CONGRUENCE BETWEEN AVERAGE GENERAL PLAYING EFFICIENCY OF BASKETBALL TEAMS AND THEIR RANK IN THE ROUND ROBIN AND ELIMINATION COMPETITION SYSTEM

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Abstract:

The congruence between the *average* general playing efficiency of basketball teams and their rank in the round robin and the elimination competitive system was assessed on a sample of twelve national junior selections, which competed at the 19th European Championship for Junior Men in Croatia. In the first part of the championship the teams competed according to the round robin system in two groups of six teams (each team played five games), and in the second part according to the elimination system (each of the first eight teams played three games, whereas the last four teams played two games). The sample of variables included the number of points scored and against. The playing efficiency on offence, defence and in general was computed within the shell of the decision-making system KISS 1.2. Pearson's product-moment coefficients of correlation were also computed. The congruence between the *average* general playing efficiency of the teams and their classification points in the round robin system was high and statistically significant. The group of the teams of more heterogeneous quality showed a better congruence. The congruence between the *average* general playing efficiency of the teams and their final placement in the elimination system was much lower than in the round robin system and statistically non-significant. However, the structure of the team's general playing efficiency in individual games can differ. Teams may achieve the same general playing efficiency by having better playing efficiency on defence, some by having a better playing efficiency on offence and others by balanced playing efficiency in both phases of the game.

Key words: *basketball - playing efficiency - expert decision system - competitive systems*

KONGRUENZ ZWISCHEN DER ALLGEMEINEN SPIELEFFIZIENZ VON BASKETBALLMANNSCHAFTEN UND IHRER RANGORDNUNG IM JEDER-GEGEN-JEDEN- UND AUSSCHEIDUNGSWETTKAMPFSYSTEM

Zusammensetzung:

Die Kongruenz zwischen der allgemeinen Spieleffizienz von Basketballmannschaften und ihrer Rangordnung im Jeder-gegen-jeden- [*Round-Robin-System*] und Ausscheidungswettkampfsystem wurde berechnet. Als Stichprobe galten zwölf Nationalmannschaften, die an der 19. europäischen Meisterschaft für Junioren in Kroatien teilgenommen haben. Im ersten Teil der Meisterschaft kämpften die Mannschaften laut dem Jeder-gegen-jeden-system [*Round-Robin-System*] in zwei von sechs Mann-schaften bestehenden Gruppen (jede Mann-schaft spielte fünf Matches) und im zweiten Teil laut dem Ausscheidungswettkampfsystem (jede von den ersten acht Mannschaften spielte drei Matches, wobei die letzten vier Mannschaften zwei Matches spielten). Die Stichprobe der Variablen umfasste die Anzahl von erzielten und erhaltenen Korberfolgen. Sowohl die Spieleffizienz im Angriff und in der Verteidigung als auch die allgemeine Spieleffizienz wurden im Rahmen der Entscheidungsfindungssystem KISS 1.2. errechnet. Pearsonsche Produkt-Moment-Korrelationskoeffizienten wurden ebenso errechnet. Die Kongruenz zwischen der allgemeinen Spieleffizienz der Mannschaften und ihren Klassifikationspunkten im Punktspielsystem [*Round-Robin-System*] war hoch und statistisch bedeutend. Die Gruppe von Mannschaften, die mehr heterogen waren, zeigte eine höhere Kongruenz. Die Kongruenz zwischen der allgemeinen Spieleffizienz der Mannschaften und ihrer Rangordnung im Ausscheidungswettkampfsystem war ziemlich niedriger als im Punktspielsystem [*Round-Robin-System*] und sie war statistisch nicht bedeutend. Die Struktur der allgemeinen Spieleffizienz einer Mannschaft in bestimmten Matches kann jedoch variieren. Die Mannschaften können die gleiche allgemeine Spieleffizienz erreichen, wenn ihre Effizienz in der Verteidigung höher ist. Andere Mannschaften erreichen höhere Effizienz, indem sie besser im Angriff spielen. Die Effizienz einiger

Mannschaften kann als das Resultat einer ausgewogenen Spieleffizienz in beiden Phasen des Spiels beschrieben werden.

Schlüsselwörter: *Basketball, Spieleffizienz, Expert-Entscheidungsfindungssystem, Wettkampfsysteme*

Introduction

Successful playing at a competition is the goal of every training process and at the same time a measure for assessing the qualitative level and state of preparedness both of players and teams.

The general quality of an individual team is determined by the competition level at which the team competes; more precisly the level is defined by the position of the team in the final competition ranking and by the total of classification points it has achieved.

