



The Effect of the use of Video Assistant Referee (VAR) on Referee Decisions in 1he Indonesian Liga 1

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ABSTRACT

This study aims to analyze the impact of the implementation of the Video Assistant Referee (VAR) on refereeing decisions and match dynamics in Indonesia's Liga 1. The study employed a descriptive-analytical approach with a comparative design, examining the 2023/2024 season (without VAR) and the 2024/2025 season (with VAR), each consisting of 306 matches. The observed variables included added time, number of goals, corner kicks, yellow cards, and red cards. Data were analyzed using the Mann-Whitney U test and the Generalized Linear Model (GLM). The results indicate that VAR increased match added time ($p < 0.001$) and reduced the number of goals ($p = 0.035$) and yellow cards ($p < 0.001$). The number of corner kicks did not change significantly, while findings regarding red cards were inconsistent across analytical methods. These findings suggest that VAR influences both match duration and player behavior in Indonesia's Liga 1

INTRODUCTION

In modern football, the role of referees is not only limited to carrying out the rules of the game, but also ensuring fairness and smooth running of matches. Every decision they take can change the dynamics and even the final result of the match. Helsen and Bultynck (2004) Note that at international level an average referee takes more than a hundred decisions in a single match, most of which are related to fouls.

In modern football, the role of referees is not only limited to carrying out the rules of the game, but also ensuring fairness and smooth running of matches. Every decision they take can change the dynamics and even the final result of the match. Helsen and Bultynck (2004) Note that at international level an average referee takes more than a hundred decisions in a single match, most of which are related to fouls. However, the perception of the fairness of referee decisions is an important factor in maintaining public trust in the integrity of competitions, especially in the era of the use of technology such as VAR which still causes debate between coaches and players (Chen & Davidson, 2022).

However, making decisions on the ground is not a simple matter. Referees are faced with fast play, limited perspectives, and pressure from players and spectators. This kind of external factor has been shown to affect objectivity: the limitations of visual perception (Oudejans et al., 2000), Stadium Noise (Unkelbach & Memmert, 2010) Pressure from the Supporters (Buraimo et al., 2010), to the profits as a host (Goumas, 2014; Teixeira da Silva et al., 2024). The study confirms that even with the presence of technology such as VAR, social pressures and stadium atmosphere can still affect referees' perception of fouls. In fact, the difference in quality between teams can also affect the extra time given by the referee (Lago-Peñas & Gómez-López, 2016). In the Indonesian context, this challenge is increasingly complex because Liga 1 is known for its high rivalry and intense spectator atmosphere.

To reduce errors, match leadership support technology began to be introduced. Pashaie, Dickson, & Abdavi (2023) Classifying these technologies into three main functions: expanding referee perception (such as goal-line technology), improving decision accuracy through sensor-based or video-based systems, and assisting with direct rule enforcement (such as vanishing spray). This approach suggests that the effectiveness of technology lies in its ability to support human decision-making, rather than replace it entirely. VAR (Video Assistant Referee) belongs to the first category because it allows referees to review important incidents through video footage from various angles.

VAR is officially included in the *Laws of the Game* in 2018 by the International Football Association Board (Board, 2018). This system is used to review four categories of incidents, namely goals, penalties, direct red cards, and player identity errors. The process involves checking the incident by the VAR team through replays from various camera angles, communication with the referee through the headset system, and the possibility of it being carried out *on-field review*, with the final decision remaining with the main referee. Research shows that the implementation of VAR improves the accuracy of referee decisions in crucial incidents, as well as relates to increased extra time and game

interruptions, although it does not significantly change the basic structure of match duration (Zhang et al., 2022).

The results of the study show that there are real benefits of VAR. FIFA's official report (2018) shows an increase in decision accuracy from 95.6% to 99.35% in the 2018 World Cup. The study by Spitz et al. (2021) shows that the use of VAR significantly improves the accuracy of referee decisions in crucial incidents, especially by reducing errors classified as *clear and obvious errors* in professional competitions. In contrast, research on the Women's World Cup showed more limited results: significant changes occurred only in the duration of the game, with no real effect on goals, fouls or cards (Zhang et al., 2022).

