

Praxeological evaluation of the efficiency in offensive activities of the individual football players as a determinant in rationalizing and shaping a sports game

Authors' Contribution:

- A Study Design
- B Data Collection
- C Statistical Analysis
- D Data Interpretation
- E Manuscript Preparation
- F Literature Search
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abstract

Background: The article has a developmental character (application); it raises problems connected with an objective assessment of an individual game.

Material and methods: Based on the assumption that an individual action constitutes the basis of team game, a praxeology evaluation of individual game in situations of footballer's sports fight with high format (152 finalists of EURO 2012) was conducted in the work. These actions, due to the nature of sports games (pressing) and a great performing difficulty (action in the discomfort) make a significant element of the footballers' training, which is becoming a necessity to get a high score in the modern game.

Results: The analysis of the research data unambiguously show that the effectiveness of individual game largely determines the sports result (important differences for teams winning their games). Also higher praxeological parameters of these actions indicate large connections with the obtained result in sports rivalry.

Conclusions: It might be generally concluded that recognition of the mode of great players' action, taking into account praxeological assessment, comprises not only the estimation of these actions in the game but it may also, to a large extent, set down directions of shaping a sports game. The guidelines of a structured training have a significant meaning for rationalizing training.

Key words: football, efficiency models.

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INTRODUCTION

Activities in sports game are mainly carried out by team actions; however, individual actions are the base of the game, which largely determines its effectiveness [1]. In the game of footballers, the diversity and excellence of individual players' technique determines the efficiency and flexibility of conducting the team game [2]. If the resource of footballers' technical elements is too limited, and in addition it is accompanied by bad performance, this usually leads to one-sided and poor form of conducting this action, which significantly reduces the effectiveness of the game. In turn, richness of motor reactions enables applying many solutions and surprising the opponent not only with the moment and running speed, but also with its type.

Therefore, streamlining players' training is a comprehensive improvement of individual and group actions, which should result from an objective analysis of a sports game that, consequently, not only enables an objective assessment of the players' actions but also rationalizes the training process.

Observation of individual and group actions in different attack and defense situations constitutes a valuable resource for training. It is known that the development of reliable evaluation of players will cause the results achieved during the game to be tangible values, which in turn allows for significant streamlining of the training process.

Observation enables assigning training tasks to quantitative and quality requirements of the game. Training is rational when training measures are similar to the actual conditions of the game. Taking it into account, it seems that such activities should also constitute the content of systematic control of the player's assessment, which is one of the elements of a cycle-organized training that constitutes a starting point in the rational preparation of player for the game.

In order to assess the efficiency of a player's action, it is necessary to implement praxeology - functional evaluations included in the category of utilitarian evaluations [3]. According to Panfil [4], implementation of praxeology evaluations for sports activity will enable getting to know mechanisms of successes and defeats in sport, and in consequence will enable organizing and streamlining this important field of social life.

Use of utilitarian evaluations is particularly important in the case of sports games, in which the impact of player's fragmentary actions on the team result is diversified. Hence, the assessment of individual players' contribution to the achieved result will enable objectifying the control. Taking this into account, Panfil [4] determines the efficiency of team action in sports game as the whole of advantages of conscious and practical actions in the game, i.e. positively assessed features of this action, including: the player rationality, efficiency and reliability.

Observation of the game with participation of players with the highest sports competence indicates that results of actions in situations of close contact with the opponent show clear changes in the footballers' individual game, hence also a comparison of the game in terms of praxeology of the best teams will enable marking model tendencies and directions of these changes [5]. In this line, an assessment of professional player's effects in individual game was

conducted in this study which took into account the game of one against one. An analysis of the game was carried out in the mentioned action of players of the Polish national team relating to teams (Greece, the Czech Republic and Russia) in group rivalry – the final phase of EURO 2012. This study has a utilitarian character, since it enables finding model solutions which will let appoint directions in organized football training.

AIMS OF THE WORK, QUESTIONS AND RESEARCH HYPOTHESES

The purpose of this study is an objective evaluation of an individual action as a determinant of rationalizing and shaping sports game. Individual activities are the basis of team game [1], and the effectiveness of 1 to 1 game (1×1) in modern football is significant in achieving a sport success [6, 7] thus, the recognition of these actions is important as far as structured training is concerned.

