Application of the analytic hierarchy process for the evaluation of basketball teams

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Abstract: In this paper we predict the ranking of 11 Israeli basketball teams by employing the Analytical Hierarchical Process (AHP) developed by Saaty [1]. Four experts participated in the evaluation process and six criteria were introduced to evaluate and rank the teams. Consistency tests led to sensitivity analyses conducted with five criteria and three experts. The results were validated against the actual ranking at the end of the season. Although there was good correlation between each expert's ranking and the actual results, the best correlation was between the predicted average rank (over all the experts) and the actual results.

Keywords: analytic hierarchy process; ranking; basketball.

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1 Introduction

During the soccer and basketball seasons, sport-practitioners, such as managers or coaches, may often be requested to predict the future or final ranking of the teams while the games are in progress. For example, the manager or coach of a soccer or basketball team might try to predict whether his or her team meets pre-season expectations and goals, or whether measures should be taken to improve the situation. Such questions may become crucial because of their substantial economic and financial implications. For instance, soccer clubs often invest large amounts of money in order to reach the 'champions league' as do basketball clubs who want to participate in one of the European cup achievements, both of which are financially highly rewarding. Even on the local level, a higher ranking in the league is often very profitable. To illustrate, according to a new regulation, the Israeli Soccer Federation now rewards the team that is in the third-from-last rank of the first division, even if the team descends to the second division at the end of the season.

Managers and coaches have found it worthwhile to learn about their teams' relative advantages and/or disadvantages during the course of the season. For example, corrective measures such as trading players and/or hiring or firing professional staff members can improve the team's situation provided, of course, that the predictions are accurate. For this purpose, managers and coaches have to process information and make judgments that may substantially influence managerial or coaching decisions. However, similar to other judgmental tasks, human performance may depart significantly from the prescriptions of formal decision theory [2].

By the 1970s, studies on human behaviour were well documented with human judgmental biases, deficiencies and cognitive illusions, characterised by extensive violations of normative rationality models [3,4]. Even though the realm of sport seems to be most appropriate for research on violation of normative rationality [5], the literature reflects a dearth of studies in that direction [6,7]. Thus, we believe that decision makers in sports management could benefit from the availability of such studies in order to make good managerial and coaching decisions.

The guiding principle of any judgment and decision aid system is to relieve decision makers of the cognitive flaws and biases related to the process of judgment and decision making. For example, decision makers have great difficulty in weighing and combining (i.e., aggregating) information [8]. Hence, judgment tasks are often decomposed into a number of presumably simpler estimation tasks [9]. In fact, most decision aids rely on the principle of ‘divide and conquer’, according to which a decision aid fractionates the total problem into a series of structurally related parts, and the decision maker is asked to make subjective assessments for only the smaller, simpler components. Through such evaluations, a manager or a coach may be better informed about the team’s relatively weaker attributes in order to be able to conduct more appropriate corrective measures. Such breakdown of information has been shown to be more manageable than assessing global entities [7].

Various decision-aid systems for evaluating the ranking of teams in a particular ball-game season can be found in the management science literature (e.g., Targerson, [10]). In the 1970s, several pairwise-comparison approaches for ranking teams in sport were applied for post evaluations after all the games had already taken place [11,12]. Sinuany-Stern [13] applied the analytic hierarchy process (AHP) approach [1] to evaluate and predict the final ranking of soccer teams before and while the games were actually still in progress.

In our paper we employ AHP for ranking basketball teams. AHP has been applied to problems in decision analysis, forecasting, strategy formulation, allocation of resources, project selection, social sciences, and engineering conflict resolution and planning [1,14]. The advantage of the AHP is that it breaks down a complex unstructured problem into its components and then constructs a hierarchy of the system components in order to evaluate them. It is also easy to implement, it can handle tangible and intangible criteria, and it imposes a discipline on the thought process.

AHP falls within the framework of Multiple Criteria Decision Analysis (MCDA). Numerous methods have been developed for rank scaling, which can be found in the literature on MCDA [15]. Nevertheless, AHP has become more popular for the following reasons:

1 it provides an opportunity for a richer involvement of the decision makers in the evaluation procedure

2 the existence of several commercial computer codes makes its implementation much simpler than most MCDA techniques

3 AHP is now much more widely taught in management workshops and textbooks (see, for example, Render and Stair [16]).

Dyer [17] views AHP as an arbitrary procedure for ranking alternatives. Dyer claims that “the key to the proper use of the AHP relies on its synthesis with the concept of multi-attribute utility theory." AHP dominates the OR/MS literature on decision analysis applications although Dyer and others claim that the utility theory offers the most theoretically sound approach. Nevertheless, in practice, Lugassi *et al.* [18] find AHP more applicable than the utility approach, although the utility approach, which is preferred by Dyer, has better axiomatic foundations, but is impractical.

