

# Differences in Basic Non-Standard Situational Efficiency Indicators between Winning and Defeated European Senior Basketball Teams

Marko Trninić<sup>1</sup>, Ante Perica<sup>2</sup> and Mario Jeličić<sup>3</sup>

<sup>1</sup> »Cedevita« Basketball club, Zagreb, Croatia

<sup>2</sup> »Kapfenberg Bulls« Basketball club, Kapfenberg, Austria

<sup>3</sup> University of Split, Faculty of Kinesiology, Split, Croatia

## ABSTRACT

*The aim of the conducted research was to identify and explain the differences in basic non-standard situational efficiency indicators between winning and defeated European senior basketball teams. Discriminant analysis and Mann-Whitney U-test were used with the purpose of investigating the differences between winning and defeated teams in the domain of basic non-standard situational variables. The grouping variable distinguished 24 defeated teams from 24 winning teams participating in 2009/2010 season of Euroleague Top 16. The research clearly reveals the differences between the winning and defeated European senior basketball teams in the domain of non-standard situational variables of position and transition offense and defense. Eight situational efficiency indicators were used which include the overall number of successful and unsuccessful position and transition defenses and offenses. Based on the results obtained by parametric and non-parametric methods, it has been noticed that successful position defense is crucial for winning, and unsuccessful position offense is an indicator of defeat prediction. Therefore, practical aims in situational training must involve balanced development of relevant abilities and skills which determine successful simultaneous performance of multiple tasks in all the phases of game flow. Such process of sport preparation improves the overall actual quality of players and whole team performance. In conclusion, it is important to emphasize that the process of improving position and transition defense stimulates the development of position and transition offense, and vice versa.*

**Key words:** basketball, basic non-standard indicators of situational efficiency, position and transition defense, position and transition offense, differences

## Introduction

There is a series of research programs and diverse research topics involving standard indicators of situational efficiency (performance indicator) at different competitive levels<sup>1-7</sup>. In elite basketball, indicators of situational efficiency of every player and the entire team in all phases and sub-phases of the game flow must not be assessed only during a match, but also during situational training, since it is the only way to get an insight into player's consistency in performing tasks and roles in the game<sup>8</sup>. The mentioned source of information is a basic precondition for setting the scale of priority goals which must be pursued in the process of sport preparation. Previous research findings based on standard parameters of situational efficiency indicate that different predictor variables distinguish winning and defeated teams at different competitive lev-

els<sup>1,9</sup>. However, scientific research, in addition to the experience of expert coaches' and scientist-practitioners in the field of sport science, suggest that standard indicators of situational efficiency are not sufficient for determining and explaining the differences between successful and unsuccessful senior basketball teams<sup>2,10-15</sup>. Due to these reasons, the competitive activity of players and teams during a game must be assessed based on standard and non-standard situational efficiency indicators in basketball game<sup>8,15</sup> and on basis of dynamical interaction analysis process between two opponents<sup>16</sup>. It is important to emphasize that the usual way of reporting on performance indicators for game sports is to use frequencies, or relative frequencies, of behavioral occurrences<sup>17</sup>. This approach ignores interactions between the player and opponent as

important sources of variability within game sports<sup>16</sup>. In relation to this, basketball game can be appropriately interpreted as a non-linear dynamic system, by applying mathematical and logical models which have an isomorphic relation with modelled problems. This is the reason why scientist-practitioners apply functional analysis of basketball game in their research, which enables the analysis of reaction processes of players in one or both teams. Furthermore, motor activities in interaction sports are determined primarily by cooperative actions within the team and by confronting the opponent. In this context, offense states can be observed as a consequence of the opposing defense state and vice versa. Thereby, the importance of tactics influence of the opposed teams is manifested in the game states of transition and position phases of the game<sup>8</sup>.

In accordance with the aforementioned, a quantitative analysis of basketball game was conducted, and within the analysis, it was investigated how eight basic non-standard indicators of situational efficiency distinguished winning and defeated European teams (Table 1). It is the authors' opinion that the difference between winning and defeated teams may be distinguished based on the structure of basic non-standard situational efficiency indicators<sup>8</sup>. This is why determining the basic non-standard situational indicators of game efficiency which distinguish winning and defeated teams is useful in modelling specific training programs, i.e. in profiling the demands in game organization<sup>15</sup>.

