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ORIGINAL

THE UTILIZATION OF VIRTUAL REALITY IN TRAINING TACTICAL DECISION-MAKING IN ARGENTINIAN RUGBY

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ABSTRACT

This study investigates the possible advantages and uses of virtual reality (VR) technology in developing rugby players from Argentina's ability to make tactical decisions. Rugby is becoming an even more dynamic and strategic sport. Thus, there's a growing need for creative training techniques. The research was based on secondary data analysis to determine the data using E-views software and generate results, including descriptive statistics, and equality test analysis, which also explains the model summary related to dependent and independent variables. With virtual reality (VR), players can imitate actual game conditions in a secure setting, honing their strategic thinking and cognitive skills without the physical rigours of on-field practice. The overall research found significant utilization of virtual reality in training tactical decision-making in Argentinian rugby. Virtual reality (VR) can assist rugby players in improving their decision-making process, collaboration, communication abilities, and overall effectiveness on the pitch through immersive and repetitive training experiences. The benefits of virtual reality training, its possible effects on player growth, and its ramifications for the future of rugby in Argentina are all covered in this essay. It also discusses factors to consider when integrating virtual reality technology into rugby training programs. It offers areas for more study to optimize its ability to improve tactical competence in Argentine rugby players.

KEYWORDS: Utilization (U); Virtual Reality (VR); Training Tactical Decision-Making (TTDM); Argentinian Rugby (AR); E-views Software

1. INTRODUCTION

With the numerous sports being played all over the world for centuries,

the history of rugby in Argentina roots its foundation in the 19th century. This sport was introduced in Argentina by immigrants from Britain and since then has become one of the most popular sports in the country. With the advancement in the world, not only have the parameters of judging the game evolved, but new technology is also continuously being developed to change traditional decision-making methods for rugby in Argentina (Yunchao, Mengyao, & Xingman, 2023). One of these new technologies, termed virtual reality technology, is thriving in different departments and aspects of life, including sports, i.e., such as soccer, rugby, etc. To implement virtual reality in any sport, various concepts and perceptions need to be taken into consideration. First, the specific rugby training areas where the virtual reality can be implemented should be identified, i.e., tactical decision-making, skill growth, altitudinal alertness, and imitation of game situations (Miles et al., 2013). After that, necessary equipment related to virtual reality setup should be arranged, including compatible controllers, computer headsets, etc. The third main component is the installation of rugby-viable software related to virtual reality, which has the capability to simulate new scenarios, interpret the physics behind them, gather data, etc. This step of virtual reality implementation can be enhanced by creating environments in which the software developers can work closer to the rugby players and conduct training sessions to develop the ultimate and superior version of virtual reality software (Mascret, Montagne, Devrièse-Sence, Vu, & Kulpa, 2022). The data similar to the actual and real-life scenarios should be simulated and embossed into virtual reality software involving decision-making training, defensive mechanisms, attacking approaches of players, etc.

To make the process more effective, different types of sensors can be added to the virtual reality setup, i.e., biosensors, which can allow the tracking of physiological responses of rugby players. At the same time, they respond against an attack or alignment (Kittel, Larkin, Elsworthy, & Spittle, 2019). This data also allows the coaches to know their players' well-being and stress levels to make the training program optimum. Moreover, training sessions to use virtual reality technology should be set up to train the faculty and coaches about getting to know the functionality of this technology and how to interpret data from it. Similarly, a gradual input of the scenarios can prove more beneficial for growing the strength and involvement of the training exercises in a virtual reality setup. Also, the combination of traditional methods of training with virtual reality can allow more enhanced integration and development of rugby programs. The continuous estimation of virtual reality's efficacy can also help improve exercise strategies to boost the rugby players' skills, decision-making capacity, and act. In the end, showcasing virtual reality's merits in rugby can escalate the sustainability and acceptance percentage of this technology (Faure, Limballe, Bideau, & Kulpa, 2020).