AHP rank scales elements (for our purposes, teams) and combines both subjective (e.g., qualitative) and objective (e.g., quantitative) assessments into an integrative hierarchical framework. The assessments are based on simple pairwise comparisons of the system's elements based on their criteria. The method is divided into four steps:

1 structuring the hierarchy of decision makers' criteria and elements

2 collecting input data by pairwise comparisons

3 using the eigenvector method to yield priorities for the criteria

4 synthesising the priorities into composite measures in order to arrive at a set of ratings for the system's elements.

In a previous study, Sinuany-Stern [13] applied the AHP to rank 16 soccer teams from the Israeli National League. Six criteria (attributes) were used for evaluating each team:

1 the teams' facilities

2 the teams' coach

3 the players' level

4 the teams' fans

5 the previous season's performance

6 the current performance.

AHP requires pairwise comparisons of entities (e.g., athletic teams). Normally, such pairwise comparisons are a great burden in managerial contexts, but in that study they were found to be appropriate for soccer where the games take place between pairs of teams. It should be noted that only one participant served as an expert on the evaluation of the teams in the First Israeli Soccer division, namely the editor of a well-known national sports magazine. However, according to the forecasting literature, combining several forecasters' (experts') opinions provides better predictions than a single forecaster [19], and therefore in our paper we have combined the predictions of several experts.

The AHP's flexibility is achieved by the manner in which a problem may be decomposed into hierarchical levels [1]. In our study, the upper level of the hierarchy contains the experts (four) and the middle level consists of the criteria which contribute to the quality of the team evaluation (five to six criteria). The lower level of the hierarchy contains given elements for evaluation (11 Israeli basketball teams).

After building the three-tier hierarchy, we collected input data that would establish the relative importance weights (priorities) for each set of elements at each level of the hierarchy. The input data for the problem consisted of matrices of pairwise comparisons of elements at a lower level, which contributed to achieving the objectives of the next higher level.

A more fundamental issue in respect to evaluation is the nature of the expert used. Professional expertise has been intensively investigated both generally in psychology [20,21] and specifically in sports psychology. For instance, it has been established that in sports, experts differ from novices in respect to underlying cognitive processing mechanisms [22-24] which enable these experts to be better decision makers [7] and to be more "sport-intelligent" [25]. In sport, however, universal criteria for determining an 'expert' have not as yet been defined [22,23]. One solution to this problem would be to use persons whose expertise on a particular subject matter is unequivocal. Such an approach was used in several investigations in elite ball-games such as basketball, soccer, team-handball and water polo [26].

The purpose of the present investigation is to replicate Sinuany-Stern's [13] results and further extend the validity of the AHP model as a methodology for evaluating sports teams and predicting their performance in basketball. Since we believe that the inclusion of some of Israel's leading soccer coaches would have strengthened the results of that study, in the present research we use four of Israel's top basketball coaches to serve as experts. Each expert evaluated the teams by specific criteria, and based on the evaluations, the rankings of the teams were predicted.

The paper proceeds as follows. We first describe the Israeli basketball system. Afterwards we present the AHP. After we apply the AHP to rank the basketball league, we proceed to the results and analysis. The paper ends with conclusions and suggestions for future research.

2 The Israeli basketball league

Basketball is one of Israel's most popular sports. According to European standards, Israeli basketball is considered to have a medium-high level of playing. The game is organised according to the precepts of the Israel Basketball Association where the men's teams are grouped into six divisions, with the 'National League' at the top. During the last three decades, Israeli basketball has undergone a substantial professionalisation and privatisation process whereby players are now highly paid, and each team is permitted to hire two foreign players. The 'National League' usually includes 12 teams, however, during the season in which the present study was conducted, one dropped out due to financial difficulties. Therefore the present study surveys only 11 teams.