For this sort of scientific-expert approach, expert coaches and scientist-practitioners must use video recording which allows them to observe and register the events of the game multiple times and through focused observation. At the same time, game flow may be described more precisely by identifying and observing various transition and position game states. The basic method in monitoring the game flow is defined as a time set sequence of pictures, and the game state in a given moment  $t$  is a set of information on the position of the ball, the position of all ten players, as well as the speed of ball flow and the movement of players<sup>18</sup>.

The aim of the conducted research was to identify and explain the differences among basic non-standard situational efficiency indicators between winning and defeated European senior basketball teams. The mentioned aim motivated the researchers to continue investigating the

state of the game as the starting basis for detecting efficiency indicators which characterize the winning teams, which indirectly affects the managing of the integral readiness process of basketball players.

## Methods

### *Sample of entities*

By use of pseudo-random sampling, 24 matches were analyzed in the 2009/2010 season of Euroleague Top 16. In the process the authors tried to avoid the situation where a certain club appeared more than 4 times. It must be emphasized that, based on random selection of matches, when a certain club was to be included in the sample for the fifth time, the selected match was not included.

### *Sample of variables*

With the purpose of analyzing position and transition defense/offense, the following basic non-standard situational efficiency indicators have been included (Table 1). Basic non-standard variables of situational efficiency in the defense phase included the total number of successful and unsuccessful position defenses and the total number of defenses which had successful and unsuccessful outcome in transition state. Furthermore, in the offense phase, basic non-standard variables were included which covered the total number of successful and unsuccessful position offenses and the total number of offenses which had successful or unsuccessful outcome in transition state (Table 1).

Further on, it is important to emphasize that successful outcomes in offense involve the realization of field shots (2 and 3 points) and free throws assigned. Unsuccessful outcomes include missed field shots (2 and 3 points missed), and turnovers. Also, in this research, the action following offensive rebound is viewed as continuation of offensive possession.

### *Procedure*

In this research program all matches were observed by three basketball experts, more precisely, by two basketball expert coaches and one statistician, and the final data

**TABLE 1**  
BASIC NON-STANDARD INDICATORS OF SITUATIONAL EFFICIENCY

Defense	Offense
PDU – total number of unsuccessful position defenses	POU – total number of unsuccessful position offenses
PDS – total number of successful position defences	POS – total number of successful position offenses
TDU – total number of defenses with an unsuccessful outcome in transition state	TOU – total number of offenses with an unsuccessful outcome in transition state
TDS – total number of defenses with an successful outcome in transition state	TOS – total number of offenses with an successful outcome in transition state

**TABLE 2**  
DESCRIPTIVE PARAMETERS, RESULTS OF K-S TEST AND LEVEL OF SIGNIFICANCE BY MANN-WHITNEY U-TEST

Situational efficiency indicators	Winning teams			Defeated teams			MaxD	p
	$\bar{X}$	Med	SD	$\bar{X}$	Med	SD		
PDU	25.33	25.00	4.55	27.63	26.50	3.84	0.11	0.08
PDS	29.92	31.00	5.90	25.17	25.00	3.07	0.15	0.00
TDU	7.25	7.00	3.40	8.29	7.00	4.15	0.14	0.64
TDS	5.42	5.00	2.50	5.96	5.00	2.51	0.25	0.41
POU	22.29	22.00	3.87	25.79	28.00	5.80	0.15	0.06
POS	29.67	30.00	4.15	27.75	29.00	4.60	0.11	0.18
TOU	6.46	6.00	2.60	7.08	6.00	2.93	0.21	0.48
TOS	9.08	9.00	4.11	7.96	8.50	3.68	0.14	0.54

$\bar{X}$  – frequency means, Med – frequency medians, SD – standard deviations, MaxD – maximal deviation of relative cumulative empirical frequency from relative cumulative theoretical frequency ( $\text{test}_{0.05}=0.19$ ), p – level of significance, Mann-Whitney test- refers to the differences between the winning and the defeated teams

were identified by agreement. Sequences of the game states during the basketball game were identified according to operationalized constructs<sup>18</sup> and written into the file. Furthermore, by usage of the software »State Analyzer 1.0.« sequences of the basketball game were processed and frequencies of all variables were gathered.

### Statistical analysis

On basic descriptive analysis, the following parameters were calculated separately for winning and defeated teams: mean ( $\bar{X}$ ); median (Med); and standard deviation (SD). Kolmogorov-Smirnov test (K-S test) was used for testing the distribution normality.

With the purpose of analyzing and explaining the differences between winning and defeated teams in the domain of basic non-standard indicators of situational efficiency, discriminant analysis and Mann-Whitney U-test were used.