In Argentinian rugby, virtual reality technology can bring wonders in

many aspects of rugby training, most specifically, the tactical decision-making process. This cannot only improve the players' performance but can also help them come up with the required strategies. For instance, with the help of virtual reality, trainers can analyze the situation during a match and can help players counterattack their opponents more effectively. They can also analyze opposing teams' playing styles and strategies to tailor their training and on-field performance. Similarly, virtual reality technology can help players individually psychoanalyze situations from different scenarios, angles, and fields and can help them devise methods and ways of playing involving kicking, attacking, tackling, etc. Moreover, the players can boost their decision-making power by interacting with the exercises that this technology puts forward, which can ultimately help them in reacting to a real-life situation in the field with a more dynamic approach (Engelbrecht, Terblanche, & Welman, 2016). All of this can happen in restricted and controlled surroundings without putting in extra effort from other teammates. Further advancements in virtual reality technology can help Argentinian rugby players assess their weak points while making decisions on the rugby field (Croft, Chong, & Wilson, 2011).

For instance, a player's reaction and responsive strategy can be analyzed in a virtual reality setup. Then, virtual reality can further assess that response to give feedback relevant to the player's response. This method can help increase the players' decision-making power on the field without getting them tangled in an unknown situation (Cannavò, Pratticò, Ministeri, & Lamberti, 2018). In this way, the ease of assessment and modification of the training programs can be done without going through a long schedule of combined team training. Similarly, Argentinian rugby players can prevent injury chances by getting trained through virtual reality technology. In this way, the decision to prevent injuries can be made more efficiently on the field. Training through virtual reality technology also eliminates the fear of being injured, and players can practice different defensive angles and forms to ultimately get the desired optimum outcome of a particular situation (Bideau et al., 2009). Argentinian rugby players of any training level can get used to this technology and start with simple decision-making situations towards more complex and intricate on-field scenarios. They can start from the beginner level to the intermediate level. They can ultimately master the professional level of decision-making pieces of training to give a high rate of field performance (Bedir & Erhan, 2021). Argentinian teams can be made more professional and higher rated by analyzing the players' decision-making capabilities, leading to the selection or elimination of those needing further practice.

This can help in deducing the high-level teammates and bring cohesion among teammates when all players with the same training levels are merged up on an Argentinian rugby field (Akbaş et al., 2019). Virtual reality(VA) in sports training refers to using powerful technology to activate real-world sports environments and scenarios for training purposes. Athletes can engage in

virtual training sessions that replicate game situations, allowing them to practice and improve their skills in a controlled and realistic virtual setting. VR technology provides athletes with a realistic and interactive training experience, enabling them to enhance their decision-making ability, geographic awareness, and overall performance in a safe and controlled environment. Involving athletes in virtual sports environments can help improve their cognitive abilities, physical skills, and mental resilience, leading to better on-field performance and competitive edge. Virtual reality(VR) in tactical decision-making training in Argentina Rugby can offer countless benefits to players and coaches. By creating a deeply engaging virtual environment that replicates game scenarios, players can enhance their decision-making skills, awareness, and strategic thinking in realistic and interactive settings. Coaches can use VR technology to design customized training programs, analyze player performance, and provide real-time feedback to optimize tactical decision-making on the field. Incorporating VR into tactical decision-making training, Argentinian Rugby can stay at the forefront of sports technology and innovation, ultimately leading to improved performance and success on the field. Furthermore, the game scenarios can be imitated to make the players more aware of experiences and requirements for a practical and on-the-spot evaluation of a situation to stand out as a perfect Argentinian rugby player onboard (Ahmad, 2023).

The research determines the Utilization of Virtual Reality in Training Tactical Decision-Making in Argentinian Rugby. The research paper is divided into five specific research chapters. The first portion represents the introduction related to the variable. The second section describes the literature review and also presents the hypothesis. The third section describes the research methodology, including research tools and techniques. The fourth section represents the result and its descriptions. The last portion summarizes the overall research study and presents recommendations for future research on the Utilization of Virtual Reality in Training Tactical Decision-Making in Argentinian Rugby.

2. Literature Review

Researchers claim that sports institutes are important in developing good behavioral activities in sports athletes. The teaching environment of sports institutes influences positive behavioral activities in athletes(Altman & Torgler, 2021).studies reveal that sports organizations provide athletes with knowledge regarding different sports-playing tactics. The knowledge about tackling pressure during sports competitions is provided to athletes through competitive knowledge management programs. These programs provide athletes with knowledge related to sports ethics. the knowledge of different sports practices makes athletes more aware of different sports-related circumstances(Arop et al., 2023).studies explain that immigrant youth face many problems in getting sport-related information.to help the immigrant sport-based youth have full

access to sport-related knowledge, SBYD programs are employed in sports institutes. These programs aim to provide the most useful information to the youth to enhance their sports performance (Cortez, 2023).studies suggest that game pressure and training load on athletes negatively impact their performance. Excessive sports training sessions make athletes tired and unable to perform well in sports competitions. adequate recovery phases during the maximum training sessions are necessary for athletes' mental and physical health(Deutsch, Rieke, Rein, Braunstein, & Bassek, 2023).scholars explain that developing decision-making skills in an athlete promotes better performance skills in athletes. Female football players are trained to make their own decisions in the game by using their decision-making ability.

