologies used to help the referee job, such as a chronometer, a 45 seconds marker, earpieces for referees' intercommunication and an electronic type of bulletin. Outside the rink, it has been recently implemented another technology, Fluidsports, by the top league team UD Oliveirense, aimed at helping the goal-kepper's training. It is not known any other technical evolution to be in use beyond those.

3. The research purpose and the objectives of this paper

The application of technology to a lot of areas, namely to sports, has produced significant impacts to performance and results improvement, either through systems or software. Having this reality in mind when addressing Roller Hockey, a traditional sport usually disconnected from the existent technological environment, it is relevant to understand how can the technology impact and influence the role of the Roller Hockey referee. Hence the motto for this paper: "What is the importance of the information technologies in the support to the referee function in the Roller Hockey?

Thus, there are three main objectives that we target to address:

1.   To understand the impact of the technology already deployed in this sport;
2.   To perceive the potential and possibilities of additional applications, already in use in other sports;
3.   To verify the degree of acceptance of an information system for the referee team.

4. Methodology

This study had 227 participants (N=227), catalogued in 5 groups – referees, athletes, coaches, managers and fans (figure 1) -, with ages ranging from 16 to 78 years old; as the referees are the main focus group, 72 Roller Hockey Portuguese referees answers were collected (N=72), corresponding to 33% of the sampled universe.

The referees where characterized by having a high average age (43 years old), mainly belonging to the masculine genre (96%) and having an academic background lower than the rest of the individuals

questioned; only 20% had a college degree and referees represented 63% of the participants having only basic school studies.

A questionnaire was developed based on the review of literature and the practical knowledge of the sport.

The questionnaire was formatted into several groups of questions, namely the highlighted following ones:
•   The characterization of the sport and its participants;
•   The evaluation of the Roller Hockey existent technology;
•   The perception of the impact and possibilities of the technology implementation, specifically an information system;

The questionnaire was implemented through the use of the Qualtrics platform and sent by email or social media, having the support of the FPP (*Federação Portuguesa de Patinagem*) to forward it to all the Roller Hockey referees ranked as International, European and National ones. The collected data was first treated using the Excel statistic tools and then further analyzed with SPSS, namely for the generation of average comparisons, factorial analysis and variance and correlations analysis, as well.

5. Results and evaluation

Prior to evaluating the main issue, it was necessary to typify the Roller Hockey activity along 4 dimensions: (1) traditionality, (2) Investment, (3) social impact and (4) promotion.
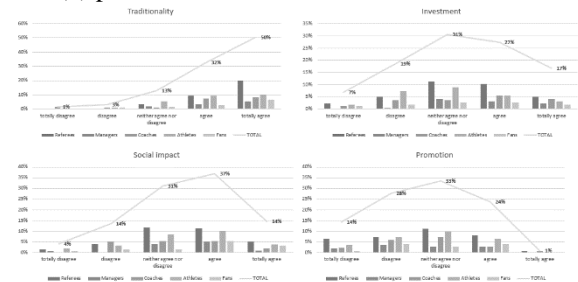

Figure 1. Roller Hockey dimensions: (1) traditionality, (2) Investment, (3) social impact and (4) promotion

The respondents have a similar perception across the four variables. They all agree that Roller Hockey is a traditional sport, with social impact and do not agree that the promotion of this sport is enough. However, there are different opinions as far as investment is concerned (Figure 1). This divergence is correlated to the categories, levels and divisions in which the respondents are involved, as in the first division of the senior level the investment has been growing, for instance.

In order to grasp the perception people have regarding the present technologies used in this sport and the further potential applications it may have in

several different situations (sport practice, support to the referees, access to information and management tools), the respondents agree with the implementation of new technologies, although revealing their satisfaction with the current level of it.
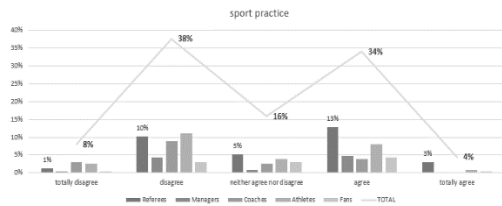

Figure 2. Current state of today's implemented technology - Sport practice

Regarding the sport practice, the respondents do not agree that the present technology is enough (Figure 2). This opinion is even clearer among coaches, as 12% from 19% total, disagree that current technology is enough for the Roller Hockey practice.
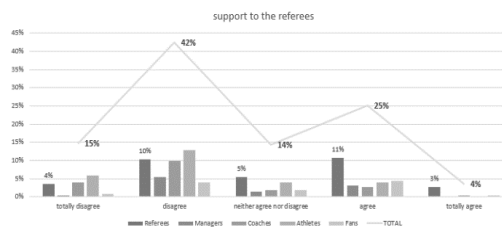

Figure 3. Current state of today's implemented technology - Support to the referees

Among the referee sampled population, it is very noticeable that their opinion is overwhelmingly disagree that the current state of today's implemented technology is not sufficient. Indeed, 42% disagree and 15% totally disagree (figure 3).

Although there are several tools to help the decision-making process nowadays, it is still considered insufficient (figure 2). Those tools, although scarce, are considered paramount and impactful, especially among its direct users, the referees (Figure 3).
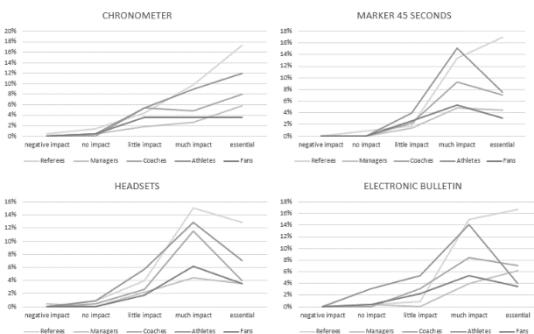

Figure 4. Tools to help the decision-making process nowadays

Specifically, when addressing this issue, several Roller Hockey stakeholders disagree that it may be enough (Figure 4). The questionnaire results reveal that today's access to information is done through the use of internet, namely visiting specific Roller Hockey websites, such as www.FPP.pt and www.HoqueiPatins.pt (table 1).