We can obtain additional information on the performance quality of basketball teams at individual games or competitions from the data concerning their playing efficiency in general, on offence and on defence. These can be expressed through various indices or marks of playing efficiency or performance (ability, quality) (Dežman, 1992; Erčulj, 1996; Trninić, Milanović & Dizdar, 1997; Kurent, 1998; Swalgin, 1998; Jukić, Milanović, Vuleta & Bračić, 2000; Lidor & Arnon, 2000; Omahna, 2000; Dežman, Erčulj & Vučković, 2002; Dizdar, 2002). All those parameters of quality of play can be computed from the variables that are recorded as the official game statistics (attempted, successful and unsuccessful throws for two and three points; attempted, successful and unsuccessful free throws, turnovers, assists, offensive and defensive rebounds, steals, blockshots, points scored and against, etc.).

Playing efficiency of the observed teams on offence, defence and in general was computed in this study with a special decision-making system presented in Table 1.

Table 1. Decision-making system BASKET_PE1

			Normalisers						
Tree of playing efficiency	mark		>=4.5	>=3.5	>=2.5	>=1.5			
	weight	RS	Exlnt	vgood	good	pass			
GPE !	100.0						General playing efficiency	xa	sd
!_PEO !	50.0	P↑	>=94	>=70	>=31	>=7	playing efficiency on offence	69.1	12.7
!_PED	50.0	R↓	>=94	>=70	>=31	>=7	playing efficiency on defence	69.1	12.7

Legend: The left side of Table 1 shows the structure of the playing efficiency tree. In the second column are the weights. In the third column the relation between the points scored and against with the playing efficiency in basketball is shown (RS). That relation is either of a progressive (P) or regressive (R) nature. The middle columns show the normalisers, given in centile norms. The last two columns give the means and standard deviations of the points scored and against for all the games at the 19th European Championship for Junior Men.

This decision-making system is composed of the knowledge database BASKET_PE1 and of the shell of the decision-making system KISS 1.2. (Leskošek, 1995; Dežman, Trninić & Dizdar, 2001). The knowledge database consists of a decision tree, weights and normalisers. The trunk of the decision tree represents the general playing efficiency of a team (GPE). The branches represent the playing efficiency on offence (PEO) and on defence (PED), both influencing, even building, the general playing efficiency. Namely, the general playing efficiency is calculated on the basis of the marks of the two basic factors and their weights. Weights define the contribution of a particular factor to the final assessment of the general playing efficiency.

The rules of basketball say that the winning team is the one that scores more points than its competitor. This means the teams scoring more points and, at the same time, receiving fewer, will be more successful. However, these results are comparable only after they are standardised. With normalisers, values are attributed to the level of results the teams achieved in particular branches (points scored and against). The computer program transforms them into centile values and then with normalisers into marks from one to five (by the method of linear interpolation).

The *average* general playing efficiency (ability, quality, or performance) at a competition is usually

in accord with the teams' final ranks or actual quality (Lidor & Arnon, 2000; Omahna, 2000). However, we suppose that this congruence is greater in the competitions with the round robin system than in the competitions with the elimination system.

The final ranking of a team (real quality) depends mostly on the number of victories, especially against immediate competitors. It is usually irrelevant whether a team wins a game with a larger or a smaller score difference (in any case, the team receives two points for a victory in a match). High general playing efficiency against weak teams usually does not ensure a high rank if the team loses to their direct competitors, even by a small point difference. Their *average* general playing efficiency may be higher, but their rank on the final placement scale will be lower. This means that the *average* general playing efficiency in a competition does not always show the true quality of a team.

Games where a certain team meets an indisposed opponent are a special problem. In such cases, the winning team achieves a very high general playing efficiency and the defeated team a very low one. This result will directly affect the *average* general playing efficiency of both teams and therefore will not be a realistic parameter of the teams' quality. These extremes will be, at least partially, compensated for in the round robin systems with many games, but not in the elimination competition systems, where usually fewer games are played.

In the elimination systems with only one decisive game, the probability that good teams will be eliminated is rather high. It can therefore happen that teams ranked lower on the placement scale will have a higher *average* general playing efficiency than those ranking higher.

It is our aim to study further these issues of assessing the team and individual playing quality since the obtained results will define our future studies of playing efficiency. Namely, we feel that the peculiarities of different competition systems have not been taken sufficiently into account in previous studies.

In the present study the goals were as follows:

1) To compute all modes of playing efficiency (the general one, on offence and on defence) of the teams at all the games of the 19th European Championship for Junior Men and their *average* playing efficiencies in the first and the second part of the competition.
2) To find the level of congruence between the *average* general playing efficiency of the teams and classification points achieved in the *first part* of the competition.
3) To find the level of congruence between the *average* general playing efficiency of the teams in the *second part* of the competition and their final placement.
4) To find the level of congruence between the *average* general playing efficiency of the teams in the *first part* of the competition and their final placement.
5) To find the level of congruence between the *average* general playing efficiency of the teams at *all the games* and their final ranking.