2.1 Participants

Four of the most successful basketball coaches in Israel served as experts in this study. Three were in the 40-50 age range and were coaches of the teams whose final rankings were 1, 2, and 3 in the first division of the season. All three coaches had outstanding professional records, either by having won the national championship and/or cup, or by having participated in various European cups or coached an Israeli national team. The fourth coach (aged 65) has achieved the reputation of being 'the first name in Israeli basketball' by virtue of having achieved an outstanding record in both national and international teams. He had previously coached teams to numerous national and European championship wins. At the time of this study, he was general manager of a second division team that won the championship and moved up to the first division at the end of that season. Thus, all four coaches can unequivocally be considered top-level basketball experts.

3 AHP

AHP provides a vector of weights that express the relative importance of several elements. This approach is composed of two main stages. The first stage provides a mathematical method of translating a given pairwise comparison matrix into a vector of relative weights for the elements. The second stage provides a hierarchical model where, in our case, the upper level may represent the criteria for evaluation while the lower level represents basketball teams evaluated according to those criteria. The first stage is applied repeatedly to assign scoring to the various levels and sublevels of the hierarchy.

Basically, the decision maker makes a subjective comparison between every two elements, choosing the pairwise comparison term, a_{ij}, from a scale of nine levels. Thus a pairwise comparison matrix is formed (matrix A). The eigenvector of the largest eigenvalue of matrix A reflects the relative importance of each element. The element with the highest value is ranked first. The eigenvector of the largest eigenvalue is analogous to the principle component of the matrix. It is in some sense the best linear transformation of a matrix of pairwise comparisons into a vector of weights. It is more complicated to evaluate n elements simultaneously than to compare two elements at a time. Therefore, the pairwise comparison matrix is used. Furthermore, the pairwise comparison provides much more information than does a direct scaling vector. AHP provides a consistence test that is possible only because there is a pairwise comparison matrix. This significance test provides a way to validate the results, as will be shown later.

Ultimately, the elements scaling values $(w_1, w_2, \ldots, w_n)$ have to be calculated. Each entry of the pairwise comparison matrix, a_{ij}, may be regarded as an estimate of the ratio between element *i* and j, w_i / w_j. Assuming these ratios are precise estimates of the scale $(w_1, \ldots, w_n)$, ideally all elements of the matrix of pairwise comparisons should be consistent with one another. This simply means that the relation $a_{ij}a_{jk} = a_{ik}$ holds for the entire matrix. This also implies that $a_{ji} = 1/a_{ij}$ for the entire matrix.

The eigenvector, $\mathbf{w}$, and the eigenvalue, λ, of the pairwise matrix *A* are defined as those that solve the equation $A\mathbf{w} = \lambda\,\mathbf{w}$. If the matrix *A* is strongly consistent, namely, $a_{ij} = w_i / w_j$, then

$$A\mathbf{w} = \begin{bmatrix} a_{11} \ldots a_{11} \\ a_{n1} \quad a_{nn} \end{bmatrix} \cdot \begin{bmatrix} w_1 \\ w_n \end{bmatrix} = \begin{bmatrix} w_1/w_1 & w_1/w_n \\ w_n/w_1 & w_n/w_n \end{bmatrix} \cdot \begin{bmatrix} w_1 \\ w_n \end{bmatrix} = \begin{bmatrix} nw_1 \\ nw_n \end{bmatrix} = n \begin{bmatrix} w_1 \\ w_n \end{bmatrix};$$

namely, $A\mathbf{w} = n\mathbf{w}$, which implies that ideally $\lambda = n$. Since for any matrix of order *n* there are at most *n* distinct eigenvectors $\lambda_1, \ldots, \lambda_n$, and their sum is $\sum_{i=1}^{n} \lambda_i = n$, and since here $\lambda = n$, it means that $\lambda = n$ is the largest eigen value if the matrix is fully consistent. However, in practice ($\lambda \neq n$). In order to improve the consistency of the numerical judgements in the comparison of the two elements *i* and *j*, the entry a_{ji} is automatically assigned the value $1/a_{ij}$ (from which it follows that $a_{ii} = 1$). This is referred to as the weak consistency. However, the relation

$a_{ij}a_{jk} = a_{ij}$ -the strong consistency-is not required. Hence, practically, a_{ij} will not equal w_j / w_i for all *i* and *j*. In this case, where only the weak consistency condition ($a_{ji} = 1/a_{ij}$) is required, Saaty has shown that the resulting scale *W* must satisfy the eigenvalue problem $A\mathbf{w} = \lambda_{max}\mathbf{w}$, where λ_{max} is the largest eigenvalue. The closer λ_{max} is to *n*, the more consistent are the results. An index of consistency is given by $C = (\lambda_{max} - n)/(n-1)$. The closer this index is to zero, the better is the overall consistency of the matrix of judgmental comparison. The eigenvector is normalised, so that $\sum_i^n w_i = 1$. A statistical critical value C_n^* is given by Saaty [1] i.e., if $C > C_n^*$; then we can conclude that the matrix is significantly not consistent for a given significance.

