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Interpreting Video Assistant Referee and Goal-Line Technology Communication: The Pitch-Based Referees Perspectives

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ABSTRACT

The in-road of digital media technologies into football has simplified referees decisions on contestable goals. This study examine the adoption of Video Assistant Referees (VAR) and Goal Line Technology (GLT) and how the interpretation of the communication between referees affects the outcome of the games. This study is anchored on Diffusion of Innovations theory. A sample of 150 pitch-based referees were proportionally selected on the basis 25 per continents for interview. This study is aimed at exploring the communicative frame of reference for technological and pitch-based referees. The study argued that VAR and GLT communication situation is largely interpreted using guess work by the pitch-based referees, as angular lens, perspectives and human prejudice of technological referees in the control room subjects the pitch-based referees to polysemous interpretations. Contrary to the speculations that the diffusion of technology usually resulted to structural unemployment, the adoption of VAR and GLT has opened up opportunities for increased numbers of referees and match officials. Consequently, this research tries to establish whether the diffusion of digital media technology into football officiating has excommunicate human errors and blunders envisaged in the era of analogue pitch and referees, thereby setting the paste for minimal errors in the contemporary phase of digital officiating.

Keywords: *VAR, GLT, Technology, Referee, Pitch and Communication*

INTRODUCTION

Digital media technology within sports is forever advancing due to the technological world of today. This technology assists match officials to make the correct decision in a game that has the potential to change the final outcome of that game/match (Technologyinsport, 2013). The first use of a decision review system within sports took place in the NFL as far back as 1985. They used instant replay technology to monitor the game inside the stadium to allow the officials to be more accurate and also add another dimension to officiating. However, this technology held many bugs and often caused delays, as well as only being able to review an incident with indisputable visual evidence (TSZ, 2016). This technology was the birth of decision review systems used in the modern day.

The decisions made by a referee or umpire can affect the ultimate outcome of a game. In some situations the direction of the game can be changed by a single decision. Price (2006) and Connelly (2003) noted it is not uncommon for the referee or umpire to be identified as the cause of the failing of a player or team, and to be blamed for influencing the result of a game by either not enforcing the rules or being biased.

Many players, Mascarenhas (2005) reports, however, do not understand the demands placed on referees for split-second decision making and "mastery of the rules". The International Fair Play Committee report that the referee is required to evaluate the important characteristic of an event or situation, and present the appropriate and correct decision in about one second. Mascarenhas (2005) highlighted that referees have to respond almost immediately to events in a game that unfold dynamically and which may have many nuances, ambiguities and uncertainties. In general, the elite level referee is required to make rapid decisions while also considering numerous sources of information.

In recent years, there has been an increasing use of technology in a number of areas of sport, although not always to support the referee's decision making. For example, external bodies, such as commentators, coaches and the like, who are in the position of scrutinizing referees' decisions, often have access to modern technologies such as slow-motion replay as well as replay showing differing angles. In some sports this is not available to the referee. In addition, there is considerable investment in the use of technology to support the athletes and the general media, and the development of precise scoring mechanisms as reported by Ford et al (1999).

This is the current situation, that the elite, high profile sport stakeholders in football are now turning to technology to provide tools, mechanisms and processes which can be used by referees as an aid to confirm their "on-pitch" decisions. This paper presents research into the decision support technologies used in football. The discussion of the findings shows that there is, indeed, a need for such technologies to assist referees, reduce the incidence of controversial decisions and lead to fairer competition.

The Concept of Referee and Communication

The concept of referee in sport is refers to an umpire or judge: the official who makes sure the rules are followed during a game. Each match is controlled by a referee who has full authority to enforce the Laws of the Game in connection with the match. The decisions of the referees according to the Laws of the Game (2018/19) will be made to the best of the referee`s ability according to the Laws of the Game and the 'spirit of the game' and will be based on the opinion of the referee who has the discretion to take appropriate action within the framework of the Laws of the Game. In the game of soccer, all match are played on the pitch, that is the field where the competition take place.