### Results

The obtained results show descriptive parameters and the results of K-S test of all investigated variables in winning and defeated teams. It can be seen in Table 2 that only two basic non-standard indicators of situational efficiency (TDS and TOU) deviated significantly from normal distribution ( $\text{MaxD}>\text{K-S test}$ ). Other variables did not show statistically significant deviation from normal distribution (Table 2).

It is evident in Table 2 that the winning teams, in relation to the defeated, had an averagely higher number of successful position defenses – PDS (29.92), successful position offenses – POS (29.67) and successful transition offenses – TOS (9.08). As opposed to the winning teams, the defeated teams had higher mean values in variables PDU (27.63), TDU (8.29), TDS (5.96), POU (25.79) and TOU (7.08).

Research findings (Table 2) indicate that PDS variable significantly distinguishes the winning and the defeated teams at the significance level of 0.01 ( $p<0.01$ ), which is in accordance with the results of parametric analysis. Furthermore, it must be noted that the POU variable lies at the very threshold of statistical significance ( $p=0.06$ ).

Table 3 reveals that the obtained canonical discriminant function significantly distinguishes winning and defeated teams at the level of significance 0.01 ( $p<0.01$ ) with a relatively high canonical correlation (0.62) and with Wilks' lambda 0.61. Further on, discriminant function correctly classifies 72% of the matches according to the win-lose criterion. It is important to stress that the authors used forward algorithm of variable selection into a discriminant model where variables (PDU, POS, TDU and TOS) were excluded from the model.

Further on, table 3 reveals that variables PDS (0.67) and POU (–0.46) distinguish winning from defeated teams.

**TABLE 3**  
STRUCTURE AND POSITION OF GROUP CENTROIDS ON DISCRIMINANT FUNCTION BY USING FORWARD VARIABLE SELECTION ALGORITHM AND SIGNIFICANCE OF DISCRIMINANT COEFFICIENTS

Situational efficiency indicators	DF	p
PDS	0.67	0.00
POU	–0.46	0.00
TOU	–0.15	0.08
TDS	–0.14	0.20
Position of group centroid: Winning	0.77	
Position of group centroid: Defeated	–0.77	
Wilks' Lambda	0.61	
Canonical Correlation	0.62	
Reclassification (%)	72.00%	
p	0.00	

DF – structure of the discriminant function, p – level of significance

## Discussion

Based on group centroid projections (Table 3), it is evident that successful position defense is crucial for winning, while unsuccessful position offense is a reliable indicator for predicting defeat. Apart from that, very similar research findings have been obtained (Table 2) by using a non-parametric method of identification of differences (Mann-Whitney U-test). Research findings show that indicators which denote efficiency in »position« variables are much more significant in determining sports achievement than »transition« variables. It is assumed that the obtained results are determined primarily by higher frequency of position states of the game<sup>15</sup>. Hence, variable representing the overall number of unsuccessful position defenses – PDU ( $p=0.08$ ), as well as the variable representing the overall number of successful position offenses – POS ( $p=0.18$ ), distinguish the winning and the defeated teams to some extent (Table 2). This confirms sustainability of the expected model which corroborates the expert knowledge, experience and coach's opinion that »defense wins«, while the attack loses the match<sup>15,19</sup>, i.e. »defense wins«<sup>20</sup>. On one hand, it is important to emphasize that defense is the only stabilizing factor in the game, preventing the disorganization of the game of a certain team particularly with inefficiency in the attack phase<sup>20</sup>. In addition to this, Holzman and Lewin<sup>21</sup> stated that a team playing good team defense can stay in the game even when the attack is dysfunctional. On the other hand, defense is a precondition to develop transition and position offense<sup>8,15,22</sup>. Winter<sup>20</sup> claims that »transition basketball starts with defense«. At the same time, the way of obtaining the ball, the players' actual quality, style and playing system as well as the confronting of the opposing team determine the frequency of primary and secondary fast break and the frequency of early and positioned attacks. Thus, the players' and team's efficiency depends on what the team is allowed by the opposing team. Namely, there is functional dependency in players' and teams' efficiency on the efficiency level of the opposing team in all the phases of game flow<sup>8</sup>.

Further on, expert coaches experience shows if defense is more successful than the opponents' offense, it increases ball possession. At the same time it is important to treat offensive rebounds not only as the prolonged offense aggression, but as the first phase of transition defense<sup>8,22</sup>. In accordance with this, basketball experts claim defense is more consistent than offense<sup>8,22,23</sup>. Good defense more likely creates consistent winning teams<sup>22</sup>.