An additional aim – the so-called application in the praxeology evaluation of individual game of players – was an attempt to assess the game of players of the Polish national team, in relation to dominant sports teams in Europe.

Taking into account the low sports level of football teams in Poland, this study may constitute a significant sign in seeking a concept of the training system (especially of young players).

Research questions:

1. Do the winning teams have a higher level of praxeology ratios in the action one against one (1×1)?
2. What are the differences in the level of praxeology ratios in the game one against one of players with high sports competence and players of the Polish national team in matches played during the European Championships (EC) 2012 tournament?

Research hypotheses:

1. Action of individual game in situations 1x1 are significant for the game – they affect the sports result, and the winning teams have a higher value of praxeology ratios than teams losing their matches.
2. Due to low sports competence (ranking EC-2012), the Polish national team had a lower value of praxeology ratios in action of the game 1×1 than teams – so-called leaders of the Polish group.

MATERIAL AND METHODS

Evaluation of the efficiency of action in the so-called “Polish group” in situations of the game 1×1 was conducted during the EC 2012 tournament; teams of the Czech Republic, Greece, Poland and Russia were included in this group (Table 1).

The obtained data in observation of the game were used to assess the efficiency ratios of action in situations 1×1, and Table 2 presents the final classification in the qualifying phase, in which the teams of the Czech Republic and Greece became leaders (promoted to further games).

Table 1. Summary of matches and sports results of the “Polish group” in EC 2012

No.	Games	Matches	Results	Analyzed team	Stage competition
1.	EC-2012	Poland – Greece	1:1	Poland – Greece	eliminations
2.	EC-2012	Poland – the Czech Republic	0:1	Poland – the Czech Republic	eliminations
3.	EC-2012	Russia – Poland	1:1	Russia – Poland	eliminations
4.	EC-2012	Russia – Greece	0:1	Russia – Greece	eliminations
5.	EC-2012	the Czech Republic – Russia	1:4	the Czech Republic – Russia	eliminations
6.	EC-2012	Greece – the Czech Republic	1:2	Greece – the Czech Republic	eliminations

Table 2. Sports ranking of the “Polish group” in the EC 2012 tournament

No.	Team	Number of matches	Points	Goals
1.	the Czech Republic	3	6	4:5
2.	Greece	3	4	3:3
5.	Russia	3	4	5:3
6.	Poland	3	2	2:3

An independent observation of 12 teams was carried out in a praxeology study, with participation of 152 players in direct sports rivalry. Individual offensive activity was evaluated and marked with the symbol 1×1. It was defined as a direct performance of two opposite players, one of whom attacks possessing a ball aiming at: scoring a goal, creating a situation to score a goal, attaining of the infield, gaining advantage, keeping the ball, passing the ball to mates, etc. The second player of the opposite team has a preventive role, seeks to thwart the mentioned aims, i.e. defends or strikes back, covers the infield or makes obstacles on the way of the attacking player, and also interrupts in different ways [7, 8].

Observing a 1×1 game, it can be claimed that these were counter-measures of the players that were within the range of the game in the situations of relative independence on their co-participants’ actions. The range of the game is the area of player’s activity, marked by the agreed on circle with a radius of 0 to 2 m [7, 8].

A positive assessment of an individual action of a player in the offensive 1×1 game was acknowledged when the aim of the game was achieved, when the attacking player passed the opponent keeping the ball, and at the same time crossed the line which goes along the crosswise axis of the field with the opponent and undertook fulfilment of the next intention in achieving the aim of the game. Ineffectual individual activity of the player in the offensive 1×1 game is considered to be a situation in which the actions of the player possessing a ball were interrupted, when the player lost the ball by off-taking it by the opponent or knocking it out, and a player with the ball did not cross the line going along the crosswise axis of the field and did not try to take up the next step to achieve the aim of the game.

