

Determining the Factors Affecting Football Fans' Satisfaction with Video Assistant Referee (VAR) Technology

Futbol Taraftarlarının Video Yardımcı Hakem (VAR)'e Yönelik Memnuniyetlerini Etkileyen Faktörlerin Belirlenmesi

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ABSTRACT

Video Assistant Referee (VAR) technology has been introduced in the sports industry as a decision support system designed to assist referees in making the correct decisions when overseeing a sporting event. In Turkey, VAR technology has been deployed to lessen controversies in football matches, but it has not completely eliminated them. As a result, it is crucial to establish whether fans, a key stakeholder in the sports sector, are satisfied with VAR technology. In this context, the study aims to investigate the effects of football fans' perceived value and identification with VAR technology on their satisfaction with it. Furthermore, the mediating role of attitudes towards the technology and the moderating role of knowledge about VAR technology will also be examined. The study used the snowball sampling method, and data were obtained via an online survey, with 411 fans participating over the data collection period. Using the fan data, Structural Equation Modeling was performed using the AMOS tool, and the study hypotheses were tested. The research revealed that identification and perceived value of VAR technology have a positive effect on satisfaction with this technology, with attitude toward technology acting as a mediator. The level of knowledge about VAR technology has a moderating effect in the relationship between satisfaction and perceived value. These findings have practical and theoretical implications for both the sports sector and the academic discipline.

Keywords: Video assistant referee, satisfaction, identification, attitudes toward technology, perceived value

ÖZ

Video Yardımcı Hakem (VAR) teknolojisi, herhangi bir spor müsabakasını yöneten hakemlerin doğru kararlar almalarına yardımcı olmayı amaçlayan bir karar destek sistemi olarak spor dünyasında uygulanmaya başlamıştır. Türkiye'de futbol maçlarında yaşanan tartışmaları azaltmak amacıyla uygulanan VAR teknolojisi, bu tartışmaları tam anlamıyla ortadan kaldırmamıştır. Dolayısıyla spor endüstrisinin önemli bir paydaşını oluşturan tarafların, VAR teknolojisinden memnun olup olmadıklarını belirlemek merak konusudur. Bu kapsamda araştırma futbol taraftarlarının VAR teknolojisine yönelik algıladıkları değer ile özdeşleşmenin VAR teknolojisine yönelik memnuniyetleri üzerindeki etkilerini keşfetmeyi amaçlamaktadır. Ayrıca bu etkilerde teknolojiye yönelik tutumun aracı rolü ile VAR teknolojisi hakkındaki bilgi düzeyinin düzenleyici rolü de incelenecektir. Kartopu örneklem yönteminin tercih edildiği çalışmada veriler çevrimiçi anket tekniği ile toplanmış ve veri toplama aralığında ankete 411 taraftarın katıldığı belirlenmiştir. Taraftarlardan elde edilen veriler kullanılarak AMOS programı aracılığıyla Yapısal Eşitlik Modellemesi yapılmış ve araştırma hipotezleri test edilmiştir. Analizler sonucu özdeşleşme ve VAR teknolojisine yönelik algılanan değer, bu teknolojiye yönelik memnuniyeti pozitif etkilediği ; bu etkilerde ise teknolojiye yönelik tutumunda aracılık rolüne sahip olduğu belirlenmiştir. VAR teknolojiye yönelik bilgi düzeyi ise memnuniyet ve algılanan değer arasındaki ilişkide düzenleyici role sahiptir. Ulaşılan bu sonuçlar hem spor endüstrisi hem de akademik alan için pratik ve teorik katkılar sunmaktadır.

Anahtar Kelimeler: Video yardımcı hakem, memnuniyet, özdeşleşme, teknolojiye yönelik tutum, algılanan değer

Introduction

Football has always been deeply intertwined with society, standing as the most widely followed sport in history. Both in terms of its impact on social life and its influence on societal developments, football has consistently remained embedded within the fabric of society (Çiçek, 2021). Looking at the history of football, it is evident that it is one of the most loved and followed sports, with a fan base that grows daily and a significant visual impact on people (Kayhan et al., 2020). In a sport that garners such immense attention, referees' incorrect decisions often spark debates among players, managers, coaches, and fans, affecting both the economic and social well-being of clubs and their supporters (Han et al., 2020). The broadcasting of football matches using audiovisual technologies in higher resolution and from multiple angles has further fueled discussions about decisions made during matches (Armenteros et al., 2020). To address these issues, technology, which has facilitated human life in many areas, has also been adapted to sports.