Methods

Sample of teams and games

Twelve national junior selections, which competed at the 19th European Championship for Junior Men in Croatia (Zadar, 14-23 July, 2000) were included in the sample.

In ***the first part of the competition*** the teams competed according to the round robin system in two numerically balanced groups:

Group A: Croatia (CRO), France (FRA), Russia (RUS), Greece (GRE), Slovenia (SLO) and Bulgaria (BUL);

Group B: Yugoslavia (YUG), Italy (ITA), Latvia (LAT), Lithuania (LIT), Israel (ISR) and Spain (SPA).

Each team played five games.

In ***the second part of the competition*** the teams played according to the elimination system. The last two teams from both groups played for the ranks from the 9th to 12th position, whereas the first four teams from both groups played for the first eight positions (ranks 1-8). The former group played two games and the latter three games.

Table 2. The second part of the competition

For ranks 1 to 4		
for 1 - 2		**France** : Croatia
for 3 - 4		**Greece** : Italy
W1:W4		**Croatia** : Italy
W2:W3	↑	**France** : Greece
For ranks 5 to 8		
for 5 - 6		**Yugoslavia** : Russia
for 7 - 8		**Lithuania** : Latvia
L1:L4		Lithuania : **Russia**
L2:L3	↑	Latvia : **Yugoslavia**
Qualifications for ranks 1 to 4 and 5 to 8		
B1:A4		**Croatia**–W1 : Lithuania–L1
B2:3A		**France**–W2 : Latvia–L2
A1:B4		Yugoslavia–L3:**Greece**–W3
A2:B3	↑	**Italy**–W4 : Russia–L4
For ranks 9 to 12		
for 9 - 10		**Slovenia** : Israel
for 11 - 12		**Spain** : Bulgaria
B5:A6		**Slovenia** : Spain
A5:B6	↑	**Israel** : Bulgaria

Altogether, the teams played 92 games (2 x 30 in the first and 32 in the second part of the competition).

Sample of variables

The sample included two variables: number of points scored and against.

Data collection

At each game, official statisticians of the 19th European Championship for Junior Men noted the closing actions of players of both teams on offence and defence. The notation was performed according to the FIBA standardised instructions. The resulting data were put into the computer and analysed. The recordings were published in twelve official bulletins.

Data analysis

Playing efficiency on offence, on defence and in general was computed with the shell of the decision-making system KISS 1.2 (Leskošek, 1995). The data were treated with the basic procedures of descriptive statistics and Pearson's coefficients of correlation were also computed by means of the SPSS for Windows.

Results and discussion

Results of the first part of the competition

Table 3. Game results in A group

GROUP A	No. of games	Victories	Defeats	Points scored	Points against	Class. points*	Difference
YUGOSLAVIA	5	4	1	392	351	9	41
ITALY	5	3	2	332	319	8	13
LATVIA	5	2	3	326	334	7	-8
LITHUANIA	5	2	3	336	356	7	-20
ISRAEL	5	2	3	325	316	7	9
SPAIN	5	2	3	334	369	7	-35

* 2 classification points for a victory and 1 classification point for a defeat.

Table 4. Playing efficiency of the teams in A group

Teams/games	1st		2nd		3rd		4th		5th		Average playing efficiency A		
1. YUGOSLAVIA	YUG-LAT		YUG-LIT		YUG-ISR		YUG-SPA		YUG-ITA		xa-a		sd-a
GPE_		3.3		3.7		2.8		3.4		3.4		3.32	0.33
!_PEO	74	3.4	94	4.6	64	2.6	80	3.9	80	3.9	78	3.68	0.74
!_PED	68	3.1	72	2.8	70	2.9	71	2.8	70	2.9	70	2.90	0.12
2. ITALY	ITA-ISR		ITA-LAT		ITA-SPA		ITA-LIT		ITA-YUG		xa-a		sd-a
GPE		3.5		3.4		2.9		3.1		2.5		3.08	0.40
!_PEO	73	3.3	69	3.0	57	1.9	63	2.5	70	3.1	66	2.76	0.56
!_PED	60	3.8	60	3.8	59	3.9	60	3.8	80	2.0	64	3.46	0.82
3. LATVIA	LAT-YUG		LAT-ITA		LAT-LIT		LAT-ISR		LAT-SPA		xa-a		sd-a
GPE		2.8		2.6		3.4		3.1		2.7		2.92	0.33
!_PEO	68	2.9	60	2.2	78	3.7	55	1.8	65	2.7	65	2.66	0.72
!_PED	74	2.6	69	3.0	67	3.2	51	4.4	73	2.7	67	3.18	0.72
4. LITHUANIA	LIT-SPA		LIT-YUG		LIT-LAT		LIT-ITA		LIT-ISR		xa-a		sd-a
GPE		3.6		2.3		2.5		2.8		3.1		2.86	0.51
!_PEO	79	3.8	72	3.2	67	2.8	60	2.2	58	2.0	67	2.80	0.73
!_PED	65	3.3	94	1.3	78	2.2	63	3.5	56	4.1	71	2.88	1.12
5. ISRAEL	ISR-ITA		ISR-SPA		ISR-YUG		ISR-LAT		ISR-LIT		xa-a		sd-a
GPE		2.4		3.8		3.2		2.9		2.9		3.04	0.51
!_PEO	60	2.2	88	4.5	70	3.1	51	1.5	56	1.8	65	2.62	1.21
!_PED	73	2.7	66	3.2	64	3.4	55	4.2	58	4.0	63	3.50	0.61
6. SPAIN	SPA-LIT		SPA-ISR		SPA-ITA		SPA-YUG		SPA-LAT		xa-a		sd-a
GPE		2.4		2.1		3.1		2.6		3.3		2.70	0.49
!_PEO	65	2.7	66	2.7	59	2.1	71	3.1	73	3.3	67	2.78	0.46
!_PED	79	2.1	88	1.5	57	4.0	80	2.0	65	3.3	74	2.58	1.03

