DIFFERENCES BETWEEN SUCCESSFUL AND UNSUCCESSFUL EUROLEAGUE TEAMS BASED ON NONSTANDARD SITUATIONAL EFFICIENCY PARAMETERS

Ante Perica[1], Igor Jelaska[2] and Slavko Trninić[2]

[1] Basketball Club "Kapfenberg Bulls", Austria
[2] Faculty of Kinesiology, University of Split, Croatia

Original scientific paper

Abstract
This research was conducted to investigate and explain the differences between successful and unsuccessful basketball teams in the 2009/2010 championship season of the Euroleague Top 16. Certain nonstandard situational variables in positional offence and defence are defined to explore the structure of the game in detail. The resulting discriminant function significantly differentiates successful from unsuccessful teams ($p<0.01$). The results indicate that the components of positional defence that most determine its success are successful individual defence of the ball on the perimeter (including proper close-outs) and successful team penetration defence. On the other hand, unsuccessful positional defence is mostly determined by unsuccessful team penetration defence, unsuccessful defence against inside cutting, and unsuccessful individual and team defence on the low-post. For successful positional offence, the most important factors we found were pick and roll/pop and handoff manoeuvres, while unsuccessful ball penetrations from the perimeter, unsuccessful pick and roll/pop and handoff manoeuvres and unsuccessful perimeter isolations characterise an unsuccessful positional offence. The results indicate the main focal points for technical and tactical preparation of professional players and teams.

Key words: *basketball, nonstandard situational efficiency parameters, defence, offence, differences*

Introduction

It is assumed that in the game of basketball, overall player quality, the quality of cooperation and opposition, appropriate tactics, and the level of teamwork and cohesion primarily determine the team's performance and competitive success (Trninić et al., 1999; Dizdar and Trninić, 2000; Trninić et al., 2000). In modern team basketball games, standard and nonstandard efficiency parameters that determine the efficiency of individual players and the team as a whole are the basis for distinguishing successful from unsuccessful teams. This is particularly important for more effective technical and tactical preparation (Trninić et al., 1997; Trninić et al., 2002). Empirical studies that have analysed the differences between winning and defeated teams were primarily focused on standard situational efficiency indicators. According to previous research on men's senior basketball games, the differences between winning and losing teams mainly depended on defensive rebounds (Akers et al., 1991; Gómez et al., 2008; Ittenbach and Esters, 1995; Trninić et al., 2002) and field-goal percentages (Gomez et al., 2008; Sampaio and Janeira, 2003; Sampaio et al., 2010). Other game-related indicators such as offensive rebounds, successful free throws, turnovers, steals, assists and fouls have not been reported consistently as discriminators between winning and losing teams (Ittenbach and Esters, 1995; Kozar et al., 1994; Pim, 1986; Sampaio and Janeira, 2003; Melnick, 2001). More recently, the suggestion has been made that a redefined set of game-related indicators could better describe offensive and defensive performance (Kubatko et al., 2007; Oliver, 2004); these include effective field – goal percentage , offensive rebounding percentage, turnovers per ball possession, and free throw rate. We believe that game analysis based on the standard variables of situational efficiency does not provide a sufficiently detailed description of the structure of the game. For this reason, the aim of this paper is to define nonstandard situational efficiency indicators to provide more specific insight into the differences between successful and unsuccessful teams in the Euroleague Top 16. We therefore hope to provide a more explicit interpretation of the technical and tactical actions that determine the success and/or failure of a particular team.

Methods

Samples
Using pseudo-random sampling, 24 games from the 2009/2010 season of the Euroleague Top 16 were analysed and variables (Table 1) were observed. We avoided situations in which a particular club appeared more than four times. All matches were observed by three basketball experts, including two expert basketball coaches and one statistician, and the final data were decided on by mutual agreement. Sequences of the game states during the basketball game were identified according to operationalised constructs (Trninić, Perica & Pavičić, 1994; Perica, Trninić & Jelaska, 2011) and written into the file. The sequence of the basketball games was processed and the frequency of all the variables was gathered (Jelaska, 2011) using the software "State Analyser 1.0." To analyse the game in positional defence/offence, we defined the following non-standard situational efficiency indicators (Table 1).