Technological advancements have significantly influenced various industries, including the sports industry, with their impact on the field rapidly increasing (Riedl et al., 2015). Football, which boasts a vast audience, emerges as the sport with the most widespread use of technology (Demir, 2019). The use of technological devices in football has been steadily growing to assist referees in making better and more impartial decisions (Riedl et al., 2015). The most recent example of this is the practice of Video Assistant Referee (VAR) technology, designed to help referees make correct decisions when needed (Winand & Fergusson, 2018). Reflecting the integration of technology into the sport, VAR technology was first introduced to football in a friendly match (Italy-France) in 2016 and later at the 2018 FIFA World Cup. It quickly became part of the Turkish Football Federation during the 2018–2019 Spor Toto Super League season, just as it did in other football leagues. Therefore, VAR technology has become a significant milestone in enabling football's adaptation to the digital age (Çırak, 2020). VAR is a technology developed to assist critical match incidents such as goals, penalties, red cards, and fouls that could alter the course of the game. With this technology, controversial positions can be examined in slow motion from different camera angles, and a final decision can be made based on the examination.. However, the introduction of this technology has not completely ended debates. Discussions among fans about whether VAR is being used correctly have persisted.

Consequently, understanding fans' attitudes, behaviors, and satisfaction with VAR has become increasingly important. Accordingly, this research aims to discover the effects of perceived value and identification on fans' satisfaction with VAR technology, as well as to examine the mediating role of attitudes toward the technology and the moderating role of knowledge level about VAR technology in these effects. A review of research on VAR technology reveals that most research focuses on referees' and players' perceptions and attitudes toward this technology (Demir et al., 2022; Spitz et al., 2021), while research examining fan satisfaction with VAR technology is limited (Deng et al., 2024; Winand et al., 2021). Therefore, designing this research from the fans' perspective and focusing specifically on fan satisfaction highlights the significance of this research. In addition to identifying the factors influencing fans' satisfaction with VAR technology, this research also explores fans' attitudes and knowledge levels regarding this technology, contributing significantly to the literature. Furthermore, the findings not only provide insights into determining fan satisfaction but also offer valuable theoretical and practical implications for sports marketing.

This paper begins with a conceptual framework and literature assessment to support the hypotheses produced within the scope of the investigation. This is followed by the Methodology section, which discusses data collection, participants, and measurement tools. The methodological portion is followed by the research findings and discussion, and the final section contains theoretical-practical contributions, as well as research limits.

Methods

Participants and Procedure

Recently, the VAR technology used in football matches has led to debates and dissatisfaction among fans. Therefore, the population of the research, focusing on fans' satisfaction with VAR technology, consists of football fans in Turkey. In this research, the snowball sampling method was chosen to attend these fans, and data were gathered through an online survey form. Ethics committee approval was obtained from the Gümüşhane University Scientific Research and Publication Ethics Committee (meeting dated October 25, 2024 and numbered 2024/8). The choice of this method was influenced by the ease

of reaching the targeted sample size and the advantages it provided in terms of time and cost (Fraenkel et al., 2012). Before applying the survey to the fans, the face validity was confirmed by three academics, and the survey was pilot-tested on 15 fans. After the pre-test, the survey link was shared through social media platforms. The survey link remained active from November 1st to December 1st, 2024, and it was determined that 477 fans participated in the survey. However, 66 participants answered "No" to the filter question "Do you watch football matches?" and their responses were excepted from the survey. As a result, the data of 411 fans were considered for the analysis. Given that the population size is in the millions, and considering that a sample size of 384 is sufficient for analysis (Yazicioğlu & Erdoğan, 2004), the sample size obtained is adequate for the analyses. In addition, a prior power analysis was performed using G*Power 3.1 to determine sample adequacy. Assuming a moderate effect size ($f^2 = 0.15$), $\alpha = 0.05$, and the required power ($1-\beta$) = 0.95, the minimum required sample size was calculated as 204. The actual sample size of 411 participants in the study exceeds this requirement, indicating that the study has sufficient statistical power. Demographic findings about the participants are provided in Table 1.

Table 1.
Demographic findings

	Categorization	Frequency	Percent
Gender	Male	321	78.1
	Female	90	21.9
Marital Status	Single	278	67.6
	Married	133	32.4
Age	17 and under	15	3.6
	18-28	219	53.3
	29-39	124	30.2
	40 and above	53	12.9
Education	Primary School	8	1.9
	Secondary School	61	14.8
	Undergraduate/Associate Degree	267	65
	Graduate	75	18.2
Monthly Income	Below 20,000 TL	142	34.5
	20,001 - 40,000 TL	101	24.6
	40,001 - 60,000 TL	105	25.5
	60,001 - 80,000 TL	37	9
	Above 80,001 TL	26	6.3
Supported Team	Beşiktaş	71	17.3
	Fenerbahçe	93	22.6
	Galatasaray	123	29.9
	Trabzonspor	30	7.3
	Other	94	22.9
Level of Fanaticism	Not fanatic at all	16	3.9
	Not fanatic	49	11.9
	Neither fanatic nor not fanatic	121	29.4
	Fanatic	135	32.8
	Extreme Fanatic	90	21.9