Accordingly, the authors consider that three out of four game intensity regulators, which are the key to success in basketball, emerge as a result of defense: disciplined pressure in defense and rebounding efficiency in defense and offense. The fourth game intensity regulator is ball control to the selective shot in offense phase. At the same time it is important to emphasize that shot selection is the first principle of organized offense and the first precondition for successful transition offense.

Bradley<sup>24</sup> states that team basketball starts in defense phase and that implementation of helping principles is the

ultimate test of discipline and responsibility of players within team defense. Further on, the same author claims the most disciplined teams win not only matches, but titles as well. Additionally, successful defense and offensive rebounds raise self-confidence in attack<sup>22</sup>. It is important to stress that during a match many expert coaches are primarily focused on the defense efficiency since it is about exact rules, and secondary to offense efficiency. Nikolić<sup>22</sup> states that realized offense is applicable only on the condition that scored goal is confirmed by successful defense, i.e. by a new chance for an successful offense.

The obtained results are in accordance not only with the opinion of expert coaches and scientist-practitioners, but also with a number of studies including standard situational efficiency indicators<sup>1,25,26</sup>. Thus, for instance, Trninić, Dizdar and Lukšić<sup>1</sup> state that defensive rebounds and opponent's unsuccessful shots for 2 and 3 points are produced by successful defense and make a difference between winning and defeated teams.

On the other side, missed 2 and 3 point shoots are not exclusively result of an successful defense. Practical observations confirm that in almost any game (on any level of competition) there are many open perimeter shoots. Obviously, making those open shoots heavily influence overall offensive efficiency. Research of Gómez et al.<sup>9</sup>, indicates that missed 3 point shoots represent important factor which characterizes defeated teams.

By watching a video recording, expert coaches and scientist-practitioners can detect players creating unbalanced states in position and transition defense and offense. The interpretation of how, when and where certain players generate mistakes in a game determines rational management of sports preparation. This kind of approach is directed towards obtaining data on how much and what a certain team has done to prevent or allow the opponent in position and transition offense and defense. The mentioned set of non-standard situational efficiency indicators on basic level may be the appropriate assumption for the work of expert coaches who require regular selective corrections of the perceived mistakes in the game, selective compensation of weaknesses of the game, selective optimizing of the development of potential and roles of a certain player in the game tactics model<sup>27</sup>.

Performance and sport achievement on the elite level of competition in basketball primarily depend on athletes' specific adaptive organism changes on high training and competition stress<sup>28,29</sup>. This refers especially to sport-specific changes of individual and team performance based on selective error correction<sup>30</sup>. Further on, the understanding of the way in which the process of sport preparation affects the change of the athletes' actual quality and performance quality of the entire team is the starting point for managing the athletes' development and reaching maximum sport achievements<sup>30</sup>.

Regardless of the fact that this research was based on a number of actual concepts and expert knowledge and experience, it has its limits, primarily those referring to the size of sampling. Therefore generalization of research results obtained in this study are limited and some fur-

ther studying is necessary involving large and impartial samples which would guarantee for exterior validity, the possibility to generalize results as well as statistical power and the validity of conclusion. It is the authors' opinion that creating specialized software with integrated modules for keeping records of the game state and transferring probabilities would essentially simplify and accelerate the measuring process and indirectly enable studying of a great number of matches.

The description of variables in this research was limited to exterior parameters (situational efficiency parameters), while interior variables (e.g. the level of development of relevant characteristic features in athletes), which involve performance and sport achievements determinants, were not measured. Despite the mentioned limits, the research clearly reveals certain practical implications indicating that situational training system should be directed towards the balanced development of offense and defense. The development of simultaneous performance of multiple tasks in the defense phase is one of the basic preconditions to produce a winning team.

Future contemporary research should involve the differences between winning and defeated teams on different levels of competing systems and for different age groups. The mentioned researches should involve internal and external variables which are in dynamic interaction and determining, at the same time, the outcomes of actions in all game phases<sup>30</sup>.

Expert coaches and scientist-practitioners believe that European players and teams could improve their performance in transition and position defense phase more than their performance in transition and position offense phase, if they improved their abilities and skills which affect individual and team performance.

Finally, it is necessary to study relevant characteristics determining the efficiency of simultaneous performance of multiple tasks in transition and position defense phase which are mutually conditioned<sup>8,15,31</sup>.

