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Short Commentary

Hawkeye Technological Innovation: Challenges and Intervention Strategies in Sports

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Abstract

Current technological innovations have changed sports industry globally. These changes are effective, positive, and most of the times with better sports performance and improving the quality of the game, but it also have challenges. The paper presents an insight into current sports technological innovations such as Hawkeye, prospects and challenges of its use in sport. The study also elicited an overview of Hawkeye technology, how it functions, benefits, and its application by different sports to officiate. It highlighted some of the challenges and intervention strategies of using Hawkeye technology in sports such as recording and processing of these images during the play of the game in order to give instant feedback might obstruct the smooth flow of the game among others. The paper made some useful conclusions as well as recommendations that will improve current sports technological innovations.

Keywords: Hawkeye, technology, sports, innovation, performance, challenges

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1 INTRODUCTION

In scholarly writing, athletics and innovation have been linked. When describing innovation as the distinguishing characteristic of the sport entrepreneur, Ratten[1] emphasized its significance in sports entrepreneurship. Technological innovation, product innovation, and promotional innovation are just a few examples of how entrepreneurial sports firms exhibit innovation. Also capable of changing their sport is athletes themselves[2]. Through competitive events and user-driven innovation, sports equipment-related technology has advanced. Sports equipment users are integrated into the innovation process early on[3].

Sport has always been a testing ground for new ideas since it offers the rare chance to employ technology to reach millions of people worldwide. Technology is a process that is always changing and has historically been very one-dimensional[4]. Sports are undergoing substantial change as a result of technology. These changes are worldwide, effective, and most often good[1,5]. They also raise the level of safety, competition, and accessibility for both players and spectators. Technology is unavoidably significant and pervasive.

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Technological advancement seems to be the current reality we must deal with, from the most basic everyday work to the optimized complexity of training process[6].

Technology has an impact on how athletes prepare for competitions and engages in them, how viewers interact with content, and how elite venues are built[7]. The world of sports has long been being quietly transformed by technology, and in 2018, venture capital funding for industries like esports exceeded $2.5 billion. The sports technology market, however, is expected to reach $30 billion by 2024, according to the forecast[8]. The Olympics in Tokyo are currently taking place in 2020, and the sports technology sector is receiving significant funding and innovation in preparation for this multi-national event[9].

Sports equipment, footwear, apparel, and accessories have evolved quickly during the past 20 years thanks to the application of science. Examples of technical advancements include wearable technology, computer games, protective gear, video assistant referees, sensors, and a new high-tech football helmet, to name a few[10]. Stadiums that are technological showcases, video systems that analyze athlete performance, and sensors and mobile applications that regulate biometric data are a few examples of the developing innovations that surround the sport community. Today, a wide range of sports, including football, cricket, snooker, volleyball, tennis, rugby union, and ice hockey, utilise Hawkeye technology to provide fast feedback on crucial decisions. Improvements are made using Hawkeye technology[11].

This quick growth and development not only paved the way for fresh approaches to performance optimization through training and competition monitoring, but it also gave rise to new ways of organizing sports organizations and, until recently, the possibility of trade[12]. But for the time being, technology is a fantastic enabler with problems that require solutions. It permeates every aspect of our daily existence. All of our everyday activities, health, travel, and job responsibilities, weekend commitments, social connections, and work commitments are made possible by some form of technology. Due to the requirement to gather input from several stakeholders, sport innovation calls for a systemic approach. Sport innovation is increasingly dependent on input from various groups in order to be accepted by consumers[13].