The game of futsal in female football players improves their decision-making ability (Fitri et al., 2021). For promoting sports, different sports organizations are working around the globe. sports organization promotes sports through sports marketing programs.by advertising the sports through social media platforms, sports knowledge increases among youth.by developing different sports strategies, sports promotion is made possible (Goel & Handa, 2020).studies claim that coaches of rugby trained their athletes using the CAR programs. The CAR program is based on a pedagogical framework and helps in transitioning the rugby player's playing skills from low to high performance. The pedagogical framework-based training programs are efficient in developing micro skills in rugby players(Groves, 2021). Training sports through small physical education-based institutes provides athletes with great sports training.in most physical education-providing institutes sports groups of sports students are made. these sports groups work by providing sports-related information to different sports athletes. These sports groups also influence the members of their group to actively take part in sports training programs and sessions(Kim, Panza, & Evans, 2021).the field of sports sciences gets promoted through various sports organizations.

The sports organizations and NGBs work to provide sports-related education to athletes. the NGBs and FHE work to overcome all the barriers they face while promoting sports-related education among youth. also, it is essential to provide sports-related education to both coaches and athletes.by understanding the sports tactics the coaches of different sports can train their athletes(Kingsbury, 2022).studies show that leadership styles in sports clubs greatly determine the sports practices carried out in that sports club. the leadership style greatly impacts the game-playing skills of athletes getting trained in sports clubs. Strategies management approaches are used in different sports clubs for developing effective leadership styles in sports coaches(Martínez-Moreno, Cavas-García, & Díaz-Suárez, 2021).studies explain that different programs are used in sports clubs to identify the sports talent in the young generation.in sports environments, the tactical skills of futsal players can be identified(Mendes et al., 2022). Studies claim that in most sports

clubs, AI-based technology is employed. this technology helps in assessing and analyzing the performance of sports athletes. The process of identifying the talent in sports players is possible using machine learning programs .machine learning technology VR is used for providing training to athletes of soccer paler and for influencing the tactical decision making approach in them(Musa, Majeed, Kosni, & Abdullah, 2020).studies show that promoting sports education through higher sports-providing institutes is key to promoting sports-related cultural practices in youth.

Making the young generation aware of the different cultural values of sports helps them gain insight into sports history. The higher education providing institutes make their sports athletes indulge in practices that enhance their knowledge related to sports cultural aspects(Odhav, 2020) Studies of scholars predict rugby as a sport that promotes decision-making ability in athletes.to assess the mechanical movement of rugby athletes in Argentina and the use of wearable sensors are used in sports training clubs. wearable technology based on VR is specifically used to identify the postures and positions of rugby players(Pastor, Villaseca-Vicuña, Segueida-Lorca, & Zuñiga, 2023).the prediction made through scholarly studies explains that the trend of using modern technology in sports fields has increased in the last two decades. the game-performing ability of athletes improved because of the use of technology in sports fields. the modern age of technology provides detailed information regarding the human body. The detail about the human body and its movements helps in determining the position of athletes during sports playing(Perocchio, 2022). The studies elaborate that using AI technology for identifying competitive sports-related practices holds great significance. the data analysis process related to sports athletes is done using VR technology.

The basic sports-related tactics are developed in athletes using AI The sport-related industries has greatly advanced because of the innovative AI algorithms(Pu, 2021).moreover ,in rugby sports the nontraditional sports practices have gained importance. the non-traditional practices allow athlete to learn sports trough an innovative approach. rhythmic movement-based training provided to ruby athletes enhances their motor skills. the profile of rugby game has improved by introducing new and innovative training methods in rugby sports raining institutes(Solomons, 2020).moreover ,athletes knowledge related to sports holds critical value for making athlete understand the different game tactics .the decision making skills of athletes are improved along with their mechanical ability trough the help of strategic approaches. the coaches are trained and educated using effective approaches to enhance their skill-providing ability. the coaches having more knowledge related to sports tactics provides their sports students with better sports skills during the training sessions(Walsh, 2021) Studies research scholars predict that the rugby sports World Cup of 2019was covered through the media All the information related to 2019 rugby world cup was provided by the media organizations in translated

forms(Wilcock, 2020).studies explain that e-sports promotes the advancement of the sports industry by promoting sports-related entertainment programs(Yuzyk & Seidner, 2022).