Legend: GPE - general playing efficiency, PEO - playing efficiency on offence, PED - playing efficiency on defence (in the first column of every game are points scored and against, in the second are marks of general playing efficiency and the playing efficiency on offence and on defence), xa–mean, sd–standard deviation.

The highest general playing efficiency (GPE) in a game was achieved by the Israeli team (3.8), the lowest by the Spanish team (2.1). Both results were achieved in the game where they played against each other (Tables 3 and 4). On average, the most efficient team in group A was Yugoslavia (GPE=3.32) and the least efficient was Spain (GPE=2.70).

In two games (YUG : LIT and ISR : SPA) the score difference between the teams was more than twenty points and in three games it was over ten points (ITA : ISR, LAT : LIT, LIT : SPA).

The Yugoslav team, the first-placed team in the group, was the most efficient on offence (PEO=3.68). On defence it achieved an average result (PED=2.90). Most of the other teams were more efficient on defence, especially the teams of Israel (PED=3.50) and Italy (PED=3.46), both achieving the highest marks.

The correlation between the average marks of the general playing efficiency of the teams and their classification points till the end of the qualifications was statistically significant at a 5% error level (r_a=0.86).

The results of the Israeli team are interesting in this group. It was positioned fifth, but its *average* general playing efficiency (3.04) was almost the same as that of the Italian team (3.08), which ranked second. It seems that this favourable result is the consequence of their very high general playing efficiency in the game with Spain. This extreme result also affected the level of their *average* general playing efficiency. Such cases, which are often not a true picture of the actual differences in the quality of both teams, but probably a result of the momentary indisposition of one team, can distort the measure of true play quality of individual teams.

Table 5. Game results in B group

GROUP B	No. of games	Wictories	Defeats	Points scored	Points against	Class. points*	Difference
CROATIA	5	5	0	409	341	10	68
FRANCE	5	4	1	365	263	9	102
RUSSIA	5	2	3	336	338	7	-2
GREECE	5	2	3	354	367	7	-13
SLOVENIA	5	2	3	328	357	7	-29
BULGARIA	5	0	5	321	447	5	-129

* 2 points for a victory and 1 point for a defeat.

Table 6. Playing efficiency of the teams in B group

Teams/games	1st		2nd		3rd		4th		5th		average playing efficiency B		
1.CROATIA	CRO-SLO		CRO-RUS		CRO-BUL		CRO-GRE		CRO-FRA		xa-b		sd-b
GPE_		3.2		3.6		3.1		3.5		3.3		3.34	0.21
!_PEO	68	2.9	78	3.7	115	4.7	81	4.0	67	2.8	82	3.62	0.79
!_PED	62	3.5	62	3.5	89	1.5	69	3.0	59	3.9	68	3.08	0.94
2.FRANCE	FRA-BUL		FRA-SLO		FRA-GRE		FRA-RUS		FRA-CRO		xa-b		sd-b
GPE		4.5		3.3		3.8		3.9		2.6		3.62	0.71
!_PEO	83	4.2	72	3.2	68	2.9	83	4.2	59	2.1	73	3.32	0.90
!_PED	33	4.7	63	3.5	39	4.7	61	3.7	67	3.2	53	3.96	0.70
3.RUSSIA	RUS-GRE		RUS-CRO		RUS-SLO		RUS-FRA		RUS-BUL		xa-b		sd-b
GPE		2.6		2.3		4.2		2.0		3.5		2.92	0.91
!_PEO	64	2.6	62	2.4	78	3.7	61	2.3	71	3.1	67	2.82	0.58
!_PED	74	2.6	78	2.2	43	4.7	83	1.8	60	3.8	68	3.02	1.20
4.GREECE	GRE-RUS		GRE-BUL		GRE-FRA		GRE-CRO		GRE-SLO		xa-b		sd-b
GPE		3.4		3.7		2.2		2.5		2.6		2.88	0.64
!_PEO	74	3.4	99	4.7	39	1.2	69	3.0	73	3.3	71	3.12	1.26
!_PED	64	3.4	73	2.7	68	3.1	81	1.9	81	1.9	73	2.60	0.69
5.SLOVENIA	SLO-CRO		SLO-FRA		SLO-RUS		SLO-BUL		SLO-GRE		xa-b		sd-b
GPE		2.7		2.6		1.8		3.5		3.4		2.80	0.69
!_PEO	62	2.4	63	2.5	43	1.3	79	3.8	81	4.0	66	2.80	1.11
!_PED	68	3.1	72	2.8	78	2.2	66	3.2	73	2.7	71	2.80	0.39
6.BULGARIA	BUL-FRA		BUL-GRE		BUL-CRO		BUL-SLO		BUL-RUS		xa-b		sd-b
GPE		1.5		2.3		2.9		2.4		2.5		2.32	0.51
!_PEO	33	1.2	73	3.3	89	4.5	66	2.7	60	2.2	64	2.78	1.23
!_PED	83	1.8	99	1.2	115	1.2	79	2.1	71	2.8	89	1.82	0.67