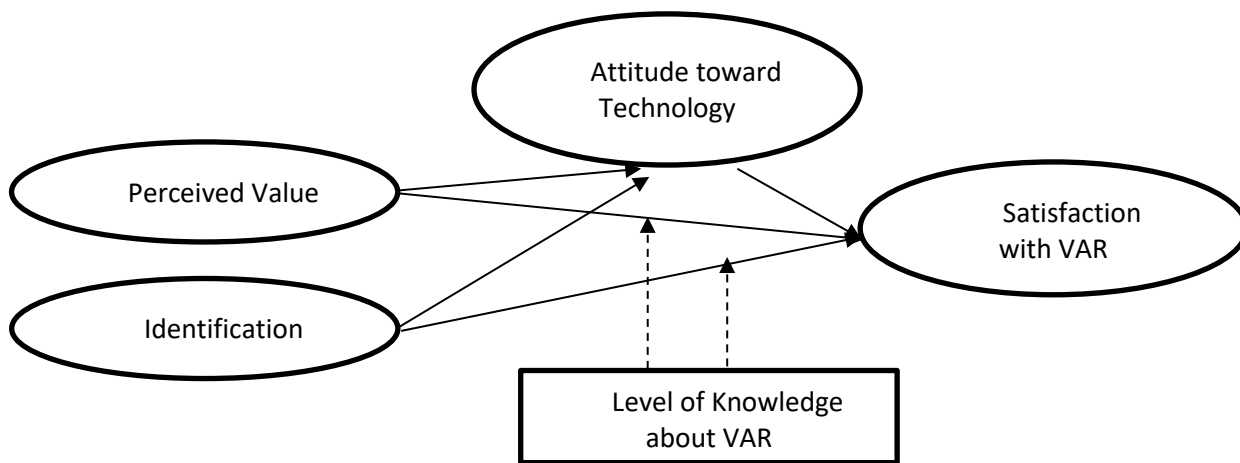
Note: TL: Turkish Lira

Measurement Tools

The survey form created for data gathering is divided into three sections. The first section includes filter questions and descriptive questions aimed at measuring the fans' knowledge level of VAR technology. The second section includes scale items related to the dependent, independent, and mediating variables in the research model. The final section contains demographic questions to uncover fans' age, marital status, gender, monthly income, and education. The scales used for the dependent, independent, and mediating variables in the research model and the survey form were taken from previous studies that have proven reliability and validity. The scales contained negatively worded (reverse-coded) items. Before the

analysis, all reverse-coded items were re-coded so that higher scores consistently indicated a higher level of the construct measured. This procedure ensured that the directionality of all items aligned and that the analyses accurately reflected participants' true responses. The scale for perceived value, one of the independent variables in the research, consists of 3 items (Peng et al., 2019), while the scale for identification consists of 6 items (Winand et al., 2021). The scale for fan satisfaction with VAR technology, which is used as the dependent variable in the research, contains 4 items (Winand et al., 2021), and the scale for attitude toward technology, used as the mediating variable, includes 3 items (Karan et al., 2023). To measure participants' knowledge level, the question "Please indicate your level of knowledge about VAR technology" was asked. A 5-point Likert scale was used for all the scales in the research. Figure 1 shows the research model and hypothesis pathways.

Figure 1.
Proposed research model



Data Analysis

The data obtained were analyzed using the SPSS 25, JAMOVI, and AMOS 24 statistical software programs. First, frequency analysis was conducted using SPSS 25 (IBM SPSS Corp., Armonk, NY, USA) to determine the descriptive and demographic characteristics of the fans who participated in the research. Then, reliability analysis was performed through the same program to determine the reliability levels of the research scales. After establishing the reliability levels, confirmatory factor analysis (CFA) was conducted using AMOS 24 to validate the factor structures of the scales. The standardized factor loadings, Average Variance Extracted (AVE), and Composite Reliability (CR) values were determined based on the CFA results. In the research model, structural equation modeling (SEM) was utilized to examine the mediating effects of attitude toward technology, while moderation analysis was employed to assess the moderating effect of knowledge level.

