Management Science Letters 4 (2014) 1707–1714

Contents lists available at GrowingScience

Management Science Letters

homepage: www.GrowingScience.com/msl

Football refereeing: Identifying innovative methods

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C H R O N I C L E

Article history:
Received January 20, 2014
Accepted 5 July 2014
Available online
July 12 2014

Keywords:
Innovation
Football industry
Technological innovation
Referees

A B S T R A C T

The aim of the present study is to identify the potentials innovation in football industry. Data were collected from 10 national and international referees, assistant referees and referees' supervisors in Iran. In this study, technological innovations are identified that assist better refereeing performances. The analysis revealed a significant relationship between using new technologies and referees 'performance. The results indicate that elite referees, assistant referees and supervisors agreed to use new technological innovations during the game. According to their comments, this kind of technology causes the referees' performance development.

1. Introduction

Undeniably, Football is among the most attractive sports making it the most popular sport in the world. Indeed, the growth of football has influenced political, economic as well as social issues. At present, refereeing has found a specific and deterministic role in football. A referee has an important position in a football match, especially at a professional level in which one incorrect decision could lead to a downturn in economic fortunes of a club (Castagna et al., 2007). It is also important to deal with issues relating to incorrect decisions and the consequences of these decisions. Therefore, in order to enhance the standard and quality of officiating it is essential that referees are able to make use of available technology either, directly or indirectly (Collins, 2010). Since the 2010 World Cup in South Africa, and due to some mistakes at higher levels in this World Cup, there have been many discussions in international federation association endeavoring to convince convincing FIFA of the

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doi: 10.5267/j.msl.2014.7.013

need to make use of available technology. According to Van Quaquebeke and Giessne (2010) many faults happening in football are vague and there is no clear-cut method to distinguish right or wrong. Indisputably, reducing referees' mistakes make the role of technology and innovation much more necessary in the future. In other words, technology could play a vital role in referees' decisions and judgments. Utilizing adequate tools can help referees to judge more precisely. Gonzalez (2003) stated that using electronic systems could improve referees' performance during football match. The main objective in utilizing innovative technologies in formal football matches is to upgrade them due to referees' responsibilities; i.e., to establish fairness which is sometimes ignored. Recent decades have witnessed that innovation and revolution play an essential role in the sport industry (Ratten, 2011). Mullin et al. (2007), Schwarz et al. (2012), Ringuet-Riot et al. (2014) stated that innovation could play an essential role in sport. According to Turner and Shilbury (2010) technology is an essential attribute to many sports promotions. By building a new system, many opportunities can be provided for various sports clubs. Collins (2010) believes that the new technology should be introduced into refereeing and it is a way to make fair decisions.

Innovation has been defined in different ways by scientists and researchers. Schumpeter (1928, 1943) was the first person to examine innovation in industry. He expressed it as presenting a new combination of producing elements and various forms in one system, i.e., a function of a new product. He defined a successful innovation as performing an action exclusively, an action, which is not the product of mind or intelligence, but positively affects it. According to Ringuet-Riot et al. (2014), innovation is a complex construct, broadly defined "as the introduction of a new idea or behavior in the form of a technology, product, service, structure, system or process on to the market" (pp.137-149). Furthermore, Pierce and Delbecq (1977) defined innovation as establishing, absorbing and practicing a new idea or activity. Khalil (2004) believed in innovation as presenting a new product, service or a process to an organization. From his personal point of view, technology (or the product) should not necessarily be new, novel or unique. Schumpeter (1943) outlined five factors based on the output of innovation. 1) innovation in product, 2) innovation in a new process in industry, 3) innovation in the market, 4) innovation in supply network, and 5) innovation in an organization. Considering different ideas and definitions of innovation, three different types of innovation can be identified.

1- Radical innovation: it usually occurs based on invention or a scientific idea and it results in changes in new technology or industries (Henderson & Clark, 1990).