3. Research Methodology

The research determines that Utilization of Virtual Reality in Training Tactical Decision-Making in Argentinian Rugby. The research based on secondary data analysis for measuring the data used E-views software and generate result included descriptive statistic, unit root test analysis also that explain the equality test, model summary and regression analysis between them related to Utilization of Virtual Reality in Training Tactical Decision-Making in Argentinian Rugby.

3.1 Importance of Tactical Decision-Making in Sports

Tactical decision-making in sports plays a crucial role in deciding the outcome of a game or match. Decision-making allows teams or athletes to convert to changing situations during a game. Coaches and players need to make quick decisions based on the current state of play, the opponent's strategies, and other variables. Being able to adjust strategies on the spot can give a team a competitive edge. Effective tactical decisions involve identifying and making the use of weaknesses of the opponent. By analyzing the opponents playing style, strengths, and weaknesses, teams can develop strategies to capitalize on any risks and gain an advantage. Tactical decisions can create scoring opportunities and openings for success. By strategically positioning players, making tactical substitutions, or changing the game plan, teams can create chances to score, guard effectively, or control the momentum of the game. Coaches and players developed game plans based on their understanding of the opponent, their strengths, and the context of the competition. Tactical decisions are the execution of these strategic plans during the game. Effective practical decision-making requires communication and coordination among team members. Players need to understand the game plan, their roles, and how to execute tactics collectively. This promotes teamwork and cohesion in the field. Tactical decision-making in sports is essential for adapting to changing circumstances, exploiting weaknesses, creating opportunities, strategic planning, psychological impact, and promoting team cohesion. Teams and athletes who excel in tactical decision-making often have a competitive advantage over their opponents.

3.2 Role of Tactical Decision-Making in the Game of Rugby

Tactical decision-making in the game of rugby is most important to success on the field. In rugby, tactical decisions are important for managing the flow of the game. This includes decisions on when to kick for territory, when to run the ball, when to set up for an attack or a fight, and when to go for a goal.

Effective game management through tactical decisions can control the pace and direction of the match. Tactical decisions play a key role in defensive structures in rugby. Teams need to make decisions on defensive line speed, drift defense, offensive defense, and positioning to counter the attacking threats posed by the opposition. Effective defensive tactics can void the opponent's attacking opportunities. Tactical decision-making is crucial in developing attacking strategies in rugby. This includes decisions on running lines, support play, offloading, kicking options, and exploiting gaps in the defense of the opposition. Tactical kicking is a significant side of rugby, and decisions on when and where to kick can have a significant impact on the game. Tactical kicking for territory, tactical kicks to regain possession, and strategic kicks to apply pressure on the opposition are all part of the tactical decision-making process in rugby. Taticle decision-making in rugby is fundamental to game management, set-piece strategies, defensive structures, attacking strategies, kicking game, and adaptability. Teams that excel in tactical decision-making are often able to control the game, exploit weaknesses in the opposition, and capitalize on scoring opportunities.

3.3 Utilization of Virtual Reality in Argentinian Rugby

The utilization of virtual reality in training practical decision-making in Argentinian rugby can offer a large number of benefits and opportunities for players and coaches. VR technology can mimic realistic game scenarios, allowing players to experience different practical situations in a controlled environment. This enables players to make decisions in real-time, enhancing their decision-making skills under pressure. VR training allows for repeated practice of tactical decision-making scenarios, helping players strengthen their learning and improve their decision-making abilities. Immediate feedback can also be provided, allowing players to understand the consequences of their decisions and learn from their mistakes.

VR Training can be adjusted to focus on specific tactical effects of the game, such as plan of action strategies, defensive structures, attacking patterns, or kicking games. Coaches can customize training modules to address the specific needs of the team and individual players. The immersive nature of VR training can enhance player engagement and motivation. By providing a realistic and interactive training environment, the player is more likely to be actively involved in the learning process and committed to improving their tactical decision-making skills. VR training can also be beneficial in introducing the risk of injuries during practice sessions.