Results

Validity and Reliability of Measures

Initially, a Normality Analysis (NA) was conducted to assign the normality level of the data to be used in the analyses. The kurtosis and skewness values obtained from the normality analysis indicate whether the data follows a normal distribution. If the skewness and kurtosis values are between -3 and +3, it suggests that the data is normally distributed (Kalaycı, 2010). The results of the NA showed that the skewness and kurtosis values ranged from -1.642 to +2.656, indicating that the data follows a normal distribution. In the second phase, CFA was actualized to validate the research scales and assign the factor loadings. Two items from the identification scale were excluded from the analysis because their factor loadings were below 0.50 (0.346, 0.470). The findings in Table 2 are the results obtained from the analyses performed after the removal of these

two items. The structural validity of the measurement model was assessed using goodness-of-fit indices. The most commonly used goodness-of-fit indices in the literature ($\chi^2/df < 5$, RMSEA < 0.08 , AGFI > 0.85 , GFI > 0.90 , NFI > 0.90 , CFI > 0.90 , TLI > 0.90 , IFI > 0.90) were considered (Bagozzi and Yi, 1988). The model fit values were calculated as χ^2/df : 3.082, RMSEA: 0.071, AGFI: 0.892, GFI: 0.923, NFI: 0.922, CFI: 0.945, TLI: 0.933, IFI: 0.946. Upon reviewing the obtained goodness-of-fit values, it is evident that the data fits the research model very well. In the next step, the validity of the structural model was tested by following four processes (discriminant, convergent, face validity, and nomological) (Hair et al., 2010).

Table 2.
CFA findings

Variable	Item	Factor Loading (Standardized)	α	AVE	CR
Identification (ID)	I believe I have a strong emotional connection with the team I support.	0.840	0.793	0.526	0.813
	The successes of the team I support are my successes.	0.654			
	I enjoy watching and supporting the matches of the team I support.	0.787			
	I enjoy when others praise the team I support.	0.593			
	I don't like when the team I support is criticized.	0.346			
	I don't like the opponents of the team I support.	0.470			
Attitude toward Technology (AT)	The use of technology (goal-line technology, offside line technology, etc.) in match decisions ensures the fair management of the match.	0.679	0.908	0.518	0.810
	The technology used in match-related decisions is better than human judgment.	0.645			
	Instant position replays in the match help referees make better decisions.	0.737			
	I am pleased with the use of technology in sports.	0.808			
Perceived Value (PV)	The VAR technology increases the quality of football matches.	0.882	0.908	0.769	0.909
	The VAR technology improves the atmosphere of football matches.	0.880			
	I enjoy the use of VAR technology in football matches.	0.869			
Satisfaction with VAR (SV)	The VAR technology disrupts the flow of the game.	0.583	0.815	0.540	0.821
	I would like the VAR technology to be used in all football matches.	0.810			
	I support referees requesting instant position replays.	0.662			
	I am satisfied with the use of the VAR technology in football matches.	0.852			

Note: Factor loadings > 0.50 , CR > 0.70 , AVE > 0.50 (Hair et al., 2010)

Table 2 shows that the factor loadings, AVE, and CR values are higher than the benchmark values, showing that structural validity has been established. For discriminant validity, the square root of the AVE value for each construct must be greater than the correlation coefficients with other constructs (Chin, 1998). The content validity was verified by 3 experts before data collection, while nomological validity is ensured by the positive correlation between the two-factor structures (Table 3). Considering the results obtained from all these processes, it is concluded that the structural model is valid.

Table 3.
Discriminant validity results

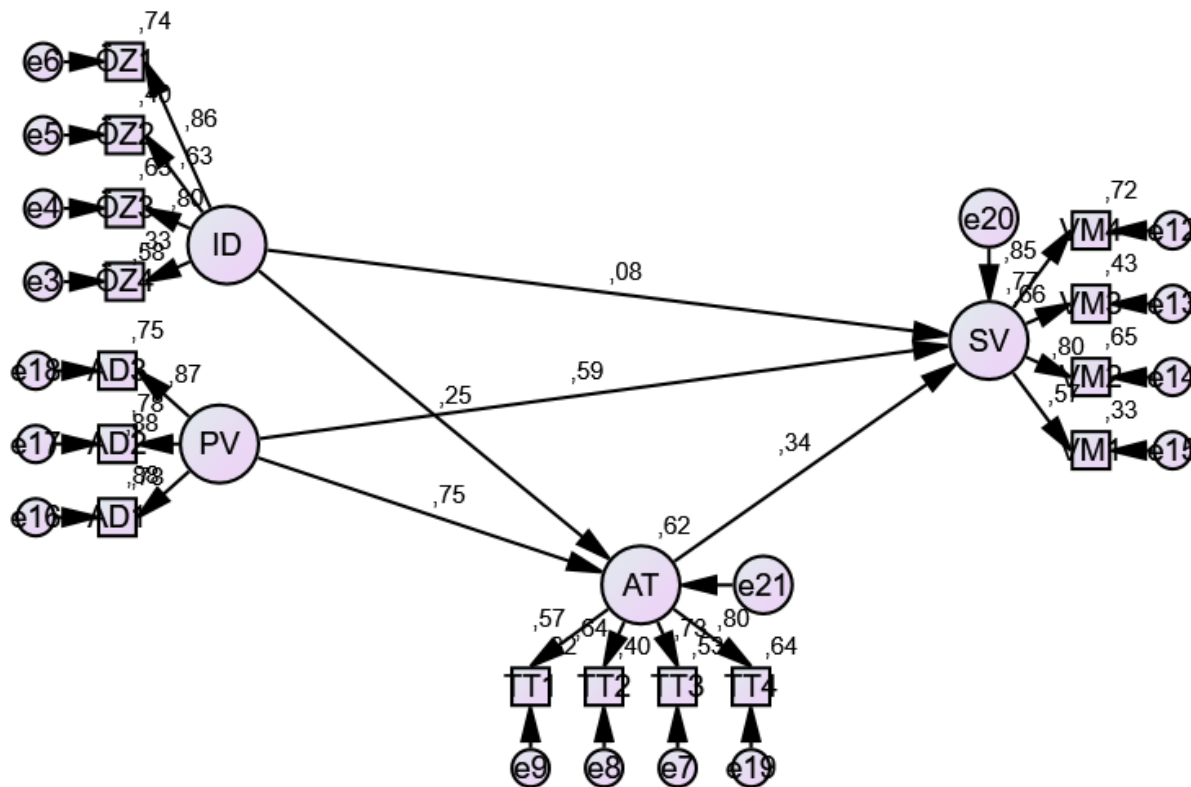
	M.	SD.	ID	AT	PV	SV
ID	3.8473	.94318	0.725			
AT	4.2165	.79169	0.275**	0.719		
PV	3.8337	1.07859	0.173**	0.620**	0.876	
SV	3.9988	.87635	0.249**	0.600**	0.716**	0.734