2-Incremental innovation: these innovations are limited, but they have an effective role in improvements of a product, process or service (Henderson & Clark, 1990).

3-Routine innovation: this is a mimicked innovation which is very limited (Dundon, 2002).

Ratten (2010) indicated that innovation in sport can be the consequence of changes in technology. Recently, the rapid increase in using technological innovations in sport has been the focus of several sport organizations and has resulted in seeking competitive advantage. Initially innovation accepted by those sports such as cycling and sailing as technology could easily take part to these sports functions. After that, during 20th century, Sports scientists, swimming and track and field coaches were also support innovation to help their athletic to improve their performance in worldwide competitions. In addition, Great Britain also contributed to sport successful performance in the beginning of 20th century, particularly, in swimming coaching and incorporation of coaching in different fields of sport science (Ringuet-Riot et al., 2014).

General understanding of technology is a bit vague and it has been analyzed from different perspectives. Loland (2002) stated that technology is a tool that is made by man in order to achieve its goal, and then sport technology is made by human to help them to reach their goal, which is related

to sport. He argues that given the nature of sport, technologies can play various functions. For example, one kind of sport technology can increase functionality, including new fast skin swimsuit for water friction reduction. Another form of technology includes helmets in ice hockey, which is designed for injuries prevention. The chance of using video cameras in assisting referees decisions are thought to promote justice.

Federation of International Football Associations (FIFA) has played a crucial role in developing football by taking some innovative measures. Sepp Blatter, FIFA President, stated that innovative technologies should be used to present a new model to promote referee's performance levels (CNN, 2010). Additionally, Lussier, and KimBall (2009) believed that the changes in football technology have been increasingly continued; the products, which were once imagined are coming into existence to prove their effectiveness. Each day indicates that variable technologies and innovations were increasing in the football industry (Atali & Kursad, 2013).

According to Maruenda (2004), managing football by non-equipped eyes sounds impossible especially in cases when the ball has passed the goal line, which is effective in the final result. When decisions are made correctly, they are effective in the result. He claims that mistakes in adjudging offside are very common; investigating the situations of the player in offside and the situation of the defenders, all has to be considered by the referee. Eye movements, players' movements and the condition of the ball prevent the referee from making the right decision since the eyes and brain may not always recognize offside conditions in the instant the infraction occurs. There are still some key points about this concern, which need to be dealt with. Gonzalez (2003) indicates that innovations such as devices the referee's whistle or devices in linesmen's flags could allow referees to make their decisions faster and not to stop a match to review the video. The referees can make their judgments through the signs they receive by their whistles and flags electronically innovated equipment such as designing new whistles, flags, ground and ball can assist referees significantly. Therefore, practicing new technological devices and compounding them with audio-visual ones can assist referees much better in their decision making (Button et al., 2006).

2. Method

This study has utilized a qualitative approach. Data was collected from 10 national and international referees, assistant referees and referees' supervisors who have been working on Iran's football federation in the superior league. Statistical population was divided into three groups of national and international referees, linesmen and side judges. In this interview, Mr. Masoud Enayat, Yadu'llah Soleimani, Hatem Beck Poor, Alireza Rajablu, Naer Jafari. Abutaleb Tahirian, Ali Khosravi, Mohammad Fanaei, Golamreza Behravan and Ismail Safiri have participated. In this study, the final results are based on previous studies and interviews, and sampling is purposeful

3. Findings and results

Based on the research questions, four potential factors such as innovative ideas in football referees filed, sport technology in football referees filed, analyzing innovative idea in the football industry and technical analysis in football referees field have been proposed . Each proposed item contained 10 questions which are presented in the following. To make accurate decisions to whether confirm or reject these factors, it is necessary to use an appropriate statistical test. According to the purpose of the test and the low number of samples, binomial test have been used in this test.

2.1 The potential factors of innovative ideas in football referees filed

In short, 10 variables that may influence innovative idea on referees filed have been considered. Four factors including, identifying the need for innovation, analyzing the innovation, determining the

performance requirement, suggesting the new ideas have been confirmed and 6 factors have been rejected. Detailed information, including the results of the survey is presented in the Table 1.