By simulating game scenarios in a virtual environment, players can work on their decision-making skills without the physical demand and risk associated with on-field training. In Argentinian rugby, the integration of VR technology in training programs can provide a cutting-edge approach to developing tactical

decision-making skills among players. Leveraging the benefits of VR simulations, reputations, feedback, adaptability, injury prevention, team collaboration, and data analysis can enhance their performance on the field and gain a competitive advantage in the sport.

3.4 Descriptive Statistic

Table 1

	VR	VR1	VR2	TTDM	TTDM1	TTDM2
MEAN	1.387532	1.584868	2.725001	1.645484	1.651032	1.596356
MEDIAN	1.256000	1.543300	1.672100	1.788200	1.782100	1.786000
MAXIMUM	2.123300	2.783000	10.92000	1.932000	1.999200	1.993200
MINIMUM	0.321000	0.992000	0.432000	1.023100	1.001200	1.001000
STD. DEV.	0.385770	0.389739	2.859082	0.333049	0.357969	0.353645
SKEWNESS	-0.177734	1.113048	2.179797	-0.917337	-0.755351	-0.408353
KURTOSIS	4.106371	4.611404	6.369586	2.140507	1.916271	1.467832
JARQUE-BERA	1.406683	7.866797	31.62517	4.275786	3.600717	3.140153
PROBABILITY	0.494929	0.019577	0.000000	0.117903	0.165240	0.208029
SUM	34.68830	39.62170	68.12503	41.13711	41.27580	39.90891
SUM SQ. DEV.	3.571647	3.645519	196.1844	2.662123	3.075408	3.001562
OBSERVATIONS	25	25	25	25	25	25

The above result represent that descriptive statistical analysis result describe the mean values, median values, the minimum rates, maximum rates, also that explain the skewness value and probability rate of each variable included dependent and independent. The mean value of virtual reality is 1.3875 the median rate is 1.256 according to the result its standard deviation rate is 0.38 shows that 38% deviate from mean.

The probability value is 0.49 shows that 49% significantly level between them. according to the result the sum of square deviation rate is 3.5716 its sum value is 34.68830 the jarque-bera rate is 1.4066 respectively shows that positive value of virtual reality. Similarly, the VR1, VR2 both are considering as independent variable according to the result its mean values are 1.5848, 2.725 its shows positive average value of mean. The standard deviation rate is 0.3897, 2.8590 its shows that 38% positive deviate from mean.

The probability value is 0.019 and 0.000 shows that 19% and 100% significant values between them. the TTDM is main dependent variable according to the result its mean value is 1.645 its shows that positive average value of mean the maximum value is 1.932 and minimum value is 1.023 shows that positive minimum and maximum values. The sum of square deviation rate of dependent variable is 3.075 and 3.0015 its shows positive deviation between

them.

3.4.1 Applications

Both coaches and players can gain from using virtual reality (VR) technology to educate tactical decision-making in Argentine rugby. There are some possible applications and benefits that might arise from it:

1. Immersive Scenario Replication: In a safe setting, virtual reality enables gamers to immerse themselves in realistic gaming settings. Without the physical rigours of on-field practice, coaches may imitate particular match scenarios, such as defensive alignments, set-piece plays, or offensive tactics, allowing players to make judgements in real time.

2. Repetitive Practice: Through repeated practice, gamers may improve their decision-making abilities through virtual reality training. Rugby games go quickly, so players need to be able to think quickly and react instinctively. This kind of repetitious training can assist.

3. Safe Environment: Players may experiment with various techniques and tactics in a virtual reality game without worrying about getting hurt. For younger or less seasoned athletes who might not be prepared for full-contact training routines, this is very helpful.

4. Analysis and Feedback: Players utilizing VR platforms can receive instant feedback indicating areas in which their decision-making process needs to be improved. In order to provide focused training interventions, coaches can also examine player performance data gathered during VR sessions to spot trends, advantages, and disadvantages.

5. Flexibility: Virtual reality simulations may be customized to tackle certain tactical difficulties encountered by rugby teams in Argentina. Virtual reality training may be tailored to match the specific requirements of individual players or the team as a whole, whether the goal is to improve defensive alignment, optimize offensive tendencies, or enhance game knowledge.

6. Team Cohesion: As players cooperate to traverse simulated game circumstances, VR training can promote improved communication and collaboration among participants. Through collective experience in a simulated setting, players may cultivate a mutual comprehension of their respective duties and obligations on the field.