Method of registered observation [4] was applied in the study, which consisted in direct secondary observation, with a possibility of repeated playback of actions that are the subject of research. Research analysis was conducted based on video material, recorded on DVD, using so-called freeze-frames. Played-back video material was used to obtain detailed information about the game in a 1×1 situation, and the received data were recorded on a specially prepared for this purpose observation sheets (Table 3).

Table 3. Model sheet of observation and data recording in 1×1 game action (example of the match: Poland - the Czech Republic)

Examed player Formation	Rate	Polish national team				Czech Republic national team			
		E – Effectiveness ratio	In – Ineffectiveness ratio	Ac – Activity ratio	Rel – Reliability ratio	E – Effectiveness ratio	In – Ineffectiveness ratio	Ac – Activity ratio	Rel – Reliability ratio
1	D1	0	0	0	0	0	0	0	0
2	D2	0	0	0	0	0	0	0	0
3	D3	0	1	1	0	0	0	0	0
4	D4	0	1	1	0	2	1	3	0.66
5	M1	0	0	0	0	3	1	4	0.75
6	M2	0	2	2	0	6	5	11	0.54
7	M3	0	0	0	0	1	1	2	0.5
8	M4	2	1	3	0.66	1	0	1	1
9	A1	2	0	2	1	2	3	5	0.4
10	A2	1	0	1	1	3	2	5	0.60
Total	Average of actions	0.50	0.50	1.00	0.27	1.80	1.30	3.10	0.45

Symbols: D - defender, M - midfielder, A - attacker

Ac - activity; E- effectiveness; In - ineffectiveness; Rel - reliability

In the praxeology evaluation of games in 1×1 action, ratios of effectiveness, activities and reliabilities were calculated [8, 9]:

- activity - determined by the sum of the actions taken in the game regardless of their outcome,
- effectiveness - determined by the sum of all the completed activities fulfilling the game objectives,
- ineffectiveness - determined by the sum of all the actions which did not finish with fulfilling the game objectives,
- reliability - determined as the ratio of the effective actions in comparison to all taken by the player.

In order to assess the accuracy and reliability of the observation sheet (validation), a method of competent judges-experts was used [10, 11]. In the received statistical values, the reliability of data collection in coefficients of correlation in a parallel test amounted to 0.92. Reliability of data collection in coefficients of correlation in retest (after 2 week) amounted to 0.96.

To compare the obtained results, basic statistic calculations were used: arithmetic mean, standard deviation, coefficient of variation. The level of significance of the differences between arithmetic mean values were tested with the help of the t-Student Test for independent groups [10].

The assessment of interdependence between the game indicators as well as testing the reliability of the observation sheet (validation) was done with the use of Pearson linear correlation coefficient [10].

Verifying statistical hypotheses was carried out with the assumption of the mistake level * - $p < 0.05$, ** - $p < 0.01$, *** - $p < 0.001$, if the increasing or decreasing trends of the obtained results were interesting.

RESULTS

EVALUATION OF THE DIVERSITY VALUE OF EFFICIENCY RATIOS IN THE STUDIED ACTIONS OF INDIVIDUAL GAME 1×1 IN TERMS OF THE ACHIEVED SPORTS RESULT

The collected data of praxeology ratios which will be presented in this section should indicate that teams with a considerable sports value (teams winning their matches in the Championships) had a higher level of efficiency ratio in action of individual game 1×1. Confirmation of this relationship can be interesting for tasks in application activities; therefore, research analysis in this section will aim to determine the variation level of the praxeology value in the studied action of individual game in terms of the achieved sports result (won matches - lost matches).

Data analysis included in Table 4 shows that almost all efficiency ratios of action in the 1×1 game show higher values for teams which achieved a good sports result (won their matches). Diversity of these values was the highest for: effectiveness, activity and reliability ratios ($p < 0.05$).