In Indonesia, VAR has only been officially implemented in the 2024/2025 Liga 1 season after PSSI prepares technological devices, trains referees, and adjusts stadiums to meet FIFA standards. This step is part of an effort to modernize national football which is expected to increase the objectivity of decisions, reduce controversy, and strengthen public trust in the professionalism of match equipment. However, as a new innovation, academic evaluations of the effectiveness of VAR in Liga 1 are still very minimal.

The majority of previous research on VAR has focused on European men's leagues or international tournaments, so the results cannot necessarily be directly generalized to League 1 which has a unique context: the varying quality of infrastructure, the professionalism of the referees in process, and the great pressure from spectators. Against this background, research on the impact of VAR in Liga 1 is important to see if the results are in line with global findings or show a typical pattern.

With the implementation of VAR in the Indonesian Liga 1 in the 2024/2025 season as the inaugural season, an empirical study is needed to evaluate its impact in the context of national competitions. This study specifically aims to analyze whether the use of VAR affects the pattern and characteristics of referee decisions in League 1, including the frequency and distribution of crucial decisions such as direct red cards, goals, and additional match time. Thus, this study is expected to provide empirical evidence on the effectiveness of VAR in improving the objectivity and quality of match leadership in the Indonesian League, as well as enriching the literature that has been dominated by studies on European leagues.

LITERATURE REVIEW

Video Assistant Referee (VAR)

Video Assistant Referee (VAR) is a video assistance technology used to assist referees in reviewing important decisions during football matches. According to the International Football Association Board (Board, 2018), VAR is used in four main categories of incidents, namely goals, penalties, direct red cards, and player misidentification. This technology is designed to reduce errors of a nature *clear and obvious errors* without eliminating the authority of the referee as the final decision-maker. By utilizing replays from different camera angles, VAR is expected to improve accuracy, objectivity, and fairness in professional football matches.

Referee's Decision in Football

The referee's decision is one of the important factors that affect the course of a football match because it relates to the enforcement of the rules of the game and the control of player behavior on the field. (Helsen & Bultynck, 2004) states that referees at a high level of competition have to take hundreds of decisions during the match in fast and dynamic game conditions. Various factors such as the limitation of the viewing angle, the pressure of the spectators, and the intensity of the match can affect the quality of the decisions taken. Therefore, the use of technology such as VAR is one of the efforts to help referees improve the quality and accuracy of decisions during matches.

The Effect of VAR on Extra Match Time

The implementation of VAR has the potential to increase the duration of matches due to the process of checking and reviewing certain incidents that require verification. Each VAR check requires time for communication between the field referee and the VAR team and the possibility of it being carried out *on-field review*. (Zhang et al., 2022) found that the use of VAR was associated with an additional increase in match time due to interruptions during the decision-making process. Thus, additional time in the first and second halves is one of the indicators that can be used to evaluate the impact of the implementation of VAR on the course of the match.

The Effect of VAR on the Number of Goals

VAR plays an important role in the goal validation process because it allows the referee to review possible fouls or offside positions that occurred before the goal was created. The presence of this technology increases the accuracy of goal confirmation so that goals that do not comply with the rules can be canceled after a review. (Spitz et al., 2021) explained that VAR is able to improve the accuracy of referee decisions in crucial situations, including in the process of creating goals. Therefore, the number of goals is one of the relevant variables to assess the impact of the implementation of VAR on the outcome of the match.

The Effect of VAR on Corners

Corners are one of the technical aspects of the game that are generally influenced by the attacking and defensive strategies applied by the team. In contrast to goals or red cards that are the main focus of VAR reviews, corners are rarely the object of direct evaluation in the VAR system. However, changes in the tempo of the match or game patterns due to the application of VAR can have an indirect impact on the frequency of corners that occur. Therefore, an analysis of the number of corners is still necessary to see if there is a change in the dynamics of the match after the implementation of VAR.