Communication on the other hand is defined as the process of sharing meanings. It could also be define as the process of passing information from one point to the other. In this context, great deal of communication usually occur in football match competition between the central referee and his subordinate referees on the pitch as well as those technological referees in the video room.

Decision support Technologies in Football

Football is one of the world most popular sport and an enormous business, and every match is currently refereed by a single person (pitch-based referee) who "has full authority to enforce the Laws of the Game". So, controversies are inevitable, and the most glaring of them are usually about referee calls for which no interpretation is required and concern about whether the ball has completely crossed goal line or not, and whether a given offense should be punishable with penalty award or not.

In 2012, famous 'bad calls' happened during the Euro 2012 (Ukraine scored a goal against England that clearly went over the line but was disallowed by pitch-based referee),World Cup 2010 (England scored a goal against Germany that was disallowed by pitch-based referee) and Nigeria was denied penalty kicked against Argentina during the 2018 World Cup competitions by the pitch-based referee. In cases like these, the referee's call is influenced by, among other things, three ineluctable factors:

- the referee's position on the field: he is not aligned with the goal line and then a parallax error affects his decision;
- the high speed of the ball that can reach up to 120km/h. It is impossible for human visual and cognitive systems (as well as for standard broadcast images, at 25fps) to estimate the position of such a moving object continuously.

A lot of research has been conducted in some sports to develop or enhance technologies that will act in an advisory capacity during the match, without the need to stop the match, but rather while maintaining the normal tempo of the game. For instance, in football Rene (2010) has closely examined and tested the micro-chip of the ball, to signal a scored goal. Also, the side-line referees contact the center pitch-based referee via microphones and earpieces, without stopping play. This includes volunteering information to the referee on off-side, foul or illegal play, line calls, etc, as it occurs. If appropriate this is then assessed by the referee to determine if any action is warranted or not, without interrupting the continuity of the match. Major decision support technologies used in football include: microchip ball and signal to referee; microphone and earpieces; electronic sensors in goal posts; tracking systems for off-side play; goal-line technology and video assistant referee.

Diffusion of Goal-line Technology (GLT) and Video Assistant Referee (VAR) in Football

The earliest technologies used in football according to Paolo, Marco, Pier, Massimiliano, Ettore & Arcangelo (2014) were based on instant replay: in case of a controversial call about a goal event the referee (or an assistant) could stop the game and watch the images (acquired from broadcast or dedicated cameras). This would slow down the game taking away possible plays and annoying the audience. Thus attention has recently turned to technologies able to decide autonomously whether or not the ball has crossed the goal line. One of the most promising approaches uses a magnetic field to track a ball with a sensor suspended inside. Thin cables with electrical current running through them are buried in the penalty box and behind the goal line to make a grid.

Goal Line Technology (GLT) and it functional principles

The GLT systems may be used to verify whether a goal has been scored to support the referee's decision. Where GLT is used, modifications to the goal frame may be permitted in accordance with the specifications stipulated in the FIFA Quality Programme for GLT and with the Laws of the Game. The use of GLT must be stipulated in the competition rules.

GLT applies solely to the goal line and is only used to determine whether a goal has been scored. The indication of whether a goal has been scored must be immediate and automatically confirmed within one second by the GLT system only to the match officials (via the referee's watch, by vibration and visual signal). If GLT is used in competition matches, the competition organizers must ensure that the system is certified according to one of the following standards:

FIFA Quality FIFA Quality PRO,
IMS - International Match Standard,

An independent testing institute must verify the accuracy and functionality of the different technology providers' systems in accordance with the Testing Manual. If the technology does not function in accordance with the Testing Manual, the referee must not use the GLT system and must report this to the appropriate authority. Where GLT is used, the referee must test the technology's functionality before the match as set out in the FIFA Quality Programme for GLT Testing Manual.