Table 4. Evaluation of the diversity value of efficiency ratios in game 1×1 in terms of the achieved sports result of the "Polish group" players in the EC-2012 tournament (p - ratio for the losing team, w - ratio for the winning team)

Statistical parameters	Elt	Ewt	lIt	lwt	Alt	Alw	RelL p	RelW p
Arithmetic mean	0.83	1.68	0.75	0.70	1.58	2.38	0.31	0.54
Standard deviation	0.22	0.19	0.25	0.43	0.45	0.57	0.03	0.13
Coefficient of variation	26.88	11.30	33.55	61.72	28.57	24.16	10.57	24.06
Significance of differences between groups	0.0006 ***		0.424		0.036 *		0.018 *	

*Praxeology ratios: Elt - effectiveness for the losing team, - Ewt effectiveness for the winning team, lIt - ineffectiveness for the losing team, lwt - ineffectiveness for the winning team, Alt - activity for the losing team, Alw - activity for the winning team, RelL p - reliability for the losing team, RelW p - reliability for the winning team; * $p < 0.05$*

In order to confirm again the significance value of praxeology ratios of individual game for the footballers' efficiency, in further research an assessment of the impact of these ratios on the number of scored points in the game of competing teams was conducted. Data analysis in Table 5 shows that the value of praxeology ratios in game 1×1 statistically significantly affected the number of scored points in the game of competing teams. This fact again points out that game 1×1 is significant for the game, and the way of assessing action by chosen praxeology ratios can accurately assess and model the sports game.

Table 5. Assessment of the impact of efficiency parameters in observed action on scored points in matches of the "Polish group" EC-2012

Ratios	Match (pt.)	Action in game 1×1			
		Effectiveness	Ineffectiveness	Activity	Reliability
Arithmetic mean	4.00	1.19	0.71	1.90	0.44
Standard deviation	1.63	0.35	0.21	0.47	0.06
Coefficient of variation	40.82	29.31	29.48	24.53	14.10
Correlation (K) R	r	0.853 **	0.583	0.902 **	0.785 *

This indicates that these ratios have the largest information value in terms of the impact on the sports result. These results are consistent with Duda and Brzyski's results [6] and Brzyski's results [7], who in their research showed similar diversities to the benefit of more advanced sports teams in the World Cup 2006 and the European Championship 2008.

DETERMINATION OF EFFICIENCY RATIOS IN THE STUDIED ACTIONS OF INDIVIDUAL GAME OF THE POLISH TEAM IN MATCHES IN 2012

Emphasizing the significance of the utilitarian value of measurable praxeology ratios in the action of individual game 1×1, hereinafter an assessment of players of the Polish national team (in the above action) in relation to other national teams (of the Czech Republic, Greece and Russia) with which the Polish team competed in EC 2012. The obtained findings will allow not only to assess the Polish national team players in this tournament, but also to determine the efficiency model for the 1×1 game, and in the process it will enable finding a way to effectively prepare players in organized training.

Based on data analysis of efficiency ratios of the game (effectiveness, ineffectiveness, activity, reliability) for action 1×1, statistical calculations and diversity level were estimated for the Polish, Greek Russian and Czech teams (Tables 6–8).

Data analysis in Table 6 includes characterization of praxeology ratios of the diversification of effective offensive actions in game 1×1. The data shows that players of individual teams presented similar values. However, the team of the Czech Republic (leader of the "Polish group") in EC-2012, statistically significantly exceeded the Polish and Greek players in this parameter.

Table 6. Evaluation of the diversity value of efficiency ratios in effective actions in game 1×1 of the "Polish group" players in the EC-2012 tournament

Statistical parameters	Examined group EC-2012											
	Poland	Greece	Poland	Russia	Poland	Czech Republic	Czech Republic	Russia	Russia	Greece	Czech Republic	Greece
Arithmetic mean	0.30	0.60	0.20	0.60	0.30	1.00	0.50	0.80	0.50	1.00	1.00	0.40
Standard deviation	0.48	0.70	0.42	0.70	0.48	1.05	0.71	0.79	0.71	0.94	0.94	0.52
Coefficient of variation	161.02	116.53	210.82	116.53	161.02	105.41	141.42	98.60	141.42	94.28	94.28	129.10
Significance of differences between groups	0.1404		0.0712		0.0396 *		0.1912		0.0988		0.0497*	

* $p < 0.05$

Data analysis in Table 7 includes characterization of praxeology ratios of the diversification of active offensive actions in game 1×1. The data shows that players of individual teams presented similar values. However, the Czech Republic team (leader of the group) statistically significantly exceeded the Polish team players in this parameter.