Legend: GPE - general playing efficiency, PEO - playing efficiency on offence, PED - playing efficiency on defence (in the first column of every game are the points scored and against, in the second are marks of the general playing efficiency and the playing efficiency on offence and on defence), xa–mean, sd–standard deviation.

The highest general playing efficiency in all the observed games was achieved by the French team (4.5) and the lowest by the Bulgarian team (1.5) in the game in which they played against each other, in the first part of the competition (Tables 5 and 6). The most efficient team on average in group B was the French team (GPE=3.62), and the least efficient was the Bulgarian team (GPE=2.32). The range was much greater in both cases than in group A. The extremely large differences in the *average* general playing efficiency values can be seen between the first two teams and the rest of the teams in group B.

In group B the teams were less homogeneous in quality than in group A. In two games (RUS : SLO and FRA : BUL) the score difference between the teams was more than thirty points, in four above twenty points (CRO : BUL, FRA : GRE, FRA : RUS, GRE : BUL), and in four over ten points (CRO : GRE, CRO : RUS, CRO : FRA, SLO : BUL). These differences are confirmed also by the standard deviations of the general playing efficiency marks of the teams in both groups. In B group the standard deviations are much higher for most of the teams (SD ranges 0.91 - 0.21) than in A group (the range of SD 0.51 - 0.33). The first two teams from group B were an exception.

The congruence between the average marks of the general playing efficiency of the teams from group B and their classification points after the first part of the competition is statistically significant at a 0.05 error level (r_b=0.93) and much higher than in A group. This means that the *average* general playing efficiency of the teams in the round robin competitive system has a higher correlation with the actual quality of teams when the qualitative differences between the teams are greater.

The analysis of the general playing efficiency of the Croatian and French teams is also interesting. The Croatian team took the first place in the group (the first part of the competition), without losing a single game. Their general playing efficiency in all games was above average and most consistent (SD=0.21). In spite of this, their *average* general playing efficiency was lower (3.34) than that of the French team (3.62), even though France was placed second in the group. This confirms the hypothesis presented in the introduction that higher general playing efficiency in an individual game ensures a victory, but higher *average* general playing efficiency does not necessarily quarantee a better rank (placement) if the team does not defeat its direct opponents. In this case, France lost the game to Croatia, even if it showed a much higher general playing efficiency in all the other games than the Croatian team. This means that the victories are most important at a competition, or in other words, it is sufficient that the general playing efficiency of the team is slightly higher than the opponent's in each game.

The results of the *average* playing efficiency of both above-mentioned teams on offence and on defence show that the Croatian team was more efficient on offence (CRO PEO=3.62 vs. FRA PEO=3.32), whereas the French team was better on defence (CRO PED=3.08 vs. FRA PED=3.96).

Results of the second part of the competition

In the elimination system (Table 7), where a single game is decisive, each mistake or indisposition of a team may be fatal. A good example of this was the game between Yugoslavia and Greece, which the Yugoslav team lost by one point, even though its *average* general efficiency in both the first and the second part of the competition was much higher than that of the Greek team.

When comparing the *average* general playing efficiency of the teams in the first and in the second part of the competition, it becomes obvious that the average efficiency values are higher in the first part. This is understandable since the variability in quality of the teams was smaller in the second part of the competition. The oscillations in general playing efficiency of the teams displayed were usually smaller in the second part than in the first (except for the Croatian, Italian, Yugoslav and Spanish teams). This can be seen from standard deviations and differences in points scored and against. With the exception of the game between Spain and Bulgaria, where the score difference was above twenty points, most of the other games ended with closer point differences, ranging from one to ten points. This can also mean that the elimination system forces teams to play more carefully (less riskily) and composed.