7. Accessibility: Virtual reality technology is getting more and more inexpensive, so rugby teams in Argentina of all sizes may use it in their training regimens. As technology advances, it may turn into a vital resource for player development nationwide.

3.5 Unit Root Test Analysis

Table 2

NULL HYPOTHESIS: VR HAS A UNIT ROOT		
EXOGENOUS: CONSTANT		
LEG LENGTH: 0 (AUTOMATIC - BASED ON SIC, MAXLAG=5)		
	t-Statistic	Prob.*
AUGMENTED DICKEY-FULLER TEST STATISTIC	-3.475435	0.0180
TEST CRITICAL VALUES:	1% level	-3.737853
	5% level	-2.991878
	10% level	-2.635542
*Mackinnon (1996) one-sided p-values.		

The above result represent that unit root test analysis result describe t statistic values and probability values of each augmented dickey fuller statistic. The result shows that overall t statistic value is -3.4754 the probability value is 0.0180 its shows negative but 18% significant value between them. the critical values represent test statistic levels 1% level, 5% level and 10% level according to the result its t statistic rates are -3.7378, -2.9918 and -2.635542 shows that negative statistic values between them.

Table 3

AUGMENTED DICKEY-FULLER TEST EQUATION				
DEPENDENT VARIABLE: D(VR)				
METHOD: LEAST SQUARES				
SAMPLE (ADJUSTED): 2 25				
INCLUDED OBSERVATIONS: 24 AFTER ADJUSTMENTS				
VARIABLE	Coefficient	Std. Error	t-Statistic	Prob.
VR(-1)	-0.709006	0.204005	-3.475435	0.0021
C	0.988267	0.295007	3.349980	0.0029
R-SQUARED	0.354435	Mean dependent var		-0.000125
ADJUSTED R-SQUARED	0.325091	S.D. dependent var		0.467622
S.E. OF REGRESSION	0.384165	Akaike info criterion		1.004165
SUM SQUARED RESID	3.246815	Schwarz criterion		1.102336
LOG-LIKELIHOOD	-10.04997	Hannan-Quinn criter.		1.030209
F-STATISTIC	12.07865	Durbin-Watson stat		1.850579
PROB(F-STATISTIC)	0.002147			

The above result represent that dickey-fuller test equation result describe that coefficient values, standard error values, t statistic values also that probability value of independent variable. according to the result its coefficient rate is -0.709 the standard error value is 0.2040 the t statistic value

is -3.4754 also that probability value is 0.0021 shows negative but its 2% significant level between them. the result describes that R square value is 0.35 shows 35% model fit for analysis according to the result its adjusted R square value is 32% the F statistic rate is 12.07 also that overall probability value is 0.002 shows that 100% significant level between them.

3.6 Equality Test analysis

Table 4

TEST FOR EQUALITY OF MEANS OF VR			
CATEGORIZED BY VALUES OF VR AND VR1 AND VR2 AND TTDM AND TTDM1 AND TTDM2			
DATE: 04/04/24 TIME: 00:46			
SAMPLE: 1 25			
INCLUDED OBSERVATIONS: 25			
METHOD	df	Value	Probability
ANOVA F-TEST	(24, 0)	NA	0.0000
ANALYSIS OF VARIANCE			
SOURCE OF VARIATION	df	Sum of Sq.	Mean Sq.
BETWEEN	24	3.571647	0.148819
WITHIN	0	0.000000	NA
TOTAL	24	3.571647	0.148819

The above result describe that test of equality result represent values and probability rates of F test its probability value is 0.0000 shows that 100% significant level. The result also describes sum of square values and mean square values between and within the variation. The sum of square value is 3.5716, 0.0000 its mean square value is 0.1488 shows that 14% average square rate between them.