Table 7. Evaluation of the diversity value of efficiency ratios in active actions in game 1×1 of the “Polish group” players in the EC-2012 tournament

Statistical parameters	Examined group EC-2012											
	Poland	Greece	Poland	Russia	Poland	Czech Republic	Czech Republic	Russia	Russia	Greece	Czech Republic	Greece
Arithmetic mean	1.40	2.10	1.40	2.20	1.00	3.10	1.60	1.70	1.60	2.40	2.30	2.10
Standard deviation	1.58	2.08	1.43	3.08	1.05	3.41	1.35	1.25	1.71	2.67	1.95	1.20
Coefficient of variation	112.69	99.00	102.13	140.18	105.41	110.13	84.37	73.63	107.04	111.46	84.63	57.01
Significance of differences between groups	0.2041		0.2351		0.0454*		0.4328		0.2190		0.3929	

* $p < 0.05$

Data analysis in Table 8 includes characterization of praxeology ratios of the diversification of reliable offensive actions in game 1×1. The data show that players of the Polish team presented worse results, but irrelevant in values. Diversity in this ratio (at the level of statistical significance) was recorded in the matches between the Czech Republic and Russia and the Czech Republic and Greece. The data show that this ratio could affect the sports result of the competing teams in the matches (the team of Czech Republic was the group leader).

Table 8. Evaluation of the diversity value of efficiency ratios in reliable actions in game 1×1 of the “Polish group” players in the EC-2012 tournament

Statistical parameters	Examined group EC-2012											
	Poland	Greece	Poland	Russia	Poland	Czech Republic	Czech Republic	Russia	Russia	Greece	Czech Republic	Greece
Arithmetic mean	0.35	0.55	0.47	0.54	0.27	0.45	0.32	0.64	0.31	0.40	0.65	0.35
Standard deviation	0.42	0.46	0.44	0.47	0.44	0.35	0.34	0.46	0.36	0.38	0.38	0.27
Coefficient of variation	119.92	82.45	95.01	87.55	164.73	77.56	106.88	71.48	117.29	94.27	58.28	76.78
Significance of differences between groups	0.1565		0.3661		0.1556		0.0440*		0.2858		0.0291*	

* $p < 0.05$

Based on the above analyses, it is possible to notice that the level of praxeology ratios in actions in game 1×1 for the competing teams is diversified in value, and the Polish team in relation to the group leader (the Czech Republic) had worse parameters in effective and active actions. This fact indicates that this action could determine the sports value of competing teams. However, in order to confirm this thesis, there were attempts to characterize the diversity level of praxeology ratios in effectiveness of the game in actions 1×1 by assessing these ratios in the global dimension (total values of ratios from all matches – Tables 9-11).

Table 9 presents a summary evaluation of diversification of effective actions in game 1×1 of players of the “Polish group”. The data show that players of the Polish team had worse parameters of this action in effective values. To a large extent, this fact corresponds with the achieved sports result, where the Polish team took the last place in the group (see Table 2).

Table 9. Summary evaluation of the diversity of effective actions in game 1×1 of the “Polish group” players in EC-2012

Examined group EC-2012					
Statistical parameters		Poland (P)	Greece (G)	Russia (R)	Czech Republic (Cz)
Arithmetic mean		0.27	0.67	0.63	0.83
Standard deviation		0.45	0.76	0.72	0.91
Coefficient of variation		168.67	113.71	113.43	109.54
Significance of differences between groups	Poland – Greece	0.008**			
	Poland – Russia	0.010*			
	Poland – Czech Republic	0.002**			

* $p < 0.05$, ** $p < 0.01$

The analyzed statistical parameters (Table 10) reveal that in the summary evaluation of the diversification of active actions in game 1×1, players of the Polish team in tournament EC-2012 in the observed matches achieved the lowest values of this ratio. In the summary assessment of the diversity level in this action, a statistical significance of differences in matches was stated: Poland – Greece and Poland – the Czech Republic. In the remaining matches, the statistical significance of differences was not found.