Note: Correlation is significant at the 0.01 level (2-tailed). M: Mean, SD: Standart Deviation

Mediation Analysis

The research used mediation analysis on AMOS to examine the mediating function of attitude toward technology in the effects of perceived value and satisfaction with the VAR. To claim a mediation relationship in a model, it is necessary for the independent variable to have a significant effect on both the dependent variable and the mediator, and for the mediator to have a significant effect on the dependent variable (Baron & Kenny, 1986). When the mediator variable is added to the research model, if the significant relationship between the independent variable and the dependent variable becomes non-significant, it is considered full mediation. If there is a reduction in the relationship, it is considered partial mediation. In evaluating the mediation results, the Bootstrap confidence interval values are considered. The significance of the mediation relationship is established by whether the confidence interval values derived from the mediation analysis contain zero. In other words, if there is a mediation relationship, the Bootstrap confidence intervals must be greater than or less than zero (Preacher & Hayes, 2008).

Figure 2.
SEM result



The results of the SEM analysis conducted on the AMOS program are presented in Figure 2. The hypothesis results obtained from the tested research model, along with the values for indirect and direct effects and the Bootstrap values, are provided in Table 4.

Table 4.
Hypotheses results

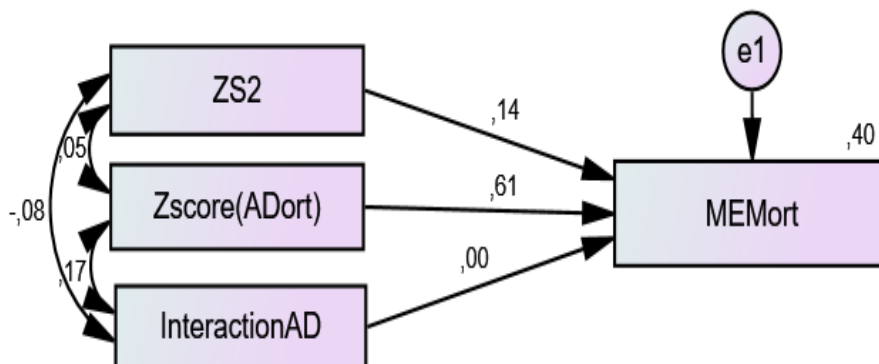
Hypotheses	Direct	Indirect	Mediating	Bootstrap Lower Bound	Bootstrap Upper Bound	<i>p</i>	Situation
H1: AT→SV	0.336					***	Supported
H2: PV→SV	0.733					***	Supported
H3: PV→AT	0.745					***	Supported
H4: ID→SV	0.114					.044	Supported
H5: ID→AT	0.251					***	Supported
H6: PV→AT→SV		0.588	Partial	0.139	0.402	.006	Supported
H7: ID→AT→SV		0.084	Partial	0.028	0.142	.014	Supported

Upon examining the table, it is observed that all hypotheses in the research are supported at a significance level of $p < .05$. According to the hypothesis results, it has been determined that identification ($\beta = 0.114$), attitude towards technology ($\beta = 0.336$), and the perceived value of the applied VAR technology ($\beta = 0.733$) have a significant positive impact on satisfaction with VAR technology. Additionally, it has been concluded that identification and perceived value positively and significantly effect attitude towards technology ($\beta = 0.251$, $\beta = 0.745$). Regarding the mediating role of attitude towards technology, the results show that identification and perceived value partially mediate the relationship between satisfaction with VAR technology. For partial mediation, the SEM mediation test analysis indicates that the Bootstrap confidence interval must be either greater than or less than 0 (Yavuz & Sağlam, 2018). Upon reviewing the Bootstrap values in the table, both H6 (lower bound 0.139; upper bound 0.402) and H7 (lower bound 0.028; upper bound 0.142) show that both values are greater than 0.