Table 1. Non-standard situational efficiency indicators

END PHASE OF POSITIONAL DEFENCE	END PHASE OF POSITIONAL OFFENCE
DPICKSUC – number of successful defences vs. pick and roll, pick and pop and handoff	OPICKSUC – number of successful pick and roll, pick and pop and handoff offences
DPICKUN – number of unsuccessful defences vs. pick and roll, pick and pop and handoff	OPICKUN – number unsuccessful of pick and roll, pick and pop and handoff offences
DSCRSUC – number of successful defences vs. screens off the ball	OSCRSUC – number of successful screens off the ball
DSCRUN – number of unsuccessful defences vs. screens off the ball	OSCRUN – number of unsuccessful screens off the ball
DLPSUC – number of successful defences vs. low-post play	OLPSUC – number of successful low-post plays
DLPUN – number of unsuccessful defences vs. low-post play	OLPUN – number of unsuccessful low-post plays
DISOSUC – number of successful defences vs. perimeter isolations	OISOSUC – number of successful perimeter isolations
DISOUN – number of unsuccessful defences vs. perimeter isolations	OISOUN – number of unsuccessful perimeter isolations
DBALLSUC – number of successful individual defences on the ball on perimeter, which did not result in vertical dribble penetration toward the basket	OPENSUC – number of successful dribble penetrations from the perimeter
DBALLUN – number of unsuccessful individual defences on the ball on perimeter, which did not result in vertical dribble penetration toward the basket	OPENUN – number of unsuccessful dribble penetrations from the perimeter
DCUTSUC – number of successful defences vs. inside cutting	OCUTSUC – number of successful inside cuts
DCUTUN – number of unsuccessful defences vs. inside cutting	OCUTUN – number of unsuccessful inside cuts
DTEAMSUC – number of successful team defences against dribble penetrations from perimeter	DTEAMUN – number of unsuccessful team defences against dribble penetrations from perimeter

Successful defensive outcomes included field goals missed (2/3 points missed) and turnovers. Unsuccessful defensive outcomes included field goals made (2/3 points made) and free throw(s) assigned. Successful offensive outcomes included: field goals made (2/3 points made) and free throw(s) assigned. Unsuccessful outcomes offensive outcomes included field goals missed (2/3 points missed) and turnovers. For the purposes of this research, the action following an offensive rebound was considered a continuation of the offensive/defensive possession. Transition offence is defined from the moment of obtaining ball possession, through advancement of the ball along a vertical line, until achieving number or/and spatial advantage or early offence (5 on 5) situations in the front court. If there is no outcome in the transition phase, the position offence starts by certain initial alignment (Jelaska, 2011). Transition defence starts with a change of possession and ends no later than achievement of defensive balance and proper defensive position in a 5 on 5 situation, which is simultaneously the beginning of positional defence (Perica, 2011). The above defined variables (Table 1) are related only to the end phase of positional offence/defence. The end phase of positional offence is the completion of offensive manoeuvres that generate number/spatial advantage and produce a certain outcome in a particular possession. In the measurement procedure, we observe the flow of different game states. Usually, the end phase consists of only up to five different game states.

Statistical analysis

To differentiate between successful and unsuccessful teams, discriminant analysis on defensive and offensive variables was performed separately. Using a positional defence success percentage of 49.5% as the criterion limit, two relatively homogenous groups (N_1=N_2=24) of cases were generated. Similarly, for positional offence the criterion limit was a success rate of 55.5%. The structural coefficients (SC) were set to have absolute values above 0.20, and significance was set to 0.05. As a measure of validity of a given model, reclassification was calculated (Tabachnick and Fidell, 2007). A forward algorithm was used for variable selection into the model.

Results

Table 2 shows the results of discriminant analysis in positional defence. We also show that the model obtained by a forward variable selection algorithm is significant ($p<0.001$) with a canonical correlation of 0.81 and a Wilk's lambda of 0.34. Furthermore, the discriminant function correctly classified 91.6% of matches.