3.7 Co-integration Test

Table 5 (a)

SAMPLE (ADJUSTED): 3 25				
INCLUDED OBSERVATIONS: 23 AFTER ADJUSTMENTS				
TREND ASSUMPTION: LINEAR DETERMINISTIC TREND				
SERIES: VR VR1 VR2 TTDM TTDM1 TTDM2				
LAGS INTERVAL (IN FIRST DIFFERENCES): 1 TO 1				
UNRESTRICTED COINTEGRATION RANK TEST (TRACE)				
HYPOTHESIZED		Trace	0.05	
NO. OF CE(S)	Eigenvalue	Statistic	Critical Value	Prob.**
NONE *	0.940342	134.2547	95.75366	0.0000
AT MOST 1	0.732464	69.41459	69.81889	0.0538

Table 5 (b)

AT MOST 2	0.542723	39.08909	47.85613	0.2567
AT MOST 3	0.442061	21.09239	29.79707	0.3519
AT MOST 4	0.202822	7.671748	15.49471	0.5011
AT MOST 5	0.101364	2.458169	3.841466	0.1169
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level				
* Denotes rejection of the hypothesis at the 0.05 level				
**Mackinnon-haug-michelis (1999) p-values				

The above result describe that co-integration analysis result represent the trace statistic values, 0.05 critical values also that probability value each hypothesis. The eigenvalue shows that 0.9403, 0.7324, 0.5427, 0.2028 also that 0.1013 shows positive eigenvalue between them. the 0.05 critical value represent that 95.753, 69.818, 47.85, 29.79, 15.49 also that 3.84 its shows positive critical value between them.

The probability rates of each hypothesis is 0.000, 0.05, 0.25, 0.11, 0.50 its shows that 100%, 5%, 25%, 11% and 50% significantly level between them. according to the result trace statistic also shows positive and significant link between them.

4. Conclusion

In conclusion, there is a great deal of potential for improving the performance of Argentine rugby players through the use of virtual reality in tactical decision-making training. Through immersive, recurrent, and secure training environments, virtual reality technology can assist rugby players in gaining the mental sharpness and strategic awareness required to succeed on the pitch.

Virtual reality (VR) platforms are also a great tool for teams and coaches trying to get an advantage in local and international rugby events because of their accessibility and customization. The research determines that Utilization of Virtual Reality in Training Tactical Decision-Making in Argentinian Rugby**.**

The based on secondary data analysis for measuring the data used E-views software and generate result included descriptive statistic, unit root test analysis, also that explain the co-integration analysis between them. To sum up, the use of virtual reality (VR) technology into the rugby teams' training regimens in Argentina is a compelling avenue for improving players' tactical decision-making abilities.

Virtual reality (VR) offers participants safe, recurrent, and immersive training settings that help them hone their fast-paced, strategic thinking skills. VR simulations' versatility makes it possible to customize training to meet the

unique difficulties faced by Argentine rugby teams, which will eventually enhance on the pitch performance.

Overall research concluded that direct and significant relation between Utilization of Virtual Reality in Training Tactical Decision-Making in Argentinian Rugby**.** VR technology has the potential to become a vital tool for player development at all levels of Argentine rugby, supporting the sport's continuing success and expansion in the nation as it becomes more widely available.

Reference

Ahmad, M. T. (2023). Quantifying the economic benefits of sustainable aquaculture practices in improving the production and quality of fish products: A cost-benefit analysis of a tilapia farm in Southeast Asia. *FishTaxa-Journal of Fish Taxonomy, 27*.

Akbaş, A., Marszałek, W., Kamieniarz, A., Polechoński, J., Słomka, K. J., & Juras, G. (2019). Application of virtual reality in competitive athletes–A review. *Journal of human kinetics, 69*(1), 5-16.

Altman, M., & Torgler, B. (2021). *Behavioural sports economics*: Routledge New York.

Arop, A. D. K., Wanjiru, A., Paul, C., Ben, A., James, N., & Kajwang, B. (2023). *Knowledge Dynamics: Exploring Intersections and Impacts*: Cari Journals USA LLC.

Bedir, D., & Erhan, S. E. (2021). The effect of virtual reality technology on the imagery skills and performance of target-based sports athletes. *Frontiers in psychology, 11*, 551149.

Bideau, B., Kulpa, R., Vignais, N., Brault, S., Multon, F., & Craig, C. (2009). Using virtual reality to analyze sports performance. *IEEE Computer Graphics and Applications, 30*(2), 14-21.

Cannavò, A., Pratticò, F. G., Ministeri, G., & Lamberti, F. (2018). *A movement analysis system based on immersive virtual reality and wearable technology for sport training.* Paper presented at the Proceedings of the 4th international conference on virtual reality.

Cortez, E. (2023). Utilization-Focused Evaluation on the Impact of a Sports-Based Youth Development on Unaccompanied Youth Students.

Croft, H., Chong, A., & Wilson, B. (2011). Virtual reality assessment of rugby lineout throw kinematics. *Sports Technology, 4*(1-2), 2-12.