2 OVERVIEW OF HAWKEYE TECHNOLOGY

The technological advancement known as Hawkeye is used in sports. It is one of those pieces of technology that the game of cricket considers to be absolutely top notch[14]. As the name implies, this technology uses six to seven very expensive cameras placed above the playing field, for example, a birds-eye view, to examine the flight and trajectory of an object utilized in a sporting event[15]. The Hawkeye is a stunning technological advancement mostly intended for sports[16], while it is being used in the gaming sector to some extent. Paul Hawkins, the creator of the Hawkeye system in the UK, was responsible for its creation[15,17]. It makes use of six or seven extremely potent cameras that are fixed at various positions of the stadium to track and get the clear view of the ball from different angles; this powerful and strong combination ensures that no shot is missed to be tracked by it. It offers three-dimensional animation of the ball's trajectory. Cricket was the first sport to employ it, but many others soon followed. The primary principle is to keep an eye on the cricket ball's path during the entire game. The courses the ball followed are then depicted in lifelike visualizations created from the data processing. Hawkeye generates a variety of statistical analyses, including those of ball speed, pitch on the wicket, and trajectory following a bounce. Hawkeye technology is a camera system that tracks the trajectory of the ball while it is in play[18]. It is the most sophisticated officiating tool in use today, and it is employed in numerous sports. Hawkeye was the first business to be awarded a FIFA Goal Line Technology (GLT) License, the technology is now classed as the most accurate, reliable and experienced provider of GLT[19]. It is undeniable that the technology has the support of the industry experts, who have experience working with numerous federations and football leagues.

Hawkeye technology, which has been used in tennis since 2002 and is more precise than a judge's eye[15]. Sports like football, cricket, snooker, volleyball, tennis, rugby union, and ice hockey all utilise Hawkeye technology. In sports like national association for stock car auto racing and horse racing, the technology is also evident[20]. It's wonderful to see how technology is being used by so many sports to provide quick feedback on crucial decisions.

3 BENEFITS OF HAWKEYE TECHNOLOGY

- In the sports of baseball, football, rugby league, cricket, and tennis, Hawkeye technology aids in making decisions without making mistakes.
- Thanks to technology, there is less criticism of the match referee's decisions from players and spectators, and the umpire can make an accurate judgment swiftly while the game is still in progress.
- This technology helps coaches and referees provide players and athletes much better feedback by studying the movement of the balls.
- It helps rule infraction determinations by referees, umpires, and other sports officials.
- The design of athletic wear and gear has improved thanks to Hawkeye technology.

● It improves fans' ability to observe sporting events.

● It improves the precision with which athletic performance is timed.

● Hawkeye enables officials to act swiftly and decisively in order to limit play interruptions. As a result of more precise judgments, the game is also fairer to the players and officials. The main benefit of this kind of technology is that it allows broadcasters to improve the viewing experience for viewers at home.

3.1 Hawkeye Technology in Cricket

Cricket was the first game to use Hawkeye technology. Making important judgments that might otherwise be quite tough to forecast is definitely made easier with its assistance. As an illustration, the choice of leg before wicket, which is one of the most important and challenging to make, is evaluated using the following three factors by this wonderful technology:

● The spot where the ball is thrown.

● The region along the batter's leg that the ball makes contact with.

● The ball's traced path prior to the batsman.

The advantages do not simply apply to the bowler, though; the batsmen also get a share of the action. As a result, the batsmen will be proud of their performance and prepared for the difficulties ahead by having a comprehensive understanding of all the balls they have faced thanks to the analysis of records, which also allows them to judge many other factors such as the ball's pace and critical hits.

3.2 Hawkeye Technology in Tennis

Tennis is undoubtedly one of the most popular and costly sports in the world, so each ball struck by the racket is quite important. And yes, almost everyone will concur with me that one of the most challenging aspects of this sport to judge is whether the ball hit by any of the players is inside the line or not. A small mistake in this judgment could cost the opposing player a match, a championship, or even a major championship, which is exactly like catching up on Corona while remaining completely confined within the four walls of the room. However, thanks to this cutting-edge technology, unlike in cricket, the dropping of the ball can be precisely measured on a tennis court by 10 very strong cameras. Additionally, some tennis tournaments broadcast their events using this technology.

Hawkeye has been utilized in tennis since 2002[15]. The name of it was electronic line calling (ELC). More than 80 competitions around the world now use the technology each year. The ELC can track virtual reality statistics, player tracking, player indents, and post-match analysis. Up to 10 cameras are positioned around the court to capture real-time images while also calculating bounce marks of the ball's contact area during game play. Hawkeyes ultra-motion cameras have a frame rate of up to 340 frames per second.