Table 1. Roller Hockey's information media and websites

Roller Hockey's information media	
Internet	100%
FPP.pt	69%
HoqueiPatins.com	85%
Zerzero.pt	26%
News	32%
Social networks	52%
Others	12%
TV	40%
Newspaper	25%
Radio	7%
Magazines	3%
Books	6%
Others	6%

Lastly, it is rather clear the absence of a management application to support this sport (APP). Following the questionnaire results, it is easy to conclude that 7% of the referees assume the existence of an APP, thanks to the electronic bulletin accessible via the FPP site (figure 5).
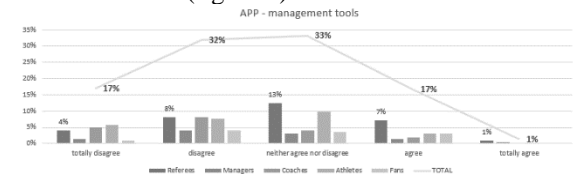

Figure 5. Current state of today's implemented technology - management tools

The game umpires were the only ones questioned concerning the management application, due to their direct interaction with the system.

The management application, defined as an integrated system with all the functions used by the referee team, should have the following features/possibilities within the same physical and temporal dimension:

• To visualize the weekly appointments, with an option to confirm ones' presence;

• To apply to absentee leave and to confirm its acceptance or refusal;

• To automatically compute all the expenditures, according to the appointment details (location, level and schedule) and to allow its forwarding;

• To consult technical delegations;

• To fill and forward each game's bulletin;

• To access FPP digital licenses, with the option to block any expulsion situation;

• To allow the Discipline Counsel to liberate any seized licenses;

• To compile the statistical data of each referee (evaluation average, games average, awarded points average, most umpired level, etc.);

This application was evaluated as rather necessary, useful, appealing and impactful to the referee teams' decision-making role (figure 5).
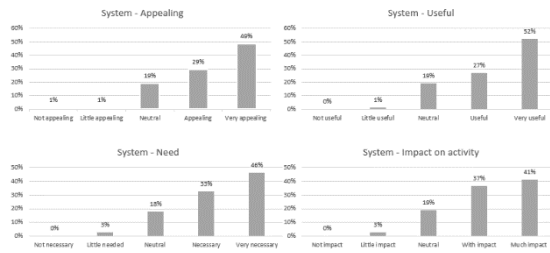

Figure 6. Classification characteristics of the information system

It was also detected that the most critical processes for a referee are the access to the evaluation information and the expenditure notes issuing and forwarding. The second most critical activity is the issuing and forwarding the games' bulletins, because automatic features to send those bulletins are already used today, for the first and second division of the seniors' level (figure 6). The very same processes where identified as necessary potential improvements (table 2).

Table 2. Bureaucratic processes of arbitrage

	Difficult processes by the referees	Processes with possibility of improvement
-Waiver request	13%	13%
-Reception of calls	2%	5%
-Reception of appointments	3%	10%
-Filling in game reports	7%	11%
-Sending match results	8%	10%
-Sending match reports	22%	15%
-Access to evaluation information	45%	41%
-Creating Expense Notes	53%	66%
-Sending expense notes	47%	70%

It is understandable that the implementation of an integrated information system for the referees may be seen by them as rather necessary to better deal with the bureaucratic processes of their job, namely the mandatory tasks.

On top of this, it is also important to note how the data from the inquiry shows a clear preference for an electronic game's bulletin. Indeed, 93% of the referees prefer an electronic version instead of the paper one (Figure 7).
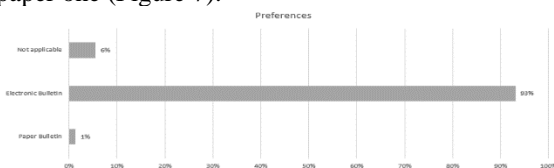

Figure 7. Referee preference bulletin

6. Conclusion

Considered a traditional sport, with low investment and promotion, Roller Hockey lacks a technological quantum leap that will bring more efficiency to the job of the multiple entities involved. The constant introduction of new technologies in sports with high investments make them more appealing to the general public. The results obtained through this study draw the conclusion that Roller Hockey has a significant margin to become more attractive to the general public and stakeholders trough the investment in technologies, namely information and management technological systems.

It was demonstrated that the referees, a group of participants in this sport with a high average age level and low academic background, consider relevant the implementation of new technologies, as the impact would be very positive, namely to better support their decision-making tasks.

The future introduction of an information system tailored to this sport is perceived to be useful, necessary and appealing. The same conclusion is reached regarding the manifested preference for an electronic bulletin, although current procedures such as the existence of a second referee in the rink should be kept.

Globally, we concluded that the tailored implementation to Roller Hockey of other sports' already existent and successful technologies is perceived as positive. That evolution has the potential to bring higher levels of transparency to the practice of this sport. It will for sure be an unavoidable and essential trend in the Roller Hockey sport in the near future. High necessary investments for the application of technology will be the main obstacle to overcome, so that Roller Hockey may continue to grow as far as the number of athletes and fans is concerned and the sport may reach higher levels of recognition in the sportive general landscape, where only a few number of sports are the focus of the majority of attention and media coverage.

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