Deutsch, J.-P., Rieke, M., Rein, R., Braunstein, B., & Bassek, M. (2023). *Change of direction demands in German high-performance soccer.* Paper presented at the World Congress on Science and Football 2023: Enhance Performance Engage Society.

Engelbrecht, L., Terblanche, E., & Welman, K. E. (2016). Video-based perceptual training as a method to improve reactive agility performance in rugby union players. *International journal of sports science & coaching, 11*(6), 799-809.

Faure, C., Limballe, A., Bideau, B., & Kulpa, R. (2020). Virtual reality to assess and train team ball sports performance: A scoping review. *Journal of sports sciences, 38*(2), 192-205.

Fitri, M., Zulnaidi, H., Ramadhan, M. H., Anwar, S., Munajat, Y., & Saputra, H. S. (2021). Futsal: A Paradigm to Improve Decision-Making Skills of Female Football Players. *Linguistica Antverpiensia*, 1625-1638.

Goel, G., & Handa, A. (2020). *Sports Industry and Marketing*: Friends Publications India.

Groves, J. (2021). *Designing and implementing a pedagogical framework to coach rugby sevens athletes who transition from 15-a-side: A collaborative action research approach.* Cardiff Metropolitan University,

Kim, J., Panza, M., & Evans, M. B. (2021). Group dynamics in sport. *Essentials of exercise and sport psychology: An open access textbook*, 613-642.

Kingsbury, D. M. (2022). *Coaches' acquisition of sport science knowledge and the role of education providers*: Sheffield Hallam University (United Kingdom).

Kittel, A., Larkin, P., Elsworthy, N., & Spittle, M. (2019). Using 360 virtual reality as a decision-making assessment tool in sport. *Journal of science and medicine in sport, 22*(9), 1049-1053.

Martínez-Moreno, A., Cavas-García, F., & Díaz-Suárez, A. (2021). Leadership style in amateur club sports: a key element in strategic management. *Sustainability, 13*(2), 730.

Mascret, N., Montagne, G., Devrièse-Sence, A., Vu, A., & Kulpa, R. (2022). Acceptance by athletes of a virtual reality head-mounted display intended to enhance sport performance. *Psychology of Sport and Exercise, 61*, 102201.

Mendes, D., Travassos, B., Carmo, J. M., Cardoso, F., Costa, I., & Sarmento, H. (2022). Talent identification and development in male futsal: a systematic review. *International Journal of Environmental Research and Public Health, 19*(17), 10648.

Miles, H. C., Pop, S. R., Watt, S. J., Lawrence, G. P., John, N. W., Perrot, V., . . . Mestre, D. R. (2013). *Investigation of a virtual environment for rugby skills training.* Paper presented at the 2013 International Conference on Cyberworlds.

Musa, R. M., Majeed, A. P. A., Kosni, N. A., & Abdullah, M. R. (2020). *Machine learning in team sports: performance analysis and talent identification in Beach Soccer & Sepak-takraw*: Springer Nature.

Odhav, K. P. (2020). *The role of sports institutes in higher education for the promotion of sports cultures: A case study of three universities in South Africa.* North-West University (South Africa),

Pastor, A., Villaseca-Vicuña, R., Segueida-Lorca, Á., & Zuñiga, P. (2023). Comparison of performance in official rugby competitions by group and match time. *Journal of Physical Education and Sport, 23*(8), 2051-2059.

Perocchio, A. (2022). The Influence of Science and Technology on the

development of modern “codified” sports.

Pu, Q. (2021). The Effects of Artificial Intelligence on Competitive Sports.

Solomons, J. (2020). *The effect of a rhythmic movement intervention on selected bio-motor skills of Western Province rugby academy players.* Stellenbosch: Stellenbosch University,

Walsh, M. P. (2021). *The Analysis, Support and Development of Coaches' Tactical Knowledge in Practice*: Liverpool John Moores University (United Kingdom).

Wilcock, B. (2020). The framing and reframing of sports news through translation in a converged media organisation.

Yunchao, M., Mengyao, R., & Xingman, L. (2023). Application of virtual simulation technology in sports decision training: a systematic review. *Frontiers in psychology, 14*, 1164117.

Yuzyk, M., & Seidner, P. (2022). E-Sports Competitions. In *Developments in Information & Knowledge Management for Business Applications: Volume 5* (pp. 671-716): Springer.