Protocol- Principles, Practicalities and procedures of Video Assistant Referee (VAR)

Each match is controlled by a referee who has full authority to enforce the Laws of the Game in connection with the match. The VAR protocol, according to the Law of the game (2018/19) conforms to the principles and philosophy of the Laws of the Game. The use of video assistant referees (VARs)

is only permitted where the match/ competition organizer has fulfilled all the VAR protocol and implementation requirements (as set out in the VAR Handbook) and has received written permission from The International Football Association Board (IFAB) and FIFA.

The use of VARs in football matches is based on a number of principles, all of which must apply in every match using VARs:

1. A video assistant referee (VAR) is a match official, with independent access to match footage, who may assist the referee only in the event of a 'clear and obvious error' or 'serious missed incident' in relation to: Goal/no goal; Penalty/no penalty; Direct red card (not second yellow card/caution); Mistaken identity (when the referee cautions or sends off the wrong player of the offending team).
2. The referee must always make a decision, i.e. the referee is not permitted to give 'no decision' and then use the VAR to make the decision; a decision to allow play to continue after an alleged offence can be reviewed.
3. The original decision given by the referee will not be changed unless the video review clearly shows that the decision was a 'clear and obvious error'.
4. Only the referee can initiate a 'review'; the VAR (and other match officials) can only recommend a 'review' to the referee.
5. The final decision is always taken by the referee, either based on information from the VAR or after the referee has undertaken an 'on-field review' (OFR).
6. There is no time limit for the review process as accuracy is more important than speed.
7. The players and team officials must not surround the referee or attempt to influence if a decision is reviewed, the review process or the final decision.
8. The referee must remain 'visible' during the review process to ensure transparency.
9. If play continues after an incident which is then reviewed, any disciplinary action taken/required during the post-incident period is not cancelled, even if the original decision is changed (except a caution/sendoff for stopping a promising attack or DOGSO).
10. If play has stopped and been restarted, the referee may not undertake a 'review' except for a case of mistaken identity or for a potential sending-off offence relating to violent conduct, spitting, biting or extremely offensive, insulting and/or abusive gesture(s).
11. The period of play before and after an incident that can be reviewed is determined by the Laws of the Game and VAR protocol.
12. As the VAR will automatically 'check' every situation/decision, there is no need for coaches or players to request a 'review'.

Situations that calls for match review using VAR

Spagnolo et al (2013) stressed that the referee may receive assistance from the VAR only in relation to four categories of match-changing decisions/incidents. In all these situations, the VAR is only used after the referee has made a (first/original) decision (including allowing play to continue), or if a serious incident is missed/not seen by the match officials. The referee`s original decision will not be changed unless there was a 'clear and obvious error' (this includes any decision made by the referee based on information from another match official e.g. offside). This was exactly what happened to the goal scored by Rahim Styline of Manchester City and was cancelled by the referee after VAR revw.

The following situations necessitated for reviewed in the event of a potential clear and obvious error or serious missed incident:

(A) Goal/no goal: Under this condition, the pitch-based referee communicative interpretation will be guided by the following considerations:

1. An offence by the team that scored the goal in the attacking phase that ended with the scoring of a goal, including
2. offence by the attacking team in the build-up to or scoring of the goal (handball, foul, etc.)
3. offside: position and offence
4. ball out of play prior to the goal
5. goal/no goal decisions•

(B) Penalty kick/no penalty kick: Here four major decisions determines the action of the referee, which include:

1. penalty kick incorrectly awarded/ penalty kick offence not penalized
2. location of offence (inside or outside the penalty area)
3. offence by the attacking team in the build-up to the ball out of play prior to the incident penalty incident.
4. offence by goalkeeper and/or encroachment by an attacker or kicker at the taking of a penalty kick defender who becomes directly involved in play if the penalty kick rebounds from the goalpost, crossbar or goalkeeper.