The multi-criteria scaling procedure is done in three steps. Let us assume, in general, that there are *K* criteria and *N* teams. In the first step, a matrix *A* is constructed subjectively by the expert, where a_{ij} is the relative importance of criterion *i* as compared to criterion *j*. The eigenvalue, λ_{max}, and the eigenvector, **w**, of the matrix *A* are calculated. The eigenvector is normalised so that

$$\sum_{k=1}^{K} w_k' = 1; \quad \text{namely}, w_k' = w_k / \sum_{k=1}^{K} w_k$$

In the second step, for each criterion, *k*, a matrix A^k is constructed subjectively by the expert, where a_{ij}^k is the relative evaluation of team *i* compared to team *j* with regard to criterion *k*. The eigenvalue, λ_{max}^k, and the eigenvector, ω^k, of the matrix A^k are calculated, and the eigenvector is normalised.

In the third step, a single vector, **W**, representing the overall score of the teams is calculated as follows:

$$\mathbf{W} = \sum_{k=1}^{K} w_k \omega^k .$$

Vector **W** is a weighted average of the vectors $\omega^1,...,\omega^k$ where the weights are the scalars $w_1,...,w_k$, respectively.

Finally, the ranking of the teams corresponds with the overall weight, **W**, where the team with the largest scaling value, $\mathbf{W}_k$, gets the highest rank, etc. This three-step procedure is repeated for each of the experts.

4 Procedure instrumentation and design

The study was carried out according to the AHP approach. In order to assess the teams we had to determine the criteria by which a team would be evaluated. In the first stage of the study, each coach was interviewed individually (at home or at another place) by one of the investigators and was requested to supply a list of criteria that he thought would be appropriate for evaluating basketball teams. There was no limit to the number of criteria. Appendix A provides the original list of criteria suggested by the coaches. The six criteria ultimately used in the study were selected for two main reasons: First, as is evident from appendix A, the criteria given by the coaches were quite similar; second, six criteria is a manageable number (7±2) for AHP as recommended by Saaty [1]. After we analysed each list we condensed it into the following six criteria: 'good players', 'good coach', 'coach-player compatibility', 'efficient and capable management', 'sound infrastructure' and 'team tradition'.

1 The criterion for 'good players' is based on offensive and defensive capabilities as well as general contributions to the team.

2 The criterion for a 'good coach' is based on record of achievements, prestige, an intelligent understanding of the game, an ability to 'read' the developments in the game and identify and capitalise on situations, and personal charisma.

3 'Coach-player compatibility' encompasses such questions as: Is the game style of the coach compatible with that of the players? Does the philosophy of the coach fit the goals of the team (e.g., a coach whose interests are oriented toward achieving titles might not be compatible with the interests of a team interested in long-range goals). This criterion turns out to be quite complex since the evaluator has to consider several criteria simultaneously, namely the 'coach', the 'players', and a comparison between these two criteria. The implications of this criterion are discussed in the Results section.

4 'Efficient and capable management' has to do with the qualifications of the team's management in terms of organisation, logistics, public relations, professional staff (i.e., finance experts, psychologists, strength and conditioning trainers), and fulfillment of salary commitments.

5 'Sound infrastructure' relates to training facilities, weights room, locker rooms, the home court, and other physical facilities.

6 'Team tradition' relates to the team's past, titles, identification of the players with the team's tradition.

The coaches' responses revealed a consensus of opinion in response to these six criteria.

In the second stage of the study, each coach was requested by the investigators to evaluate the team according to AHP (as detailed above) in relation to these six criteria. For this purpose, standard tables were used for pairwise comparisons of the criteria and of the teams according to each criterion (see example in Table 1). Note that three of the coaches filled out the tables at home or in a similar quiet environment; while coach 3 fulfilled this task in a noisy gym, prior to a game which he observed, but did not coach. As we show later, the level of attention being paid to this task had implications as to the reliability of the data. Coach 3 was significantly inconsistent in evaluating the criteria (Table 2 shows that the coach was inconsistent with 0.05 level of significance). In comparison to the other coaches he was also the least consistent for each criterion.