The Influence of VAR on Yellow Cards and Red Cards

The application of VAR can affect player behaviour as any actions that potentially violate the rules can be reviewed via video recording. Awareness of the existence of additional supervision encourages players to be more careful in making physical contact and actions that risk sanctions. (Spitz et al., 2021) suggests that VAR has a preventive effect on the aggressive behavior of players because it increases the perception of supervision during the match. Thus, the number of yellow cards and red cards can be used as indicators to measure the influence of VAR on player discipline and the quality of referee decision-making.

METHODOLOGY

This study uses a descriptive-analytical quantitative approach with a comparative design to assess the influence of the application of *Video Assistant Referee* (VAR) on referee decisions and match dynamics in Liga 1 Indonesia. The draft compares two seasons of the competition under different conditions: 2023/2024 (without VAR) and 2024/2025 (with VAR), each consisting of 306 matches.

All official matches recorded by the league operator (*PT Liga Indonesia Baru*) is used as a research sample with the following criteria: (1) the match lasts for two full rounds and (2) the match statistical data is available in full. Matches that do not meet these criteria are excluded from the analysis. This design is in line with the approach of Zhang et al. (2022) which compares all the matches of the two editions *FIFA Women's World Cup* to assess the effect of implementing VAR.

Data was collected from the Football Field, the official statistical provider of *PT Liga Indonesia Baru*, and the recording of the match broadcast from Vidio as the official broadcaster, recording was carried out using an observation sheet to obtain the observed variable data. The observed variables include:

1. First half extra time (seconds),
2. Second half extra time (seconds),
3. Number of goals,
4. Number of corners,
5. Number of yellow cards
6. Number of red cards.

The variables of the number of goals, the number of corners, the number of yellow cards, and the number of red cards are observed on the Lapangan Bola

page as the official statistical provider of PT Liga Indonesia Baru. Meanwhile, the additional time variable uses the recording of the match broadcast from Vidio as the official broadcaster.

Data analysis was carried out in stages using a **frequentist approach**.

1. **Descriptive analysis** is used to describe the average and data distribution of each variable in two seasons.
2. **The Kolmogorov-Smirnov normality test** is used to determine the appropriate type of inferential test.
 - If the data is normally distributed, *an Independent Sample t-test is performed*.
 - If the data is not normally distributed, a **non-parametric Mann-Whitney U test** is used.
3. To test the consistency of results between variables and control for potential variations between seasons, a **Generalized Linear Model (GLM)** was used with a single factor of "competition year".

The entire analysis was carried out using **SPSS version 25.0**. The use of GLM aims to confirm the results of the Mann-Whitney U test in a more flexible parametric model, as recommended by (Hopkins et al., 2009).

RESEARCH RESULT

The Kolmogorov-Smirnov normality test showed that most variables were not normally distributed, so the main inferential analysis used the Mann-Whitney U test to compare two seasons: 2023/2024 (without VAR) and 2024/2025 (with VAR).

To strengthen the results, a Generalized Linear Model (GLM) with a single factor of "years" was also carried out to check the consistency of the effects between variables. The *Wald Chi-Square* and *BIC (Bayesian Information Criterion) values* are used to assess the fit of the model.

Table 1. Descriptive analysis and results of the Mann-Whitney U test and Bayesian analysis for matches without VAR (2023/2024) and with VAR (2024/2025)

Variabel	From VAR		VAR		Z	p-value	BF10	Cohen's d with 90% CI
	M	SD	M	SD				
First half extra time (seconds)	135.49	63.22	190.59	100.78	-7.801	0.000	0.000	-0.655 (-0.790-(-0.518))
Second Half Extra Time (seconds)	277.45	71.22	356.08	109.87	-9.956	0.000	0.000	-0.849 (-0.988-(-0.710))
Goals	2.88	1.67	2.61	1.61	-2.104	0.035	2.000	0.165 (0.032-0.298)
Corner Kick	9.86	3.57	9.65	3.55	-1.071	0.284	12.013	0.059 (-0.074-0.192)
Yellow card	4.97	2.21	4.34	2.12	-3.678	0.000	0.029	0.290 (0.156-0.424)
Red card	0.23	0.52	0.29	0.51	-2.238	0.025	4.615	-0.127 (-0.260-0.006)

Descriptive data of match variables in the Indonesian League 1 is presented in Table 1. After the implementation of VAR, there was a significant increase in first half extra time ($p < 0.001$) and second half extra time ($p < 0.001$).