Table 2. Eigenvalue (λ), Wilk's lambda (W λ), canonical correlation (Rc), chi square test value (κ^2), degrees of freedom (df), significance level of discriminant function (p), and percentage of successful reclassification of cases due to the discriminant function (ReClass%)

λ	33970
W λ	0.34
Rc	0.81
2κ	44.36
df	9
p	0.00
ReClass%	91.6%

Table 3. Centroid projections on discriminant functions using a forward algorithm for variable selection and significance of discriminant coefficients

Variable	DF1	p
DBALLSUC	-0.45	0.00
DTEAMSUC	-0.22	0.06
DCUTUN	0.23	0.01
DTEAMUN	0.25	0.03
DLPUN	0.20	0.02
DSCRSUC	-0.15	0.11
DLPSUC	-0.16	0.14
DPICKUN	0.13	0.10
DISOSUC	-0.11	0.22
Group	DF1	
G1_0	1.36	
G1_1	-1.36	

Variables (DCUTSUC, DSCRUN, DPICKSUC, DISOUN and DBALLUN) were excluded from the model due to their insignificant contribution to the discriminant function (Table 3). Additionally, the variable DBALLSUC (SC= -0.45) had a statistically significant impact on the discriminant function and a "near" statistical significance for variables DTEAMSUC (SC= -0.22), DCUTUN (SC= 0.23), DTEAMUN (SC= 0.25) and DLPUN (SC= 0.20).

From Table 4 it can be observed that the model for offensive variables, which is derived using a forward stepwise algorithm, is significant ($p<0.01$) with a canonical correlation of 0.67 and a Wilks lambda of 0.53. Furthermore, the discriminant function correctly classified 81.3% of matches.

Table 4. Eigenvalue (λ), Wilk's lambda (W λ), canonical correlation (Rc), chi square test value (κ^2), degrees of freedom (df), significance level of discriminant function (p), and percentage of successful reclassification of cases due to the discriminant function (ReClass%)

λ	0.88
W λ	0.53
Rc	0.67
2κ	42151
df	5
p	0.00
ReClass%	81.3%

Table 5. Centroid projections on discriminant functions using a forward algorithm for variable selection and significance of discriminant coefficients

Variable	DF1	p
OPENUN	-0.58	0.04
OPICKSUC	0.51	0.00
OPICKUN	-0.33	0.06
OISOUN	-0.14	0.07
OSCRSUC	0.22	0.20
Group	DF1	
G1_0	-0.91	
G1_1	0.91	

The forward algorithm excluded variables OSCRUN, OLPSUC, OLPUN, OISOSUC, OCUTSUC, and OCUTUN from the model due to their insignificant contributions to the discriminant function (Table 5). From Table 5 it can be easily observed that the variable OPICKSUC (SC= 0.51) significantly predicts successful offensive teams, while high values of the variables OPENUN (SC= -0.58), OPICKUN (SC= -0.33) and OISOUN (SC= -0.14), characterise unsuccessful offensive teams.

Discussion

Table 3 demonstrates that the biggest contributions to successful positional defence are made by successful positional individual defence on the ball on the perimeter without allowing vertical penetration (DBALLSUC) and successful team defence against dribble penetration from the perimeter (DTEAMSUC). The DBALLSUC variable refers to the pressure on the ball on the perimeter in a static situation and/or close-out to the ball without allowing vertical dribble penetration to the basket.