Table 10. Summary evaluation of the diversity of active actions in game 1×1 of the “Polish group” players in EC-2012

Examined group EC-2012					
Statistical parameters		Poland (P)	Greece (G)	Russia (R)	Czech Republic (Cz)
Arithmetic mean		1.27	2.20	2.10	2.27
Standard deviation		1.34	2.01	2.40	2.24
Coefficient of variation		105.58	91.22	114.17	98.94
Significance of differences between groups	Poland – Greece	0.019*			
	Poland – Russia	0.049*			
	Poland – Czech Republic	0.020**			

* $p < 0.05$, ** $p < 0.01$

In the last analyzed parameter (Table 11), a summary evaluation of the diversification of reliability of actions in game 1×1 of the competing players was presented. The data show that in the observed matches in the EC-2012 tournament an average value of players of the Czech Republic, Russia and Greece was estimated at a similar level. However, players of the Polish national team in the observed matches recorded the lowest reliability ratios of actions in game 1×1.

Table 11. Summary evaluation of the diversity of reliable actions in game 1×1 of the “Polish group” players in EC-2012

Statistical parameters		Examined group EC-2012			
		Poland (P)	Greece (G)	Russia (R)	Czech Republic (Cz)
Arithmetic mean		0.18	0.32	0.33	0.34
Standard deviation		0.33	0.37	0.38	0.38
Coefficient of variation		185.85	118.42	115.33	111.58
Significance of differences between groups	Poland – Greece	0.023			
	Poland – Russia	0.049*			
	Poland – Czech Republic	0.042*			

* $p < 0.05$

The global dimension of praxeology ratios determined tendencies of the competing teams to actions of game 1×1. Based on analysis of the above data, it is possible again to notice that the team with the highest sports level (in the group rivalry: the Czech Republic) obtained the highest values for effectiveness, activity and reliability, and the Polish team had the worst values and (statistically significantly) differs in the level of action in game 1×1 from the leading teams (the Czech Republic and Greece) which were promoted to further phases of the tournament.

DISCUSSION

In summary of the presented research problem, it is possible to state that evaluation of offensive individual game in action 1×1 much corresponds with the achieved sports result. Higher classified sport teams obtained better praxeology parameters in this action. Therefore, taking into account the fact that similar relationships (in analysis of game 1×1) were obtained in other Championships (World Cup-2006 and EC-2008) [6, 7], it is possible to assume that this actions are significant for the effectiveness of the game and can affect the achieved sports result by teams. The obtained values of efficiency ratios can also constitute the praxeology indicator in the modelling of sports game, determining a rational direction in organized training. Semi-automatic video camera systems, motion analysis systems as well as GPS recording equipment should be mentioned here [12]. The system using GPS mechanisms is especially reliable in following the players’ game [13]. Through the use of these devices, it is possible to analyze the players’ activeness very precisely together with their position and the way of movement on the field [14, 15].

Despite the growing popularity, which undoubtedly has to do with the precision of registration GPS devices, their use especially while monitoring highly-valued matches is limited, because of the need to mark the players and the ball, for which there is currently no agreement of international football associations. Therefore, these types of recorders are mostly used to monitor trainings and rivalry in control matches[16, 17].

In our research, these difficulties have probably been replaced by a less automated method the registered observation ,which, despite technical imperfections, met the conditions of objectivity. According to Panfil [4], these

conditions were met by: direct observation, the possibility of repeated event recovery, the use of the so-called freeze frame and the use of praxeological indicators in the evaluation of listed activities

CONCLUSIONS

1. Actions of individual game (1×1) are significant for the effectiveness of the game. The winning teams in the analyzed tournament had a higher value of praxeology ratios of the games than teams losing their matches.
2. Evaluation of game actions 1×1 differentiates players in terms of the level of efficiency ratios in action in the offensive game, which in consequence may decide about the sports result.
3. Due to low sports competence (EC-2012 ranking), the Polish national team had a lower value of praxeology ratios in the observed action of game 1×1 than leaders teams.
4. Analysis of action in individual game (1×1) of players of the Polish national team in the observed matches of EC-2012 tournament revealed low levels of efficiency ratios in the analyzed actions, which may suggest their low sports competence in individual game. This fact may result from mistakes in managing the players or training mentality in the existing system.

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