Moderator Analysis

The moderator variable controls the direction and strength of the relationship between the independent and dependent variables. Therefore, in this research, the moderating role of knowledge about VAR technology was examined in the relationships between perceived value, identification, and satisfaction with VAR technology. A moderator analysis was conducted using the AMOS program to measure the moderating effects (See Figure 3).

Figure 3.
Moderating effect model



Before the analysis, all variables were converted into standardized form (Z-score) to avoid multicollinearity problems, and interaction terms were subsequently created. The hypothesis results obtained from the moderating analysis performed in the AMOS program are presented in Table 5.

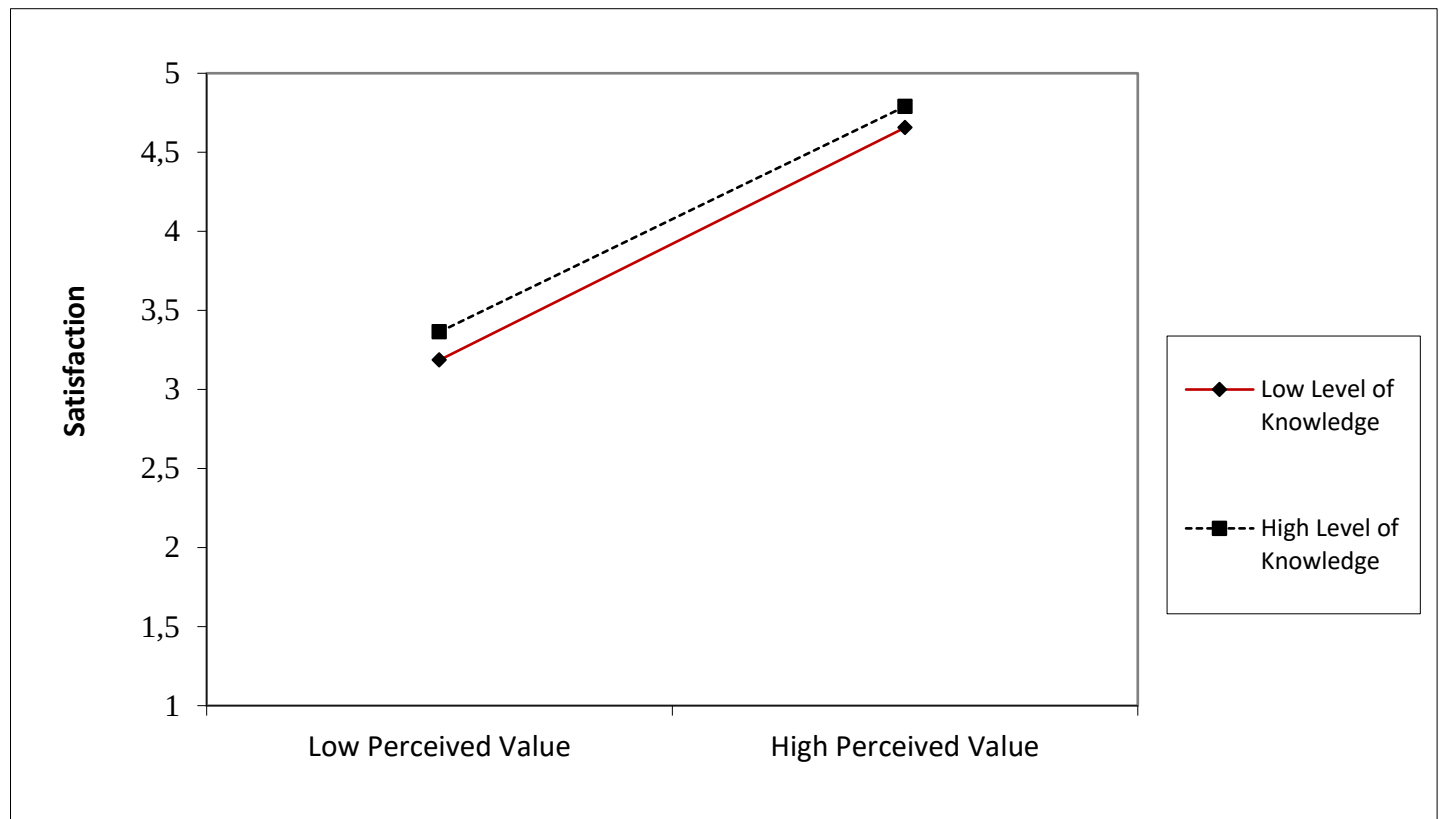
Table 5.
Moderating results

Hypotheses	Stand. Estimate	R ²	SE	CR	p	Situation
H8: PV→LK→SV	0.004	0.404	0.029	0.110	.012	Supported
H9: ID→LK→SV	-0.040	0.083	0.035	-0.788	.431	Not Supported