In a basketball game, close-outs are the most frequent situations, which is a consequence of numerous defensive helping schemes (rotations after pick and roll rotations, team penetration defence, team defence on the low post, etc.). The goal of any successful defence is not to allow ball penetration into the paint area and to force opponents to take long distance three-point shots under pressure, which means correct defensive position, proper footwork and timely close-outs are of crucial importance. Therefore, quality defence consists of a constant balance between not allowing scoring in the lane ("no easy basket") and simultaneously forcing outside shots under pressure. This task is even more difficult if we take into account the shooting range of a particular offensive player (individual defensive tactics). Variable DTEAMSUC marks winning teams because the goal of a quality team penetration defence is to minimise the opponent's scoring under the basket. Different mechanisms of cooperation and teamwork are used to help achieve control of the paint. Variable DTEAMUN characterised unsuccessful teams because allowing "easy baskets" characterises defeated teams (Harris, 1993). The biggest contributors to unsuccessful positional defence (along with previously mentioned DTEAMUN) are unsuccessful defence against inside cutting (DCUTUN) and unsuccessful low-post defence (DLPUN). The significance of the variable DCUTUN is most likely because if one permits inside cuts, conditions are created for the opponent to achieve high percentage shots and/or personal fouls in defence. Furthermore, allowing inside cuts permits an offensive rebound after an unsuccessful shot, and thus, a successful transition defence. To prevent inside cuts, it is essential to maintain proper defensive position and a high focus. Failure to stop inside cuts is an "unforced error". There is no special reward when a defensive player bumps on an inside cut (insignificance of the variable DCUTSUC in table 3), but failure to do so is extremely detrimental. Finally, the variable DLPUN marks unsuccessful teams, confirming again that the number of allowed points in the area under the basket should be minimised by, for example, denying the pass into low/middle post positions. From an expert's point of view, defensive fundamentals differentiate defensively successful and unsuccessful teams, and thus, the winners from the losers (Perica, 2011). We believe that appropriate and highly complex defensive schemes are not sufficient but, rather, proper timing in establishing a correct defensive position determines all further reactions and thus the defensive efficiency (Nikolić, 1993; Trninić, 1995). Table 5 shows that for a successful positional offence, the most important manoeuvres are pick & roll/pop and handoff actions (OPICKSUC), while unsuccessful dribble penetrations from the perimeter (OPENUN), unsuccessful pick and roll/pop and handoff actions (OPICKUN) and unsuccessful isolations from the perimeter (OISONE) determine unsuccessful positional offence.

Because of the dominance of the containment defence style in today's European basketball (Perica, 2011), most dribble penetrations are stopped, which often ends with outside shots. Therefore, the statistical significance of the variable OPENUN points to the fact that missed outside shots characterise losing teams (Gomez et. al., 2008). Accordingly, it can be assumed that too many total long distance shots have negative effects, especially if the offence has not been based on ball flow and cooperation until an open shot is produced (shot selection); rather, it ends with only one or two passes. This may negatively affect the team confidence and team cohesion because there is no team cooperation and thus no "team shooting rhythm". Such an offensive style does not create a balance between inside and outside games (Trninić, 2006). Expert coaches believe that the most effective attack exists when there is a balance between inside and outside shots (Nikolić, 1993; Trninić, 1995), whereby it is essential that the offence must penetrate the defence with a dribble and/or pass (Jackson and Delehanty, 1995; Winter, 1998). On the other hand, unsuccessful offensive teams are characterised not only by a greater number of unsuccessful isolations from the perimeter (OISOUN) but also by the total number of such actions (Jelaska, 2011). That means that too many perimeter isolations have a negative effect on the offensive game of Euroleague basketball teams. The reason for this is a lack of ball flow that enables easy containment of the defence, which counteracts the isolation plays by implementing zone-like principles and forcing opponents to take long distance shots under pressure. It is plausible to expect that the variables OPICKSUC and OPICKUN, which are due to the prevalence of pick and roll/pop and handoff manoeuvres in today's European basketball, determine the success of the positional offence (Jelaska, 2011). Setting quality screens on the ball enables quick creation of advantage as well as drawing two or more defensive players towards the ball, temporarily throwing the defence out of balance and thus producing inside or outside shots and/or the low-post game. Finally, it is of interest to discuss why the variables OLPSUC and OLPUN were excluded from the model as insignificant. The variables were most likely excluded because there are few quality offensive players at the low and/or middle post position in today's European basketball. This is reflected by a 45% success rate at the low post in positional offence (Jelaska 2011). However, we believe that, regardless of this fact, teams should frequently pass the ball to the low/middle post position (approximately 30 passes per game). In this way, opportunities arise for both inside and outside play.