Table 1
Potential Factors of innovative ideas

Potential Factors	Number	min	max	Mean	Standard deviation
Identifying the need for innovation	10	5	4	4.3	0.483
Identifying the value of Innovation in referee	10	4	2	3.1	0.568
Identifying the role of innovation in referee	10	4	2	3.1	0.568
Analyzing the innovation	10	5	4	4.6	0.516
Determining Performance requirement	10	5	4	4.5	0.527
Suggesting the new ideas	10	5	4	4.8	0.422
Identifying the innovation in related organizations	10	3	1	1.9	0.568
Supporting the new ide by mangers	10	2	1	1.4	0.516
Identifying the idea feasibility	10	2	1	1.9	0.316
Using new ideas in referee	10	5	3	3.4	0.699

In the following, each question has been examined by binomial test. The result presented in Table 2.

Table 2
The result of Binomial test about innovative analysis

Potential Factors	Groups	Classification	Number	Observed Prop	Test Prop	P-value	The results of potential factors
Identifying the need for innovation	Group1 Total	≤3	10 10	1.0 1.0	0.6	0.000	Confirm
Identifying the value of Innovation in referee	Group1 Group2 Total	≤3 >3	2 8 10	0.2 0.8 1.0	0.6	0.624	Reject
Identifying the role of innovation in referee	Group1 Group2 Total	≤3 >3	2 8 10	0.2 0.8 1.0	0.6	0.107	Reject
Analyzing the innovation	Group1 Total	≤3	10 10	1.0	0.6	0.000	Confirm
Determining Performance requirement	Group1 Total	≤3	10 10	1.0 1,0	0.6	0.000	Confirm
Suggesting the new ideas	Group1 Total	≤3	10 10	1.0 1.0	0.6	0.000	Confirm
Identifying the innovation in related organizations	Group2 Total	>3	10 10	1.0 1.0	0.6	0.107	Reject
Supporting the new ide by mangers	Group2 Total	>3	10 10	1.0 1.0	0.6	0.107	Reject
Identifying the idea feasibility	Group2 Total	>3	10 10	1.0 1.0	0.6	0.107	Reject
Using new ideas in referee	Group1 Group2 Total	≤3 >3	3 7 10	0.3 0.7 1.0	0.6	0.322	Reject

2.2 The potential factors of sport technology in football referee filed

In short, 10 variables that may influence sport technology on referees filed have been considered. Four factors including, determining the performance requirement, defining innovation technology, gaining required technology, determining technical goal have been confirmed and 6 factors have been rejected. Detailed information, including the results of the survey is presented in the Table 3.

Table 3
The potential factor of sport technology

Potential factors	Number	Minimum value	Maximum value	Mean	Standard deviation
To define a product	10	1	4	2.4	0.966
To determine performance requirements	10	4	5	4.6	0.516
To define productivity	10	1	2	1.5	0.527
To define innovation technology	10	3	5	4.6	0.699
To have necessary technical knowledge	10	2	3	2.8	0.422
To gain required technology	10	4	5	4.8	0.422
To determine technical goals	10	4	5	4.3	0.483
To compete in the product development	10	1	2	1.3	0.483
To have technology good	10	1	3	1.8	0.632
To have risk innovation capability	10	1	3	1.5	0.707

In the following, each question has been examined by binomial test and the results are presented in Table 4 as follows,

Table 4
The result of Binomial test about sport technology in football referee filed