## Conclusion

The aim of this research was to establish and explain the differences between winning and defeated teams based on non-standard situational variables which involve technical-tactic activities of players and the entire team in basketball. The differences in basic non-standard indicators of situational efficiency between winning and defeated teams were identified by discriminant analysis and Mann-Whitney U-test. The following variables were used in the process: PDU, PDS, TDU and TDS in addition to offense variables: POU, POS, TOU and TOS. The research clearly reveals the differences between winning and de-

feated European senior basketball teams in the domain of basic non-standard indicators of situational efficiency in position defense and offense obtained by discriminant analysis and Mann-Whitney U-test. Further on, discriminant function substantially makes a difference between winning and defeated teams at the significance level of 0.01 with relatively high canonical correlation. It must be noted that the results obtained by non-parametric Mann-Whitney U-test were in accordance with the results of parametric analysis. The results of this research corroborated the ideas of various expert coaches and players as well as scientist-practitioners that »defense wins, and attack loses matches«. Thus the assumption that the selection of adequate tactic defense systems is a basic precondition to win titles has its backing in European basketball. The selection of tactic game systems must be based on actual abilities of each player and the whole team. Finally, we may conclude that research results in the domain of sport science give an actual picture on the importance of defense as the regulator of playing intensity and determinants of game development and sport achievements.

Therefore, the programs of situational training should be directed towards the development of characteristics relevant for defense efficiency, rebound efficiency in defense and offense and shot selection. The process of sport preparation must involve situational exercises for transition, preparation and competition period which will affect the development of discipline in controlling position defense and jumping efficiency in defense and offense since the mentioned aspects of the game determine the number of ball possessions which is a precondition for game development and sport achievement. The authors consider that in situational training one must develop all phases and sub-phases of the game as well as performance consistency.

Additionally, the most important determinants in the system of integral sport preparation are balance and synergy of different training systems which directly affect the level of performance and sport achievement. In relation, it is important in situational training to set selective goals and standard evaluations for individual and team defense and to encourage understanding and beliefs about transition and position defense as precondition of efficient performance.

## Acknowledgements

The paper is a result of work within the framework of the scientific research project number 315-0342607-1815 (Diagnostics of Specific Psycho-social Features of Athletes in Team Sports Games), granted by the Ministry of Science, Education and Sport of the Republic of Croatia.

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*M. Trninić*

*»Cedevita« Basketball club, Trg Krešimira Čosića 11, 10000 Zagreb, Croatia  
e-mail: markotrnic1@gmail.com*

## **RAZLIKE U TEMELJNIM NESTANDARDNIM SITUACIJSKIM POKAZATELJIMA IGRE IZMEĐU POBJEDNIČKIH I PORAŽENIH EUROPSKIH SENIORSKIH KOŠARKAŠKIH EKIPA**

### **SAŽETAK**

Cilj provedenog istraživanja bio je utvrđivanje i objašnjenje razlika u temeljnim nestandardnim situacijskim pokazateljima igre između pobjedničkih i poraženih europskih seniorskih košarkaških ekipa. Korištena je diskriminacijska analiza te Mann-Whitney U-test s ciljem istraživanja razlika između pobjedničkih i poraženih ekipa u prostoru nestandardnih situacijskih varijabli. Grupirajuća varijabla je odvajala 24 poražena od 24 pobjednička tima koji su participirali u Top 16 Eurolige u natjecateljskoj sezoni 2009/2010. Istraživanje jasno upućuje na razlike između pobjedničkih i poraženih europskih seniorskih košarkaških ekipa u prostoru nestandardnih situacijskih varijabli pozicijske i tranzicijske obrane i napada. Pritom je korišteno osam situacijskih pokazatelja igre koji obuhvaćaju ukupan broj uspješnih i neuspješnih pozicijskih i tranzicijskih obrana i napada. Na temelju analize dobivenih rezultata parametrijskom i neparametrijskom metodom uočeno je da je za pobjedu najvažnija uspješna pozicijska obrana, a da je pokazatelj za predviđanje poraza neuspješan pozicijski napad. Stoga praktični ciljevi u situacijskom treningu moraju obuhvatiti uravnoteženi razvoj relevantnih sposobnosti i vještina koje određuju uspješno simultano obavljanje višestrukih zadataka u svim fazama tijeka igre. Takav proces sportske pripreme unaprijeđuje cjelokupnu stvarnu kvalitetu igrača i igru cijele momčadi. Zaključno je važno istaknuti kako proces usavršavanja pozicijske i tranzicijske obrane potiče razvoj pozicijskog i tranzicijskog napada i obrnuto.