Such an orientation in the offence develops team cooperation through the inside-out and in-out-in play and encourages team shooting rhythm. It is assumed that the concept of balance between inside and outside play is the most important part of an organised game for offence (Newell, 1994). In conclusion, our results can help expert coaches to set priorities in the technical and tactical preparation of players and teams. We consider that both technical and tactical training programs should include the selection of exercises aimed at developing individual and team dribble penetration defence, timely and proper close-outs, individual and team defence against inside cuts and stopping an opponent's low-post play. On the other hand, it is necessary to encourage the development of proper tactical decision making in the offence, team cooperation in creating good offensive flow, and a balance between the inside and outside game. One should also develop players to be able to play pick and roll/pop and handoff offensive manoeuvres to create successful shots (under the basket, short and long distance shots) in various offensive configurations.

References

Akers, M.D., Wolff, S., & Buttross, T. (1991). An empirical examination of the factors affecting the success of NCAA Division I College Basketball teams. *The Journal of Business and Economic Studies, 1*(2), 14-21.

Dežman, B., Erčulj, F., & Vučković, G. (2002). Differences between winning and losing teams in playing efficiency. *Acta Kinesiologiae Universitatis Tartuensis, 7*(Suppl.), 71-74.

Gómez, M.A., Lorenzo, A., Sampaio, J., Ibáñez, S.J., & Ortega, E. (2008). Game-related statistics that discriminated winning and losing teams from the Spanish men's professional basketball teams. *Collegium Antropologicum, 32*(2), 451-456.

Harris, D. (1993). *Winning defense.* Indianapolis: Master Press.

Ibáñez, S.J., Sampaio, J., Sáenz-López, P., Giménez, J., & Janeira, M.A. (2003). Game statistics discriminating the final outcome of Junior World Basketball Championship matches (Portugal, 1999). *Journal of Human Movement Studies, 74,* 1-19.

Ittenbach, F., Kloos, T., & Etheridge, J.D. (1992). Team performance and national polls: the 1990-91 NCAA Division 1 Basketball season. *Perceptual and Motor Skills, 74,* 707-710.

Ittenbach, R.F., & Esters, I.G. (1995). Utility of team indices for predicting end of season ranking in two national polls. *Journal of Sport Behavior*, *18*(3), 216-224.

Jackson, P., & Delehanty, H. (1995). *Sacred hoops*. New York: Hyperion.

Jelaska, I. (2011). Konstrukcija i aplikacija novog modela za evaluaciju uspješnosti u kompleksnim sportskim aktivnostima. [Construction and application of new model for success evaluation in complex sport activities. In Croatian]. (Unpublished doctoral dissertation, University of Split). Split:Kineziološki fakultet.

Kozar, B., Vaughn, R.E., Whitfield, K.E., Lord, R.H., & Dye, B. (1994). Importance of free-throws at various stages of basketball games. *Perceptual and Motor Skills, 78*(1), 243-248.

