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The Analytic Hierarchy Process: A Methodology for Win-Win Management

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Abstract. Conflict resolution is the search for an outcome that represents for some participants as improvement from, and for no-participants a worsening of, their present situation. Group decision making sessions often leads to conflict and loss of sight in particular when the problem is hard to structure and involves qualitative and quantitative criteria. Most executive managers face on daily basis problems that contain one or more of the above elements. They need scientific, but practical tools to help them in making rational decisions. This paper presents the analytic hierarchy process (AHP), a scientific methodology was developed. The AHP can be described as an effective tool for decision making at the executive level of management. It addresses three aspects of decision making problems multi criteria, group decision- making, and conflict resolution. The AHP concept will be reviewed. How does it work? Practical examples of its applications are surveyed. The advantages of implementing the AHP are highlighted.

1. Concept of the Analytic Hierarchy Process (AHP)

Decision-making involves criteria and alternatives to choose from. The criteria usually have different importance and the alternatives in turn differ in our preference for them on each criterion. To make such tradeoffs and choices we need a way to measure. Measuring needs a good understanding of methods of measurement and different scales of measurement.

Many people think that measurement needs a physical scale with a zero and a unit to apply to objects or phenomena. That is not true. Surprisingly enough, we can also derive accurate and reliable relative scales that do not have a zero or a unit by using our understanding and judgments that are, after all, the most fundamental determinants of why we want to measure something. In reality, we do that all the time and we do it subconsciously without thinking about it. Physical scales help our understanding and use of the things that we know how to measure. After we obtain readings from a physical scale, they still need to be interpreted according to what they mean and how adequate or inadequate they are to satisfy some need we have. However, the number of things we do not know how to measure is infinitely larger than the things we know how to measure, and it is highly unlikely that we will ever find ways to measure everything on a physical scale with a unit.

Can we rely on our minds to be accurate guides with their judgments? The answer depends on how well we know the phenomena to which we apply measurement and how good our judgments are to represent our understanding. In our own personal affairs, we are the best judges of what may be good for us. In situations involving many people, we need the judgments from all the participants. In general, we think that there are people who are more expert than others in some areas are and their judgments should have precedence over the judgments of those who know less as in fact is often the case in practice.

Judgments expressed in the form of comparisons are fundamental in our biological makeup. They are intrinsic in the operations of our brains. Comparisons imply that all things we know are understood in relative terms to other things. The question then is how do we make comparisons in a scientific way and derive from these comparisons scales of relative measurement? When we have many scales with respect to a diversity of criteria and sub criteria, how do we synthesize these scales to obtain an overall relative scale? Can we validate this process so that we can trust its reliability?

These are all questions we need to consider in making a decision. It is useful to remember that there are many people in the world who only know their feelings and may know nothing about numbers and never heard of them but can still make good decisions, how do they do it? It is unlikely that by guessing at numbers and assigning those directly to the alternatives to indicate order under a criterion will yield meaningful priorities because the numbers are arbitrary and they would likely be from different scales.

The foregoing questions were raised by T. Saaty whose answers provide a comprehensive definition of the concept of the AHP (Saaty, 1980 & 2004). AHP is a decision-making tool for dealing with complex, unstructured and multi criteria decision.

2. Basics of AHP

In using the AHP, one constructs a hierarchy (consisting of goal, criteria and alternatives), and then makes judgments (or performs measurements) on pairs of elements with respect to a controlling element. Ratio scales are derived from these judgments and then synthesized throughout the structure to select the best alternative.

2.1 Structuring the Hierarchy

In applying the AHP to a decision problem one structures the problem in a hierarchy with a goal at the top and then criteria (and often sub criteria at several levels, for additional refinement) and alternatives of choice at the bottom. The criteria can be subjective or objective depending on the means of evaluating the contribution of the elements below them in the hierarchy. Furthermore, criteria are mutually exclusive and their priority or importance does not depend on the elements below them in the hierarchy. The number of alternatives should be reasonably small because there would then be a problem with improving the consistency of the judgments. It was observed that an individual cannot simultaneously compare more than seven objectives (plus or minus two) without becoming confused. Saaty (1980) and Saaty and Ozdemir (2003) showed that the maximum number to compare should be no more than seven. If the number of alternatives is more than seven, the rating mode of the AHP may be used. In the rating mode, in addition to the three general levels in a simple hierarchy of the objective, the criteria and the alternatives, an extra level above the alternatives consisting of intensities, which are refinements of the criteria governing the alternatives by creating a scale for each intensity, is included.

In short, when constructing hierarchies one must include enough relevant details to represent the problem as thoroughly as possible, but not so much as to include the whole universe in a small decision. One needs to consider the environment surrounding the problem, identify the issues or attributes that one feels influence, contribute to the solution, and identify the participants associated with the problem. Arranging the goals, attributes, issues, and stakeholders in a hierarchy serves three purposes:

1- It provides an overall view of the complex relationships inherent in the situation.

2- It captures the spread of influence from the more important and general criteria to the less important ones.

3- It permits the decision maker to assess whether he or she is comparing issues of the same order of magnitude in weight or impact on the solution.