The congruence between the final placement and the *average* general playing efficiency of the teams in the elimination system was statistically non-significant and low (r_r=0.36). This was the consequence of the results of the games of the teams competing for the position from the 9th to the 12th place. In this case also, the maxim "Winning is of a primary importance, the point difference is only of a secondary importance" was valid.

The better congruence was found between the final placement of the teams and their *average* general playing efficiency in the first part of the competition (the round robin system), as it amounts r_{ab}=0.81. A somewhat lower congruence is between the final placement of the teams and their

Table 7. Playing efficiency of the teams observed

Teams	1st round		2nd round		3rd round		For ranks			ln A and B group		
1.FRANCE	FRA-LAT		FRA-GRE		FRA-CRO		xa-r		sd-r	xa-ab		sd-ab
GPE		3.2		3.6		3.0		3.27	0.31		3.62	0.71
!_PEO	59	2.1	71	3.1	65	2.7	65	2.63	0.50	73	3.32	0.90
!_PED	53	4.3	57	4.0	64	3.4	58	3.90	0.46	53	3.96	0.70
2.CROATIA	CRO-LIT		CRO-ITA		CRO-FRA		xa-r		sd-r	xa-ab		sd-ab
GPE		3.4		3.3		2.9		3.20	0.26		3.34	0.21
!_PEO	83	4.2	70	3.1	64	2.6	72	3.30	0.82	82	3.62	0.79
!_PED	73	2.7	62	3.5	65	3.3	67	3.17	0.42	68	3.08	0.94
3.GREECE	GRE-YUG		GRE-FRA		GRE-ITA		xa-r		sd-r	xa-ab		sd-ab
GPE		3.0		2.4		3.2		2.87	0.42		2.88	0.64
!_PEO	83	4.2	57	1.9	71	3.1	70	3.07	1.15	71	3.12	1.26
!_PED	82	1.9	71	2.8	65	3.3	73	2.67	0.71	73	2.60	0.69
4.ITALY	ITA-RUS		ITA-CRO		ITA-GRE		xa-r		sd-r	xa-ab		sd-ab
GPE		3.9		2.7		2.7		3.10	0.69		3.08	0.40
!_PEO	72	3.2	62	2.4	65	2.7	66	2.77	0.40	66	2.76	0.56
!_PED	49	4.5	70	2.9	71	2.8	63	3.40	0.95	64	3.46	0.82
5.YUGOSLAVIA	YUG-GRE		YUG-LAT		YUG-RUS		xa-r		sd-r	xa-ab		sd-ab
GPE		2.9		3.6		3.2		3.23	0.35		3.32	0.33
!_PEO	82	4.1	95	4.7	78	3.7	85	4.17	0.50	78	3.68	0.74
!_PED	83	1.8	75	2.5	73	2.7	77	2.33	0.47	70	2.90	0.12
6.RUSSIA	RUS-ITA		RUS-LIT		RUS-YUG		xa-r		sd-r	xa-ab		sd-ab
GPE		2.1		3.1		2.8		2.67	0.51		2.92	0.91
!_PEO	49	1.4	64	2.6	73	3.3	62	2.43	0.96	67	2.82	0.58
!_PED	72	2.8	61	3.7	78	2.2	70	2.90	0.75	68	3.02	1.20
7.LITHUANIA	LIT-HRV		LIT-RUS		LIT-LAT		xa-r		sd-r	xa-ab		sd-ab
GPE		2.5		2.8		3.1		2.80	0.30		2.86	0.51
!_PEO	73	3.3	61	2.3	69	3.0	68	2.87	0.51	67	2.80	0.73
!_PED	83	1.8	64	3.4	65	3.3	71	2.83	0.90	71	2.88	1.12
8.LATVIA	LAT-FRA		LAT-YUG		LAT-LIT		xa-r		sd-r	xa-ab		sd-ab
GPE		2.7		2.4		2.8		2.63	0.21		2.92	0.33
!_PEO	53	1.6	75	3.4	65	2.7	64	2.57	0.91	65	2.66	0.72
!_PED	59	3.9	95	1.3	69	3.0	74	2.73	1.32	67	3.18	0.72
9.SLOVENIA	SLO-SPA		SLO-ISR				xa-r		sd-r	xa-ab		sd-ab
GPE		3.3		3.0				3.15	0.21		2.80	0.69
!_PEO	73	3.3	53	1.6			63	2.45	1.20	66	2.80	1.11
!_PED	66	3.2	51	4.4			59	3.80	0.85	71	2.80	0.39
10.ISRAEL	ISR-BUL		ISR-SLO				xa-r		sd-r	xa-ab		sd-ab
GPE		3.5		2.9				3.20	0.42		3.04	0.51
!_PEO	73	3.3	51	1.5			62	2.40	1.27	65	2.62	1.21
!_PED	61	3.7	53	4.3			57	4.00	0.42	63	3.50	0.61
11.SPAIN	SPA-SLO		SPA-BUL				xa-r		sd-r	xa-ab		sd-ab
GPE		2.7		3.9				3.30	0.85		2.70	0.49
!_PEO	66	2.7	100	4.7			83	3.70	1.41	67	2.78	0.46
!_PED	73	2.7	67	3.2			70	2.95	0.35	74	2.58	1.03
12.BULGARIA	BUL-ISR		BUL-SPA				xa-r		sd-r	xa-ab		sd-ab
GPE		2.5		2.0				2.25	0.35		2.32	0.51
!_PEO	61	2.3	67	2.8			64	2.55	0.35	64	2.78	1.23
!_PED	73	2.7	100	1.2			87	1.95	1.06	89	1.82	0.67