Table 1 The pairwise comparison matrix for the criteria of expert 1

Criterion	*1*	*2*	*3*	*4*	*5*	*6*
1 Good players	1	1	2	2	5	2
2 Good coach	1	1	2	2	5	2
3 Coach & players	0.5	0.5	1	2	3	3
4 Good mgmt.	0.5	0.5	0.5	1	3	1
5 Infrastructure	0.2	0.2	0.33	0.33	1	0.5
6 Team tradition	0.5	0.33	0.33	1	2	1

Table 2 The criteria weights by coach

Criterion/Coach	*1*	*2*	*3**	*4*
Players	0.26	0.24	0.19	0.27
Coach	0.28	0.16	0.42	0.14
Coach/player	0.19	0.43	-	0.33
Management	0.12	0.09	0.17	0.16
Infrastructure	0.05	0.04	0.09	0.04
Tradition	0.10	0.04	0.13	0.06
Criteria consistency value	0.03	0.95	1.89*	0.19

* inconsistent value

5 Results and analysis

Table 2 presents the weights given to the criteria by each of the four experts as calculated from their pairwise comparison matrix by AHP. For example, column 1 of Table 2 represents the weights of expert 1 extracted from the eigenvector of the largest eigenvalue of the matrix of Table 1. Table 3 summarises the rank-scale evaluations of the teams by each expert based on the six criteria, utilising AHP. For example, Maccabi received the largest score by expert 1 (0.305).

It is interesting to note that each expert ranked Maccabi in the first place. Table 4 summarises the teams' rankings of each expert, as well as the average rankings of the teams. Only three experts responded to all six criteria. Expert 3 did not respond to criterion 3 (coach/player). As shown there, when comparing the average score of three experts with four experts for five criteria, only the location of team ranks 6 and 8 were switched – the rest have the same rank. When comparing the average score for three experts based on six criteria and for three experts based on five criteria, only the location of team ranks 4 and 5 were switched.

Table 3 Team evaluation by expert*

Team/Expert	*1*	*2*	*3**	*4*
Maccabi	0.305	0.265	0.285	0.249
Hapoel Jerus.	0.151	0.176	0.120	0.085
Hapoel Eilat	0.085	0.112	0.107	0.076
Hapoel Galil	0.084	0.086	0.039	0.144
Maccabi Ran.	0.095	0.096	0.175	0.154
Hapoel Rishon	0.054	0.058	0.044	0.085
Hapoel Givat.	0.038	0.057	0.023	0.037
Hapoel TA	0.029	0.028	0.019	0.019
Maccabi RG	0.047	0.042	0.106	0.069
Maccabi Bnei	0.076	0.046	0.059	0.068
Hapoel Holon	0.037	0.033	0.022	0.014

* Expert 3 is based on 5 criteria, the others on 6

Table 4 Summary of teams' ranking results

Team	*6 criteria*				*5 criteria*						
	Experts			*Average 3 experts*	*Experts*				*Average 4 experts*	*Average 3 experts*	*Actual ranking*
	1	2	4		1	2	3	4			
Maccabi Tel-Aviv	1	1	1	1	1	1	1	1	1	1	1
Hapoel Jerusalem	2	2	5	2	2	2	2	5	2	2	2
Hapoel Eilat	4	3	6	5	3	3	4	7	4	4	4
Hapoel Galil-Elion	5	5	3	4	4	5	8	2	5	5	5
Maccabi Raanana	3	4	2	3	5	4	2	4	3	3	3
Maccabi Rishon-Lezion	7	6	4	6	7	6	7	3	8	6	6
Hapoel Givat-Shmuel	9	7	9	9	10	7	9	8	9	9	8
Hapoel Tel-Aviv	11	11	10	11	11	10	11	10	11	11	11
Maccabi Ramat-Gan	8	9	7	8	8	9	5	9	6	8	9
Bnei Herzelia	6	8	8	7	6	8	6	6	7	7	7
Hapoel Holon	10	10	11	10	9	11	10	11	10	10	10

For validation of the results we compared the experts' evaluations with the actual ranking. On average, there is good correlation between the results and the actual ranking at the end of the season (all correlations between the predicted average ranks and the actual ranks were over 0.86). When only five criteria were considered for all four experts the correlation between the AHP ranking and the actual results was less significant (0.86) – three teams did not match with the actual results. When expert 3 was eliminated (since he evaluated only 5 criteria) the results for five criteria were more accurate (0.99 correlation): When expert 3 was eliminated the results for five criteria were more accurate (correlation of 0.991): Only two teams did not match with the actual ranking at the end of the season. In line with Saaty's [1] assumptions, adding a complex criterion onto the sixth one (coach/criterion) does not improve the predictability of the model, implying that the criteria need to be independent of each other (Table 2, at the bottom, presents the consistency values.) Furthermore, adding an expert (expert 3) who was not consistent worsened the results. Note that in all cases (see Table 5) the correlation between AHP rank and the actual rank at the end of the season was very high (the P value was less than 0.001). Furthermore, for each expert the correlation between his rank and the actual rank was highly significant with a P value of at most 0.01. Also, there was a significant similarity among the experts' ranks according to the Friedman analysis of the variance non-parameter rank test.