When the results in the table are examined, it is found that the level of knowledge about VAR technology has a moderating role in the relationship between perceived value and satisfaction with VAR technology ($\beta = 0.004$, $p = .012$, $p < .05$), while there is no moderating role for this variable in the relationship between identification and satisfaction with VAR technology ($p = .431$, $p < .05$). Therefore, the fans' level of knowledge about VAR technology significantly moderates the relationship between perceived value and satisfaction. However, it has been determined that the level of knowledge does not play a significant role in the relationship between identification and satisfaction. Based on these results, H8 is supported, while H9 is not supported. The results related to the moderating role of knowledge level are presented in Graph 1.

Graph 1.

Moderating effect of knowledge level in the relationship between perceived value and satisfaction



As seen in Graph 1, fans with a high level of knowledge about VAR technology experience a greater effect of perceived value on satisfaction with VAR technology compared to fans with a low level of knowledge. In other words, for fans with low levels of knowledge about VAR technology, the effect of perceived value on satisfaction is less significant compared to fans with high knowledge. As fans' knowledge levels increase, the effect of perceived value on satisfaction also increases. Therefore, the level of knowledge about VAR technology determines the degree of perceived value's impact on satisfaction with VAR technology. Based on these results, the knowledge level plays a moderating role in the effect of perceived value on satisfaction with VAR technology, thereby supporting H8.

Discussion

In this research, an SEM was used to identify the factors influencing football fans' satisfaction with the VAR technology used in football matches. When evaluating the research results, it was determined that perceived value, identification, and attitude toward technology have positive effects on fans' satisfaction with VAR technology. Furthermore, it was found that attitude toward technology has a mediating role in the relationships between perceived value, identification, and satisfaction with VAR technology, while knowledge level about VAR technology moderates the relationship between perceived value and satisfaction. The first key finding of the research is that fans' attitudes toward technology positively effect their satisfaction with VAR technology. Thus, the more positive the attitude toward technology, the more positive the satisfaction with VAR technology. Given the importance of technology in improving consumer experiences in today's technological era, technologies used in sports reduce controversial decisions and this situation increases the satisfaction of sports viewers (Ryall, 2012). As in this research, many previous studies have also proven the positive relationship between attitude and satisfaction (Nuryakin et al., 2023; Winand et al., 2021). Winand and Fergusson (2018) stated that fans with a positive attitude toward decision-support technologies would support the practice of VAR technology. Other factors that positively affect satisfaction with VAR technology are perceived value and identification. Fans develop an emotional bond with the team they support, and the team's goals and the game's outcome can influence their emotions (Deng et al., 2024). Although previous research found that fan identification did not have a significant effect on fan satisfaction (Winand & Fergusson, 2018), the result of the current research supports the research of Winand et al. (2021). Winand et al. (2021) argued that fans with high identification levels would be happier if VAR technology cancels a decision in favor of the opposing team. Considering football fans' loyalty to their teams, fans seek strong evidence to defend their teams, and VAR technology responds to this search. This situation is also related to the perceived value of VAR technology among fans. The higher the perceived value of VAR technology, the higher the satisfaction with it. Therefore, minimizing referee errors and improving the quality of the game through VAR positively impacts satisfaction with VAR technology (Deng et al., 2024). There are studies indicating that perceived value positively influences satisfaction from a consumer behavior perspective (Calabuig-Moreno et al., 2016; Mostaghimi et al., 2016). From a fan behavior perspective, positive relationships have been found between the perceived value of sports events and satisfaction (Cronin et al., 2000), and between the general perceived value of basketball leagues and satisfaction (Calabuig-Moreno et al., 2016). Specifically regarding VAR technology, Deng et al. (2024) found that the perceived value of this technology positively effects satisfaction. Therefore, the results of the research align with the findings of similar research in the literature.