Meanwhile, the number of goals per game decreased significantly ($p = 0.035$), as did the number of yellow cards ($p < 0.001$) and red cards ($p = 0.025$). In contrast, the number of corners showed no significant change ($p = 0.284$).

These results show that the implementation of VAR has a direct impact on match overtime as well as influencing player behaviour on the field, particularly in terms of discipline and caution against fouls.

Table 2. Results of generalized linear models for each match variable

Variabel	Estimate	95% CI	p-value	BIC
First half extra time (seconds)	55,098	(41,790 – 68,406)	< 0.001	7179,124
Second Half Extra Time (seconds)	78,627	(63,981 – 93,274)	< 0.001	7296,455
Goals	-0,271	(-0,531 – -0,011)	0,041	2362,071
Corner Kick	-0,209	(-0,772 – 0,354)	0,466	3307,155
Yellow card	-0,627	(-0,970 – -0,285)	< 0.001	2698,720
Red card	0,065	(-0,016 – 0,147)	0,116	940,770

The results of the *Generalized Linear Model* (GLM) analysis for each match variable are presented in Table 2. The implementation of VAR has a significant influence on first-half extra time ($p < 0.001$), second half extra time ($p < 0.001$), number of goals ($p = 0.035$), and yellow cards ($p < 0.001$). However, there was no significant effect on red cards ($p = 0.116$) and corners ($p = 0.284$).

The difference in results between the Mann-Whitney U and GLM tests on the red card variable shows that the effect of VAR on the incidence of red cards is relatively small and sensitive to the analytical approach used. Given the low frequency of red cards and the distribution of data dominated by zero values, parameter estimation in parametric models tends to be less stable, resulting in differences in the degree of significance between methods.

DISCUSSION

Overall, the results of this study show that the implementation of Video Assistant Referee (VAR) in the Indonesian Liga 1 has a real impact on the dynamics of the match. The increase in extra time in both halves shows that VAR extends the duration of the game due to the communication process and the referee's review of the decision. These results are in line with the findings (Zhang et al., 2022) di FIFA Women's World Cup, Bao et al. (2025) di UEFA European Championship, serta (Kubayi et al., 2021) in the FIFA World Cup, both of which reported an increase in average game duration of between one and three minutes per game after the implementation of VAR. In the context of the Indonesian Liga 1, the greater increase in time is likely due to the factors of early adaptation to the system and the efficiency of communication between officials that are still developing.

Apart from the checking process, the length of match time can also be caused by other factors such as coordination between referees that is not fully efficient or support facilities that are not evenly distributed in all stadiums. This is natural in the early days of the application of new technology. This means that the success of VAR depends not only on the technology itself, but also on the

readiness of the humans who operate it and the conditions of the field in which the system is used.

The decrease in the number of goals and yellow cards after the implementation of VAR shows that this technology not only serves as a corrective tool against referee decisions, but also as a mechanism to control player behavior. The decrease in the number of goals indicates that the validation process for offside and fouls in the penalty area has become stricter, so the chances of controversial goals have decreased. These findings are consistent with the results of the study (Kubayi et al., 2021) which reported a similar trend on FIFA men's international tournaments. However, the results of the yellow card reduction are not in line with the results of the research conducted by (Zhang et al., 2022). This difference can be interpreted as each competition has a different response to the application of VAR

In the context of Liga 1 which is known for hard play and great pressure from spectators, the presence of VAR indirectly changes the way players behave on the field. Players are more in control of their emotions and in control of their actions because they are aware that every incident can be reviewed. This shows that VAR is not only a tool to improve decisions, but also a tool that helps shape player behavior to be more orderly and sportsmanlike.