(C) Direct red cards (not second yellow card/caution)

DOGSO (especially position of offence and serious foul play (or reckless challenge) positions of other players).
violent conduct, biting or spitting using offensive, insulting or abusive gestures at another person.

(D) Mistaken identity (red or yellow card)

If the referee penalizes an offence and then gives the wrong player from the offending (penalized) team a yellow or red card, the identity of the offender can be reviewed; the actual offence itself cannot be reviewed unless it relates to a goal, penalty incident or direct red card.

Communication Practicalities within VAR

The following practical communication arrangements usually take place in a football match where VAR is used as a system of digital match officiating:

The VAR watches the match in the video operation room (VOR) assisted by an assistant VAR (AVAR) and replay operator (RO); Depending on the number of camera angles (and other considerations) there may be more than one AVAR or RO; Only authorized persons are allowed to enter the VOR or communicate with the VAR/AVAR/RO during the match.

Also, the VAR has • independent access to, and replay control of, TV broadcast footage; The VAR is connected to the communication system being used by the match officials and can hear everything they say; the VAR can only speak to the referee by pushing a button (to avoid the referee being distracted by conversations in the VOR); In a situation where the VAR is busy with a 'check' or a 'review', the AVAR may

speak to the referee especially if the game needs to be stopped or to ensure play does not restart; If the referee decides to view the replay footage, the VAR will select the best angle/replay speed; the referee can request other/additional angles/speeds

Theoretical Framework

This study adopts Roger's Diffusion of Innovations theory as a guide. The proponent of this theory E.M. Rogers defines diffusion as 'the process by which an innovation is communicated through certain channels over time among the members of a social society'. The adoption process is differentiated from the diffusion process in that the diffusion process occurs within society, as a group process; whereas, the adoption process pertains to individual (Roger, 2003). The adoption has to do with the process through which an individual or society passes from hearing an innovation to finally adopting the innovation.

Diffusion of Innovation (DoI) is a theory that seeks to explain how, why, and at what rate new ideas and technology spread through cultures. The key elements of the theory according Rogers (1964) are innovations, communication channels, time and social system. In fact much diffusion research involves technological innovations so Rogers (2003) usually used the word "technology" and "innovation" as synonyms.

For Rogers (2003, p.13), a technology is a design for instrumental action that reduces the uncertainty in the cause-effect relationships involved in achieving a desired outcome. Technology to Rogers composed of three parts: hardware, software. While the hardware is the tool that embodies the technology in the form of a material or physical object, software is the "information base for the tool" (Rogers, 2003, p.259).

Methodology

The type of research embarked upon is exploratory qualitative research which attempts to understand a phenomenon through evaluating the meanings assigned to them by participants. The essence of using exploratory research is to understand the individual experiences of those being studied (digital referees and VAR), how they think and feel, and how they act/react in their habitual contexts. The population of the study comprise of referees who officiate football match only. And a sample of 150 pitch-based referees will be proportionally selected on the basis 25 per continents for interview. The study adopted thematic data analysis of Braun and Clark (2002) for analyzing the data. Thematic data analysis according to Braun and Clark (2002) is defined as a qualitative analytic method for "identifying, analysing and reporting patterns (themes) within data". Apart from minimally organizing and describing of data in rich detail, the method also interprets various aspects of the research topic as well. In general, thematic analysis according to Fereday Muir-Cochrane (2007) involves the searching across a data set to find repeated patterns of meaning. They further sees thematic analysis as a form of pattern recognition within the data, where emerging themes become the basis for analysis. The major advantages of thematic analysis that endear this study to adopt it include the fact that it can carefully summaries key features of a large body of data and offer a thick description of the data set and can highlight similarities and difference across the data set as well.

Results and Findings

Digital media inclusion into match officiating, in the views of the 150 referees who took part in the survey shows that the technologies have simplified jobs of referee. VAR and GLT has sealed the problems of contestable goal and match outcome in football, however it open up another challenges for the referees (digital divide).