Kubatko, J., Oliver, D., Pelton, K., & Rosenbaum, D. (2007). A Starting Point for Analyzing Basketball Statistics. *Journal of Quantitative Analysis in Sports, 3*(3), 1-22.
Lidor, R., & Arnon, M. (2000). Developing indexes of efficiency in basketball: talk with the coaches in their own language. *Kinesiology, 32*(2), 31-41.
Melnick, M.J. (2001). Relationship between team assists and win-loss record in the National Basketball Association. *Perceptual and Motor Skills, 92*(2), 595-602.
Oliver, D. (2004). Basketball on paper. *Rules and Tools for Performance Analysis.* Brassey's, Inc., Washington, D.C.
Perica, A. (2011). Analiza i vrednovanje stanja pozicijske i tranzicijske obrane u košarkaškoj igri. [Analysis and evaluation of positional and transitional defensive states in basketball. In Croatian] (Unpublished doctoral dissertation, University of Split). Split: Kineziološki fakultet.
Pim, R. (1986). The Effect of Personal Fouls on Winning and Losing Basketball Games. *The Coaching Clinic, 24*(4), 14-16.
Sampaio, J., & Janeira, M. (2003). Statistical analyses of basketball team performance: understanding team´s wins and losses according to a different index of ball possesions. *International Journal of Performance Analysis in Sport, 3*(1), 40-49.
Sampaio, J., Lago, C., & Drinkwater, E. (2010). Explanations for the United States of America's dominance in basketball at the Beijing Olympic Games (2008). *Journal of Sports Sciences, 28*(2), 147-152.
Tabachnick, B.G., & Fidell, L.S. (2007). *Using Multivariate Statistics*, 5th ed. Harper Collins, New York.
Trninić, S., Milanović, D., & Dizdar, D. (1997). Worin unterscheiden sich Sieger von Verlierern im Basketball. *Leistungssport, 2,* 29-38.
Trninić, S., Perica, A., & Dizdar, D. (1999). Set of criteria for the actual quality evaluation of the elite basketball players. *Collegium Antropologicum*, *23*(2), 707-721.
Trninić, S., & Dizdar, D. (2000). System of the performance evaluation criteria weighted per positions in the basketball game. *Collegium Antropologicum*, *24*(1), 217-234.
Trninić, S., Dizdar, D., & Dežman, B. (2000). Empirical verification of the weighted system of criteria for the elite basketball players quality evaluation. *Collegium Antropologicum*, *24*(2), 431-442.
Trninić, S., Dizdar, D., & Lukšić, E. (2002) Differences between winning and defeated top quality basketball teams in final tournaments of European club championship. *Collegium Antropologicum*, *26*(2), 521-531.
Winter, T. (1997). *The triple post offence.* Manhattan: Ag Press.

RAZLIKE IZMEĐU USPJEŠNIH I NEUSPJEŠNIH EUROPSKIH SENIORSKIH KOŠARKAŠKIH EKIPA TEMELJEM NESTANDARDNIH SITUACIJSKIH VARIJABLI

Sažetak

Istraživanje je provedeno s ciljem utvrđivanja i objašnjenja razlika između uspješnih i neuspješnih ekipa Top 16 Eurolige u sezoni 2009/2010. u prostoru nestandardnih situacijskih varijabli pozicijskog napada i obrane. Dobivena diskriminacijska funkcija značajno razlikuje uspješne od neuspješnih ekipa (p<0.01). Dobiveni rezultati ukazuju kako su područja pozicijske obrane koja najviše određuju njenu uspješnost: uspješna individualna obrana na lopti na vanjskom prostoru (perimetru), pravovremeni prilazak na loptu (engl. closing out) sa nedozvoljavanjem vertikalnog prodora, uspješna timska pomaganja i rotacije u situacijama zaustavljanja prodora s loptom sa perimetra. S druge strane, u najvećoj mjeri neuspješnost pozicijske obrane određuju neuspješna timska obrana od prodora s loptom sa perimetra, neuspješna obrana od unutarnjih utrčavanja sa perimetra i ubacivanja visokih igrača u srce reketa te neuspješna pojedinačna i timska obrana na niskom postu. Za uspješan pozicijski napad najvažniji su pick and roll/pop i handoff manevri a neuspješan pozicijski napad najviše određuju neuspješni prodori sa loptom, neuspješni pick and roll/pop i handoff manevri te neuspješne izolacije sa perimetra. Dobiveni rezultati ukazuju na primarne ciljeve tehničko-taktičke pripreme kod seniorskih igrača i momčadi.

Ključne riječi: *košarka, nestandardni pokazatelji situacijske učinkovitosti, obrana, napad, razlike*

Received: October 07, 2014
Accepted: December 20, 2014
Correspondence to:
Assist.Prof.Igor Jelaska, Ph.D.
University of Split
Faculty of Kinesiology
21000 Split, Teslina 6, Croatia
Phone: +385 (0)21 302 440
E-mail: igor.jelaska@kifst.hr