The significant decrease in the number of yellow cards also indicates the psychological effect of VAR on player behavior. Players tend to be more cautious due to the awareness that any incident can be reviewed through video views. These results are in line with research (Spitz et al., 2021), which suggests that VAR has a preventive effect on aggressive behavior by reinforcing the perception of surveillance. Similarly in the Turkish Super League it is shown that VAR contributes to increased player compliance and reduced referee bias towards big teams, which ultimately reinforces a sense of competitive fairness (Strong et al., 2025).

In addition to helping the referee, this also gives a sense of fairness to the players. They know that decisions not only depend on the referee's point of view on the field, but can also be examined objectively. This impact makes the match feel more honest and reduces the potential for misunderstandings between players and officials.

Meanwhile, the insignificance of the change in the number of corners strengthens the view (Wei et al., 2025) that technical aspects such as corner kicks are more influenced by the team's strategy and execution effectiveness than by the use of referee technology. The inconsistency of the effect on the red card also indicates that gross fouls are contextual and do not depend entirely on VAR, but rather on the referee's subjective interpretation of the intensity of contact and the situation of the match.

It also shows that not everything in football can be controlled by technology. VAR is only used at key moments such as goals, penalties, or heavy fouls. So, the effect does not cover all aspects of the game, but only things that have the potential to change the outcome of the match.

When compared to results at the international level, the impact of VAR in Liga 1 Indonesia seems broader because it affects not only match time, but also

behavior and game results. In competitions such as the FIFA World Cup and UEFA Euros, the effect of VAR is more limited to increased decision accuracy and extra time duration (Bao et al., 2025; Kubayi et al., 2021). This shows that VAR in Indonesia has a dual role: as a tool for decision correction and as an instrument for the formation of a more disciplined and sportive game culture.

This difference can occur because Indonesian football is still in the process of building a modern and transparent system. VAR being part of the big change not only helps referees, but also encourages all elements of the match to improve. If in the future the experience and ability of officials continue to improve and the system becomes more efficient, VAR has the potential to become an important tool to maintain justice while improving the quality of Indonesian football.

With the increasing experience of referees and the efficiency of the VAR system going forward, this technology is expected to be able to maintain a balance between the fairness of decisions and the smooth tempo of the game, as well as strengthen the professionalism of national football.

CONCLUSIONS AND RECOMMENDATIONS

This study shows that the application of Video Assistant Referee (VAR) technology has a real influence on the course of matches and the way referees make decisions in Liga 1 Indonesia. The presence of VAR was proven to extend the duration of the match due to the review process, as well as reducing the number of goals and yellow cards. These findings show that VAR not only serves as a correction tool, but also shapes the behavior of players who are more careful and disciplined in playing.

Meanwhile, the impact on red cards was inconsistent between analysis models, and the number of corners was relatively unchanged. This indicates that the influence of VAR is more pronounced on the behavior and decision aspects of the referee than on the technical aspects of the game.

Overall, the implementation of VAR has made a positive contribution to increasing professionalism, transparency, and a sense of fairness in national football competitions. With the improvement of referee experience, the efficiency of communication between officials, and the strengthening of technological infrastructure, VAR has the potential to become an important pillar in efforts to modernize and improve the quality of Indonesian football.

However, further research needs to be carried out by considering the simultaneous influence of VAR on the technical aspects of the game and player behaviour, as well as taking into account the variables of cultural context, and level of competition in order to gain a more comprehensive understanding of the effectiveness of VAR in various football conditions. In addition, research can be carried out with a larger sample and not compare two seasons of competition.

ADVANCED RESEARCH

This study has several limitations, including the use of data that is limited to two seasons of the Indonesian Liga 1 competition and match variables that only include basic statistical aspects. In addition, this study has not considered other factors that can affect referee decisions and match dynamics, such as team

quality, match location, level of match importance, and spectator conditions. Further research suggests using longer observation periods, adding technical and contextual variables of matches, and comparing the impact of VAR on different competitions or match levels. A qualitative approach through interviews with referees, players, and coaches can also be taken to gain a deeper understanding of the influence of VAR on decision-making processes and behavior during matches.

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