Table 5 The correlation* between the actual and predicted ranks by the number of experts and the number of criteria

Expert no.	*1*	*2*	*3**	*4*
No. of criteria				
5	0.97 (6)	0.95 (12)	0.99 (2)	0.86 (8)
6	0.98 (4)	1 (0)	0.94 (4)	-

* ( ) the number of non-matched ranks in relation to the actual ranks

Based on the criteria weights given by each expert (Table 2), experts 1 and 3 gave the highest weight to the 'coach', while experts 2 and 4 gave the highest weight to 'player-coach compatibility'. Both experts ranked the players in the second place and the coach third place. All the experts ranked the infrastructure as the least important factor. Except for expert 3, the experts gave consistent rankings for all pairwise comparison matrices. Expert 3 was inconsistent for two pairwise matrices, namely the criteria matrix and the matrix of comparing the teams according to their infrastructure.

Analysis of the relationship between the ranks each coach gave to the team revealed the following results. All the experts ranked the same team (Maccabi Tel Aviv) first place, including its coach (who was one of the experts). It is of interest that one coach, who had previously been fired, ranked his former team three places below its actual ranking while another expert ranked his own team one place above its actual ranking. The other two experts ranked their team below their actual rank. The correlation between the actual rank and the rank of each expert was found to be lower than the average results when combining three or four experts with five or six criteria. It seems that the average over experts balanced out the biases of each expert (see the number of unmatched ranks on the bottom of Table 5).

5 Conclusions and future research

The results of this study showed that the AHP model's predictions correlated significantly with the actual ranking at the end of the season. The study supports Saaty's [1] argument that criteria have to be independent by showing that when a complex criterion (a combination of two criteria) was used, the results were indeed less accurate. Furthermore, we also demonstrated that the AHP consistency measure was an efficient tool for measuring the experts' level of concentration when providing the data. For example, expert 3, who made his evaluation under non-optimal conditions, was indeed found to be inconsistent (see Table 2), and the elimination of his responses from the study provided better results. Thus, deleting a complex criterion and an inconsistent expert provided better predictions. Moreover, combining the results of several experts provided better results than those based on the report of each individual expert. Our results may also indicate that coaches tended to both overestimate their own team and to underestimate teams with which they had bad relations (e.g., teams from which they had been fired). In future research this conclusion should be validated for larger samples.

This investigation provides further evidence that multi-criteria models such as AHP could be beneficial to decision makers (e.g., managers and coaches) in the applied setting of sports. Decision-aid systems (such as the one proposed by Saaty [1]) can relieve them of cognitive flaws and biases incurred during judgment and decision-making processes, especially those being made under stressful conditions [24]. It seems that the strategy of fractionating a total complex problem into a series of structurally related parts – asking experts to assess these fractions and aggregating them by a model – may indeed contribute substantially to the judgment and decision processes often required in the area of sport management. The validity of this conclusion should be further investigated with other groups of experts along with coaches, such as sport journalists and top players, who can provide valuable input in determining team ranking.

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Appendix A

Criteria for comparison, as proposed by the coaches

Coach A:

- Team's tradition
- Resources
- Management's qualifications (organisational and logistical management, public relations, etc.)
- Proper professional management
- Infrastructure (facilities, strength and conditioning room, dressing rooms)
- Reservoir of players
- Coach-team compatibility
- Selection and compatibility of players

Coach B:

- Orderly framework, club and management
- Players
- Coach
- Compatibility of the coach's philosophy with the players

Coach C:

- Good players
- Orderly/intellectual management
- Coach who fits the team and its goals
- Professionals holding key roles
- Clubs with tradition
- Team with a gymnasium where its home games are played

Coach D:

- Players' talent
- Good coach
- Common team ability of all the players
- Coach-player compatibility
- Club's conditions
- Players' identification with the club