The interpretation of match video footage in VAR which is usually done to settle disputing situations is guided by agreed rules of the game, in which all match official headed by pitch-based referee consented to. Therefore, individual pitch-based referee's prejudice is essential but subjected to agreed rules of the game and visual angular lens and perspectives presented through the VAR. This situation largely determine communicative frame of reference used by pitch-based referees to judge whether a particular offence worth penalty or not, and whether a player is outside or inside in a contestable goal or pre-goal situations.

Other major communicative factors responsible for pitch-based referees decision apart from *the rules of the game* include: *angular lens perspective, the nature of the offence, as viewed through the VAR.* Where wearable technology (WT) as part of electronic performance and tracking systems (EPTS) is used in matches played in an official competition organized under the auspices of FIFA, confederations or national football associations, the competition organizer must ensure that the technology attached to the referees and the player's equipment is not dangerous and must bear the following mark: IMS- This mark indicates that it has been officially tested and meets the minimum safety requirements of the International Match Standard developed by FIFA and approved by The IFAB. The institutes conducting these tests are subject to the approval of FIFA. Where electronic performance and tracking systems (EPTS) are used (subject to the agreement of the national football association/competition organizer) the competition organizer must ensure that the information and data transmitted from EPTS to the technical area during the match in matches played in an official competition are reliable and accurate.

The diffusion of VAR and GLT into football in Europe has gradually open up technological advantage to match officiating, by increasing the numbers of match official. However, in Africa, football officials are yet to migrate from analogue pitch and officiating to the modern digital pitch and referee.

Conclusion

In the soccer world, there is a great deal of communication especially between pitch based referees and digital referees who monitor technologies to reduce human errors on the pitch. A great number of problems have been managed as a result of the inroad of VAR and GLT into soccer. Soccer is the world's most popular sport and an enormous business, and every match is currently refereed by a single person who "has full authority to enforce the Laws of the Game". So, controversies are inevitable, and the most glaring of them are usually about referees communications for which no interpretation is required and concern about whether the ball has completely crossed goal line or not, and whether an action (tackle) worth penalty or not.

VAR and GLT were designed and adopted to help reduce human errors in the pitch. Consequently, the interpretation of the video footage from the digital technologies and phone calls by the pitch based referees usually subject fans and spectators to puzzles. This study found that angular lens, camera perspective and the rules of the game alongside referee's prejudice are major factors that determine the decisions of the pitch based referee in contestable situations. It is on this premise that same scenario can be interpreted differently by the same referee in the same competition. For instance awarding penalty to Croatia in the 2018 World cup match with Nigeria but denying Nigeria penalty in the same World cup match with Argentina.

Substantially, the diffusion of VAR and GLT has reduce human errors envisaged in football match and increase referee's ability to officiate competition with ease. Also, the adoption of the digital media technologies into soccer and sports has open up new platforms for referees (analogue versus digital referees, analogue versus digital pitch). Be that as it may, while the diffusion and adoption of VAR and GLT has increased the numbers of referees and match officials in competitions where IFAB and FIFA are deeply involved, in Africa, there is a slow diffusion and adoption of the digital media technologies of VAR and GLT.

Recommendations

1. Referees should avoid sentiment and interpret video footage from VAR based on standard rules of the game.
2. VAR and GLT should be accepted and use in all international and national soccer competitions, in other to have uniformity in the game of soccer.
3. FIFA, IFAB, IMS, should liberalized VAR and GLT should that the technologies will be affordable and use in all national and international football leagues.

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Abbreviations and Their meanings

VAR	Video Assistant Referee
GLT	Goal Lin Technology
VOR	Video Operation Room
RO	Replay Operator
AVAR	Assistant Video Assistant Referee
TV	Television
IMS	International Match Standard
IFAB	International Football Association Board
FIFA	Federation of International Football Association
OFR	On-Field Review
EPTS	Electronic Performance and Tracking System