Potential factors	Groups	Classification	Number	Observed Prop	Test Prop	P-value	The results of potential factors
To define a product	Group1	≤3	1	0.1	0.6	0.367	Reject
	Group2	>3	9	0.9			
	Total		10	1.0			
To determine performance requirements	Group1	≤3	10	1.0	0.6	0.000	Confirm
	Total		10	1.0			
To define productivity	Group2	>3	10	1.0	0.6	0.107	Reject
	Total		10	1.0			
To define innovation technology	Group1	≤3	7	0.7	0.6	0.006	Confirm
	Group2	>3	3	0.3			
	Total		10	1.0			
To have necessary technical knowledge	Group 2	>3	10	1.0	0.6	0.107	Reject
	Total		10	1.0			
To gain required technology	Group1	≤3	10	1.0	0.6	0.000	Confirm
	Total		10	1.0			
To determine technical goals	Group1	≤3	10	1.0	0.6	0.000	Confirm
	Total		10	1.0			
To compete in the product development	Group2	>3	10	1.0	0.6	0.107	Reject
	Total			1.0			
To have technology good	Group2	>3	10	1.0	0.6	0.107	Reject
	Total			1.0			
To have risk innovation capability	Group2	>3	10	1.0	0.6	0.107	Reject
	Total			1.0			

2.3 Potential factor of analysis innovative idea in the football industry

In short, 10 variables that may influence innovative idea on referees filed have been considered. Four factors including, analyzing opportunities, analyzing current demand, analyzing future demand and analyzing sports industry have been confirmed and 6 factors have been rejected. Detailed information, including the results of the survey is presented in Table 5.

Table 5
Potential factors of analysis innovative idea in the football industry

Potential factors	Number	Min	Max	Mean	Standard deviation
To analyze rivals	10	1	1	1.0	0.000
To analyze potential customers	10	1	2	1.3	0.483
To analyze the treat	10	1	2	1.6	0.516
To analyze opportunity	10	4	4	4.0	0.000
To analyze current demands	10	4	5	4.9	0.316
To analyze future demand	10	5	5	5.0	0.000
To analyze sports industry	10	4	5	4.2	0.422
To analyze current treat	10	2	3	2,1	0.316
To analyze technology products	10	1	3	2.2	0.632
To analyze creativity in related organization	10	1	3	1.3	0.675

In the following, each question has been examined by binomial test. The result presented in Table 6

Table 6
The result of Binomial test about analyzing the innovative idea in football industry

Potential factors	Group	Classification	Numbers	Observed Prop	Test Prop	P-value	The results of potential factors
To analyze rivals	Group 2 Total	>3	10 10	1.0 1.0	0.6	0.107	Reject
To analyze potential customers	Group2 Total	>3	10 10	1.0 1.0	0.6	0.107	Reject
To analyze the treat	Group 2 Total	>3	10 10	1.0 1.0	0.6	0.107	Reject
To analyze opportunity	Group 1 Total	≤3	10 10	1.0 1.0	0.6	0.000	Confirm
To analyze current demands	Group 1 Total	≤3	10 10	1.0 1.0	0.6	0.000	Confirm
To analyze future demand	Group 1 Total	≤3	10 10	1.0 1.0	0.6	0.000	Confirm
To analyze sports industry	Group 1 Total	≤3	10 10	1.0 1.0	0.6	/0.000	Confirm
To analyze current treat	Group 2 Total	>3	10 10	1.0 1.0	0.6	0.107	Reject
To analyze technology products	Group 2 Total	>3	10 10	1.0 1.0	0.6	0.107	Reject
To analyze creativity in related organization	Group 2 Total	>3	10 10	1.0 1.0	0.6	0.107	Reject

2.4 The potential factors in technical analysis referees filed

In short, 10 variables that may influence innovative idea on referees filed have been considered. Four factors including, analyzing existence technology, analyzing technology implementation, , analyzing technology boost, and analyzing equipment and required technology have been confirmed and 6 factors have been rejected. Detailed information, including the results of the survey is presented in the Table 7.