Legend: GPE - general playing efficiency, PEO - playing efficiency on offence, PED - playing efficiency on defence (in the first column of every game are the points scored and against, in the second are marks of general playing efficiency and the playing efficiency on offence and on defence), xa–mean, sd–standard deviation.

average general playing efficiency in all the games (r_{all}=0.73). Both correlation coefficients are statistically significant at 0.05 error level. It was also found that the structures (profiles) of even very similar general playing efficiency values may vary considerably. Some teams achieved the same general playing efficiency with better playing efficiency on offence (**YUG** : RUS – GPE = 3.2, PEO = 3.7,

PED = 2.7), others with better playing efficiency on defence **(FRA** : LAT – GPE = 3.2, PEO = 2.1, PED = 4.3), whereas the third group of teams may accomplish it by a balanced playing efficiency in both phases of the game (**GRE** : ITA – GPE = 3.2, PEO = 3.1, PED = 3.3). It is therefore important to know all the three values.

Conclusions

The findings of the current study show that different competition systems affect differently the congruence between the *average* general playing efficiency of teams and their actual quality. Some other published (Lidor & Arnon, 2000) and unpublished studies, using other measures to assess the general playing efficiency (various indices), have confirmed these findings. It is therefore very important to consider the specificities of competitive systems when studying team playing efficiency and explaining the obtained results.

It is also recommendable to know the profiles (structures) of the general playing efficiency of teams (values of their playing efficiency on offence and on defence), because it is an important information for coaches. The decision-making system BASKET_PE1 makes it possible.

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SUKLADNOST IZMEĐU PROSJEČNE OPĆE UČINKOVITOSTI KOŠARKAŠKIH MOMČADI I NJIHOVOG PORETKA U BODOVNOM I IZLUČNOM NATJECATELJSKOM SUSTAVU

Sažetak

Uvod

Uspješno natjecanje cilj je svakog procesa treninga i ujedno mjerilo za ustanovljivanje razine kvalitete ili pripremljenosti košarkaških momčadi. Ugrubo se kvaliteta (igračka uspješnost) pojedine momčadi određuje razinom natjecanja u kojemu se momčad natječe, a preciznije kvalitetu momčadi određuje njeno mjesto u konačnom poretku ili postignuti bodovi.

Dodatnu informaciju o razini kvalitete igre momčadi na pojedinim utakmicama ili u natjecanju daju nam podaci o njenoj ukupnoj, cjelovitoj igračkoj učinkovitosti u cjelini ili podaci o učinkovitosti u nekim dijelovima igre (napadu i/ili obrani). Igračku učinkovitost možemo izračunati na razne načine pomoću standardnih situacijskih varijabli, koje na utakmicama bilježe službeni statističari (Dizdar, 2002).

U našem istraživanju izračunali smo igračku učinkovitost momčadi pomoću sustava odlučivanja BASKET-PE1 (tablica 1). Taj sustav sastavljen je iz baze znanja BASKET-PE1 i ljuske sustava odlučivanja KISS 1.2. (Leskošek, 1995). Baza znanja sastavljena je iz stabla, pondera i normalizatora. Stablo sustava odlučivanja BASKET-PE1 predstavlja cjelovitu igračku učinkovitost momčadi (*general playing efficiency* - GPE), a njegove grane igračku učinkovitost u napadu (*playing efficiency on offence* - PEO) i obrani (*playing eficiency on defence* - PED). Cjelovita igračka učinkovitost izračunata je pomoću standardiziranih vrijednosti bazičnih varijabli (danih i primljenih koševa) i pondera. Oni određuju doprinos pojedine varijable pojašnjenju opće igračke učinkovitosti. Sustav odlučivanja BASKET-PE1 daje standardizirane podatke o igračkoj učinkovitosti momčadi na pojedinoj utakmici u cjelini te u napadu i obrani (tablice 4, 6 i 7).