3.3 Hawkeye Technology in Football

The most popular and crazy sport-football has also adopted this magnificent technology since it is so impressive[17]. We are aware that tracking the precise course of the ball towards the goal in order to determine whether or not it is a goal is highly tough and crucial. When it comes to following those exhilarating shots by Ronaldo, Messi[18], or any other great star of this sport, the hawk-like keen cameras leave little room for questions or objections[21].

The intricate procedure of installing 7 cameras per goal (for a total of 14 cameras for a match) at the best visibility location on the stadium roof is what enables speedy decision-making in football[15,19]. The cameras analyze each image to pinpoint the location of the ball inside the goal while also identifying regions where the ball is most definitely not. Even with mud on the ball, the camera is still able to see any pattern on it. If the ball has been detected by two of the seven cameras in the goal, the system can find it. The system's millimeter accuracy eliminates the need for broadcasters to replay potentially dubious verdicts. The device then sends a sign to the officials referees watch as soon as a ball crosses the line, giving them immediate feedback. This technology makes it possible to determine whether the ball passed the goal line while in flight or after making contact with the ground. Additionally, it is possible to judge when a line has crossed for a throw, goal kick, corner, and many other situations.

3.4 Hawkeye in Basketball

Basketball is also not too far behind, and Hawkeye technology has approved the use of this fascinating technology. The final two minutes of a basketball game contain the majority of goosebumps-inducing moments[20], and it is this period that is used to determine the winner. Because the super cameras capture every potential movement during the game, it is quite simple to ascertain the final result of the match during the last two minutes of play. Additionally, since it may alter the course of the game, it is helpful to see if any baskets were made after the allotted time.

3.5 Hawkeye in Rugby

In order to get fair and accurate results, rugby in 2015 used Hawkeye technology[15]. Since the sharp cameras capture everything that happens during game play and a sport like rugby is very difficult when it comes to physical contact and grappling, many players use this as a weapon or tool of retaliation to harm other players in order to win the match, but with the development of this technology, those players can definitely not repeat the same coward act as

their cheap act.

4 CHALLENGES AND INTERVENTION STRATEGIES OF USING HAWKEYE TECHNOLOGY IN SPORTS

4.1 The Cost Implications

Hawkeye technology uses a number of cameras, typically six or seven, that are positioned above the playing area to track the path and trajectory of balls. Hawkeye technology consists of numerous cameras ranging from 6-7 installed above the field of play to analyze the flight and trajectory of balls. These cameras are very costly and expensive to purchase, therefore not everybody can afford these technological sport equipment.

The federal and state government should accept their primary responsibility of funding of the sports development section and through regular and adequate budgetary allocations to the sector in support of sports equipment and development programmes.

4.2 Technology Equipment Made Sports Exclusive to Wealthy People

Due to high cost of this current technological equipment in the market not everyone can easily purchase this equipment. Low-income countries might not afford this equipment for the training and competitions for both coaches and officials may lead to unfair advantage for some athletes and coaches[20].

The federal, state, and local governments in Nigeria were mandated under the country's National Sport Policy to provide enough venues and equipment for widespread participation in sport through duty-free importation.

Depending on the size of each ground, the distance at which the cameras can see the pitch and the ball can vary significantly.

There is no way our participation and officiating in competitive sports can improve without having well trained coaches. Coaches in Nigeria therefore should undertake training, re-training and participation in workshops and seminars both locally and internationally to human errors.

The ball may not be seen to all of the cameras due to players or spectators, or it may miss one or more cameras entirely during its flight. This system ought to be capable of handling that, perhaps by offering some redundancy.

The National Sport Commission and its state counterpart should assess the current state of the industry and develop a framework for future expansion, modernization, and equipment manufacture.

4.3 Human Error in Decision Making

The ball might get confused with other similar objects. For instance, with flying birds or the shadow of the ball itself. The image processing techniques used need to take care of these challenges. Luckily, there are techniques which are easy to implement and are well known to the Image Processing Community on the whole, to take care of these issues.