Another important finding of the research is that attitude toward technology mediates the relationship between perceived value, identification, and satisfaction. This result shows that some of the effects of perceived value and fan identification on satisfaction with VAR technology occur through the attitude towards technology. In the literature, there are studies where both attitude and attitude toward technology are used as mediating variables (Chawla et al., 2023; Sarioğlu, 2022). Given that VAR technology is a new technology used in football, it is known that the perceived value of a new technology influences the attitude toward it (Wu et al., 2014). From a sports perspective, Yoshida et al. (2013) emphasised a positive relationship between the perceived value of sports events and behavioral intention. When examining the relationship between identification and attitude towards technology, a positive relationship between the two variables was identified. Anderski et al. (2025) argue that identification plays an important role in shaping fans' reactions to innovations such as smart stadium technologies. Winand and Fergusson (2018) found that there is a significant difference in the way fans with high and low levels of identification perceive decision-aid technology. Therefore, considering the significant relationships between attitude towards technology, perceived value, and identification, the results obtained within the scope of mediation relationships support the literature and contribute to the field. When evaluating the results related to the moderating variable, which is the level of knowledge about VAR technology, it was found that the level of knowledge moderates the relationship between perceived value and satisfaction, but does not have a moderating role between identification and satisfaction. This result indicates that, for fans with a low level of knowledge, the effect of the perceived value of VAR technology on satisfaction is less than for fans with a high level of knowledge. As fans' level of knowledge increases, the effect of perceived value on satisfaction also increases. Therefore, the level of knowledge about VAR technology plays a determining role in the level of the effect of perceived value on fans' satisfaction. Many previous studies have revealed the moderating role of knowledge in consumer satisfaction (Huang et al., 2016; Wang et al., 2016). Although no research has been conducted in the sports context, Bhatti and Alkhozaim (2023) found that prior knowledge about a destination moderates the relationship between the perceived value of the destination and satisfaction. Thus, the result obtained under moderation supports the literature in

terms of consumer behavior and contributes to the literature regarding fan behavior. Although the moderating effect of knowledge level on the relationship between perceived value and satisfaction was statistically significant ($p < .05$), the effect size was extremely small ($\beta = 0.004$). Therefore, this moderating influence does not have a meaningful practical implication. The statistical significance likely results from the sample size rather than a substantive moderating mechanism. Hence, the findings should be interpreted with caution, and future studies are encouraged to re-examine this relationship with different samples and alternative moderator constructs.

Conclusion and Recommendation

The results of this research offer significant contributions both theoretically and practically. Although previous studies have been conducted on VAR technology (Winand & Fergusson, 2018; Winand et al., 2021), studies examining fan satisfaction with this technology (Deng et al., 2024) are limited. From a theoretical standpoint, this research adds to the literature by looking into the effects of perceived value and identity on fan satisfaction with VAR technology, with attitudes toward technology serving as a mediator and knowledge level acting as a moderator. While previous studies have utilized attitude as a mediator variable (Chawla et al., 2023; Sarioğlu, 2022), determining the mediating effect of attitude towards technology in the relationship between fans' perceived value and identification with satisfaction fills a gap in the literature. Moreover, identifying the moderating effect of fans' knowledge level of VAR technology on the relationship between perceived value and satisfaction is another important theoretical contribution. Finally, determining that identification has a positive effect on both satisfaction and attitudes toward technology adds a new theoretical contribution to the literature.

From a practical standpoint, the findings of this research guide sports marketers and stakeholders in the football industry. Although VAR technology has offered numerous advantages since its implementation, it has also sparked debates. Therefore, fan satisfaction, as the customers of football clubs, is crucial not only for the fans themselves but also for other stakeholders in the sport (such as clubs, sponsors, etc.). Given the positive impact of perceived value on satisfaction, all stakeholders must collaborate to increase the value of this technology for fans. As this technology is used to prevent referees' wrong decisions and support correct decision-making, it helps in satisfying fans, and those fans who identify more strongly with their teams are more satisfied with the technology. Hence, clubs should develop strategies to enhance fan loyalty. Moreover, considering that as fans' knowledge of VAR technology increases, its perceived value positively influences satisfaction, both clubs and sports media should inform fans about the use of VAR when it will be applied, and general implementation rules. Given that technologies like VAR have the potential to impact fan engagement during matches negatively, it is essential to consider fans' opinions to ensure their satisfaction.

In addition to the significant theoretical and practical contributions of the research, there are several limitations. For starters, because the data were acquired using a convenience sampling method, the research results cannot be generalized, and the conclusions only apply to the fans who took part in the survey. Additionally, since only football fans participated in the research, fans from other sports were not considered. Furthermore, the factors influencing satisfaction with VAR technology are limited, and the number of these factors could be increased. In light of these limitations, future researchers are encouraged to use research methods that allow for broader generalization of results. Additionally, since this research only considered football fans, future researchers could explore fans of different sports, compare the satisfaction levels of fans from different sports, or compare the satisfaction of fans from different football teams. Furthermore, the perceptions, attitudes, and satisfaction of players and referees regarding VAR technology could also be examined. Finally, the research could be repeated by incorporating other independent, mediating, and moderating variables that may influence satisfaction with VAR technology.

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