Prosječna opća igračka učinkovitost pojedine momčadi na natjecanju često je u skladu s poretkom na kraju natjecanja (tj. s njenom stvarnom kvalitetom). Pretpostavljamo da je sukladnost veća na natjecanjima na kojima momčadi igraju po sustavu svaki sa svakim (bodovni sustav), a da je manja na natjecanjima na kojima se igra po eliminacijskom sustavu. Temeljni cilj ovog istraživanja je tu pretpostavku potvrditi.

Ispitanici i metode rada

Uzorak momčadi činilo je dvanaest juniorskih reprezentacija koje su nastupale na 19. europskom košarkaškom prvenstvu u Hrvatskoj (2000). Momčadi su bile podijeljene u dvije prednatjecateljske skupine od po šest momčadi. U prvom dijelu natjecanja momčadi su igrale po sustavu svaki s svakim (bodovni sustav), a u drugom dijelu po eliminacijskom sustavu. U prvom dijelu natjecanja svaka momčad odigrala je pet utakmica. U drugom dijelu prvih osam momčadi odigralo je tri utakmice, a posljednje četiri momčadi odigrale su dvije utakmice (tablice 2, 3 i 5).

Uzorak varijabli činile su dvije nezavisne varijable: broj danih koševa i broj primljenih koševa (tablica1).

Igračka učinkovitost u napadu, u obrani i u cjelini za svaku momčad na svakoj utakmici izračunata je pomoću ljuske sustava odlučivanja KISS1.2. (Leškošek, 1995). Podatke smo obradili osnovnim postupcima deskriptivne statistike. Izračunati su također i Pearsonovi koeficijenti korelacije. Korišten je statistički program SPSS za Windows.

Rezultati i rasprava

Rezultati istraživanja su slijedeći:

- Sustav odlučivanja BASKET-PE1 pokazao se upotrebljivim ako želimo relativno brzo ustanoviti igračku učinkovitost momčadi na utakmicama u cjelini ili djelomično (u napadu i obrani). Standardiziranje rezultata omogućava uspoređivanje dostignuća pojedinih momčadi na utakmicama.
- Sukladnost između *prosječne* cjelovite igračke učinkovitosti momčadi i bodova koje su postigle u prvom dijelu natjecanja (tj. u bodovnom sustavu) *u svojoj* prednatjecateljskoj skupini, visoka je (r_a=0.86, r_b=093) i statistički značajna. Viša je sukladnost dobivena u skupini u kojoj su momčadi bile heterogenije po kvaliteti.
- Sukladnost između *prosječne* opće igračke učinkovitosti *svih* momčadi u prvom dijelu natjecanja (bodovnom sustavu) i njihovog konačnog poretka visoka je (r_{ab}=0.81) i statistički značajna.
- Sukladnost između *prosječne* opće igračke učinkovitosti *svih* momčadi u drugom dijelu

natjecanja (izlučnom, eliminacijskom sustavu) i njihovog konačnog poretka niska je (r_a=0.36) i statistički neznačajna.
- Sukladnost između *prosječne* opće učinkovitosti *svih* momčadi na natjecanju i njihovog konačnog poretka srednja je (r_a11=0.73) i statistički značajna.
- Ekstremni rezultati na jednoj utakmici, koji obično nisu izraz prave razlike u kvaliteti momčadi, nego neraspoloženosti momčadi, mogu iskriviti stvarnu *prosječnu* opću ili djelomičnu igračku učinkovitost jedne i/ili druge momčadi. Ovo osobito vrijedi ako je broj utakmica malen.
- Identična opća igračka učinkovitost momčadi na utakmicama može imati različite profile. Neke momčadi postižu istu vrijednost opće igračke uspješnosti boljom igrom u napadu, druge boljom igrom u obrani, a treće izjednačenom igrom u obje faze igre. Zbog toga je dobro poznavati sva tri podatka.
- Bolji poredak na natjecanju imaju momčadi koje postignu višu igračku učinkovitost protiv kvalitetnih momčadi.
- Za proučavanje *prosječne* igračke učinkovitosti (cjelovite ili djelomične) momčadi na natjecanjima najprikladniji je bodovni natjecateljski sustav.

Zaključak

Rezultati istraživanja potvrdili su našu pretpostavku da različiti natjecateljski sustavi različito utječu na sukladnost između *prosječne* opće igračke uspješnosti momčadi na natjecanju i konačnog poretka momčadi (stvarne kvalitete). Zbog toga moramo biti oprezni kada interpretiramo prosječne opće ili djelomične igračke učinkovitosti pojedinih momčadi na natjecanjima - u obzir moramo uzeti i karakteristike natjecateljskih sustava.

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