Table 7
The potential factors in technical analysis

Potential factors	Number	Min	Max	Mean	Standard deviation
To analyze existence technology	10	4	5	4.5	0.527
To analyze technology implementation	10	3	5	4.0	0.943
To analyze the technology boost	10	2	3	2.1	0.316
To analyze equipment and required technology	10	5	5	5.0	0.000
To evaluate technology dissemination channels	10	1	2	1.2	0.4222
To evaluate technology	10	1	3	1.9	0.738
To evaluate time frame work	10	4	5	4.2	0.422
To achieve adequate skills in existing technologies	10	1	3	1.9	0.568
To utilize exiting technology	10	2	3	2.9	0.316
To evaluate technology transfer methods	10	1	2	1.2	0.422

In the following, each question has been examined by binomial test. The result presented in Table 8.

3. Discussion and results

Considering the results of the questionnaires, in general, there is an agreement to use new technologies in refereeing. Our findings confirm that there was a high tendency to use technology and they can be applied both by referees and supervisors satisfactions. Today's professional football has witnessed day-by-day innovations in techniques, tactics and physical strength. In addition to players, referees need to have access to new technology. It seems that practicing new technologies can reduce the mistakes in refereeing. Besides, new technologies can be considered as an expected element in high levels of football.

Table 8
The result of Binomial test about technical analysis

Potential factors	Groups	Classification	Number	Observed Prop	Test Prop	P-value	The results of potential factors
To analyze existence technology	Group 1 Total	≤3	10 10	1.0 1.0	0.6	0.000	Confirm
To analyze technology implementation	Group 1 Group 2 Total	≤3 >3	6 4 10	0.6 0.4 1.0	0.6	0.006	Confirm
To analyze the technology boost	Group 2 Total	>3	10 10	1.0 1.0	0.6	0.107	Confirm
To analyze equipment and required technology	Group1 Total	≤3	10 10	1.0 1.0	0.6	0.000	Confirm
To evaluate technology dissemination channels	Group 2 Total	>3	10 10	1.0 1.0	0.6	0.107	Reject
To evaluate technology	Group 2 Total	>3	10 10	1.0 1.0	0.6	0.107	Reject
To evaluate time frame work	Group 1 Total	≤3	10 10	1.0 1.0	0.6	0.000	Confirm
To achieve adequate skills in existing technologies	2 Group Total	>3	10 10	1.0 1.0	0.6	0.107	Reject
To utilize exiting technology	Group 2 Total	>3	10 10	1.0 1.0	0.6	0.107	Reject
To evaluate technology transfer methods	Group 2 Total	>3	10 10	1.0 1.0	0.6	1.107	Reject

Referees and supervisors believe that new technology can be an effective tool for referees and linesmen. Technologies' vital role in the future can never be denied especially when referees and linesmen are given direct or indirect access to these devices to judge vague situations. The rules of new technology do not mean that referees need to use them every now and then, but when there is a doubt, they can be exercised for better clarification and practicing fairness. Therefore, professional referees need to increase their standards. It seems it is the right time to practice them so as to increase excitement among spectators and fans. In addition, it opens up a new branch in refereeing and new technology practiced either for referees' equipment or human resources and trainings can improve refereeing in the future. This result illustrates that players, spectators and coaches want to share the excitement in these matches and it is believed that new technology should enter this modern game so that its attractiveness is maintained and refereeing level will be improved.

Regarding the tendency of referees and supervisors to have new technology in football, some infrastructures need to be established to improve refereeing functions.

1. Holding classes to make referees acquainted with new technologies and re-investigating them is a necessity.

2. Since the importance of new technology is higher than the mean level, stated by referees and supervisors, it seems necessary that Federation secretaries, referees and linesmen should pay more attention to new technologies and attempt to improve them. These parameters can be included as "goal line technology", "regulated distance", "ambiguous scenes", "innovations on referees' and linesmen's devices for better cooperation", "innovations.

3. It seems that according to FIFA policies and international boards to practice goal line technology in Brazil World Cup 2014, football federation secretaries need to pay more attention to infrastructures in stadiums.

Acknowledgment

The authors would like to thank the referees, assistant referees and referees' supervisors who have given us valuable comments by participating in this survey.

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