However, the National Sport Commission shall map out strategies for national sport development for the next ten years (2031AD) and also plan for the local production of the sporting equipment and facilities.

It is exceedingly difficult to pinpoint the precise locations where the ball makes contact with the pitch during a game of cricket, the batsman, or other objects. This is due to the fact that we don't actually know these locations in advance, necessitating the merging of a model with actual camera images to create this perspective.

For the system to be useful more than just individual photos are needed; it must be able to precisely track the ball's 3D trajectory. The field of view of each camera should be constrained to a tiny area in order to achieve this accuracy. This indicates that additional cameras are required in order to cover the full playing field.

For the system to be useful, the National Sport Commission should also preserve a data bank on national sports associations, athletes-supervised training camps, sports, and associated research discoveries. This data bank should be maintained through computer programmers and standard record keeping.

4.4 The Joy of Celebrating When a Goal is Scored is Removed

The spirit and the joy of celebrating when a goal is scored have been killed. Hawkeye evaluations during goals have been criticized by fans and onlookers for detracting from the fun of the game because no one can truly rejoice until the Hawkeye review is over. The mood in the sports arena can suffer if this spontaneous thrill of goal celebrations is lost because a review might occur.

4.5 Technology Slows Down the Speed of the Game

All these recording and processing of the images during the play of the game in order to give instant feedback might obstruct the smooth flow of the game by officials.

4.6 Problem of No Clear Angle of Where the Ball Was

The problem here was there wasn't a clear angle

of where the ball was. You can see Jimmy Graham's helmet, but no angle was clear enough where you could confidently mark the ball and say he was short[15]. It was 3rd down so you'd need to be able to spot it correctly, premeasured, and give the packers the chance to go for it on 4th. No angle was good enough to do that so the called on the field stood. First down packers until game over.

5 CONCLUSION

Sports have become a major industry around the world, the ultimate unifier that transcends national boundaries and rises above partisan politics to bring people together and promote peace. There is still a long way to go, but we have to think that technology used in sports symbolizes a door open to new information that is emerging and a potentiating of the sports phenomena. There are several issues that the sports community should talk about in light of the quick development in technology used in sports and physical activity. To make the most of the new technology available, some jobs should also be redefined, and organizations should be reorganized. However, it's important to remember to follow any applicable confidentially and ethical guidelines. The majority of our coaches lack the knowledge and expertise necessary to prepare our players for international competitions like the Olympic Games. No local coach has the expertise to prepare competitors for such a competition.

5.1 Recommendations

1) Provision of adequate funds to ensure proper implementation and sustenance of the current technological innovations

2) Upgrading of sports physical infrastructures and provision of additional facilities, which are grossly inadequate in most institutions should be vigorously pursued by the Federal Government.

3) These cameras need to be enhanced so they can follow the ball's three dimensional trajectory correctly and with great precision.

4) Nigeria's curriculum reform should be aware of international innovations in the sports sector. The idea that general education and problem-solving education are better preparation for life than specialized training is becoming more and more prevalent in light of the world's present trends and rapid development. There seems to be a rising understanding of the importance of initiating each person into the worlds of meaning, fields of knowledge, or forms of human experience that include the entirety of human culture.

5) The development of a critical, inventive, and resourceful mind is also thought to be more valuable than amassing a large amount of information through innovations.

6) These technological innovations need to be added into the school curriculum from primary to university levels.

7) There is a great need for seminars, workshops, conferences on the use and application of these technological innovations by the coaches and athletes. We cannot give what we don't have.

8) Even lecturers at National Sport Commission equally need international experience and exposure so that they can impart that to the coaches they train.

9) The federal, state and local governments shall be responsible for standard sport facilities and equipment which must confirm with international specification at various levels.

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Conflicts of Interest

The authors declared no conflict of interest.

Author Contribution

Conception and structuring of the manuscript were done by Uzor TN. Drafting the manuscript, final revision and editing was done by all authors.

Abbreviation List

GLT, Goal line technology

ELC, Electronic line calling

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