2.2 The Prioritization Procedure

Elements in each level are compared pairwise with respect to their importance to an element in the next higher level, starting at the top of the hierarchy and working down, a number of square matrices called preference matrices are created in the process of comparing elements at a given level. Judgments of preference are made on pairs of elements in the structure using what Saaty defines as "the fundamental scale of AHP (Saaty 1996, p. 73) which is reproduced in Table 1.

The fundamental scale used in AHP enables the decision maker to incorporate experience and knowledge in an intuitive and natural way. This scale is insensitive to small changes in a decision maker's preference, thereby minimizing the effect of uncertainty in evaluations.

AHP is an absolute scale in which people use numbers to express how much one element dominates another with respect to a common criterion. The scale derived from these absolute numbers is a ratio scale.

Table 1. The fundamental scale of absolute numbers.

Intensity of Importance	Definition	Explanation
1	Equal Importance	Two activities contribute equally to the objective
2	Weak or slight	
3	Moderate importance	Experience and judgment slightly favor one activity over another
4	Moderate plus	
5	Strong importance	Experience and judgment strongly favor one activity over another
6	Strong plus	
7	Very strong or demonstrated importance	An activity is favored very strongly over another; its dominance demonstrated in practice
8	Very, very strong	
9	Extreme importance	The evidence favoring one activity over another is of the highest possible order of affirmation
Reciprocals of above	If activity i has one of the above nonzero numbers assigned to it when compared with activity j, then j has the reciprocal value when compared with i	A reasonable assumption
Rationals	Ratios arising from the scale	If consistency were to be forced by obtaining n numerical values to span the matrix

2.3 Synthesizing

After forming the preference matrices, the process moves to the third step of deriving relative weights for the various elements. The relative weights of the elements of each level with respect to an element in the next higher level are computed as the components of the normalized eigenvector associated with the largest eigenvalue of their comparison matrix. The composite weights of the decision alternatives are then determined by aggregating the weights throughout the hierarchy. This is done by following a path from the top of the hierarchy to each alternative at the lowest level and multiplying the weights along each segment of the path. The outcome of this aggregation is a normalized vector of the overall weights of the options. The reader interested in the mathematical aspects of this procedure is referred to Saaty (1996 & 2004).

AHP can be used to make relative measurements through paired comparisons of criteria and of alternatives as discussed above, or to make rating measurements of the alternatives with respect to the criteria. The ratings mode includes pairwise comparison of the criteria with respect to the goal. Then rating levels, such as excellent, very good, good, average, poor, and very poor, are specified for each criterion. Pairwise comparisons among the rating levels of each criterion are then conducted to yield a set of priorities (weights) for these levels. For each criterion, the rating level priorities are divided by the maximum rating weight of that criterion to yield scaled weights. Within each criterion, each alternative is assigned a rating level and the associated scaled weights. The final score of an alternative is the sum of the product of the criterion weights times the scaled weight with respect to that criterion, where the sum is taken across all the criteria (Saaty, 1996).

The ratings mode is used when the number of alternatives is large and decisions are standardized. The only requirement for the ratings mode is having expert knowledge to be able to compare rating levels with respect to certain criteria.

The AHP has two synthesis modes: distributive and ideal. In the distributive mode, one normalizes an alternative's scores under each criterion so that they sum to one. This leads to a dependency (on how well all other alternatives perform) that might cause rank reversal. In the ideal mode, one divides the score of each alternative by the score of the best alternative under each criterion, thus it preserving rank if unimportant alternatives are added or deleted. Decision makers must know which mode is appropriate for a particular problem. The decision maker must decide whether to preserve rank or not, which depends on the nature of the problem. Millet and Saaty (2000) provide the following guideline: use the distributive mode to determine the extent to which each alternative dominates all other alternatives under the criterion. Use the ideal mode to determine how well each alternative performs relative to a fixed benchmark. Experiments with the two methods, however, gave different results only eight percent of the time (Saaty and Vargas, 1993).

2.4 Consistency Versus Inconsistency

AHP provides decision makers with a useful way of checking and improving consistency. A by-product of solving the eigenvalue problem to measure priorities we obtain the principal eigenvalue, $\lambda_{max,}$ from which we can derive the consistency index (C.I.) as follows: C.I. = $(\lambda_{max} - n)/(n-1)$, where n is the order of the comparison matrix.

The measurement of consistency reflects whether the decision maker understands and captures the interactions among different factors of the problem or his decision is a matter of random hitting the target. However, perfect consistency is hard to achieve in real life problem solving. Saaty states "inconsistency must be precisely one order of magnitude less important than consistency, or simply 10% of the total concern with consistent measurement. If it were larger it would disrupt consistent measurement and if it were smaller it would make insignificant contribution to change in measurement" (Saaty 1996 & 2004, p: 9).

3. An Example of an AHP Decision

Consider a decision such as to choose the best city in which to live. We shall show how to make this decision using relative measurement method of the AHP. The criteria are pairwise compared with respect to the goal, the alternatives are pairwise compared with respect to each criterion and the results are synthesized or combined using a weighting and adding process to give an overall ranking of the alternatives.

The relative measurement model for picking the best city in which to live is shown below in Fig. 1.

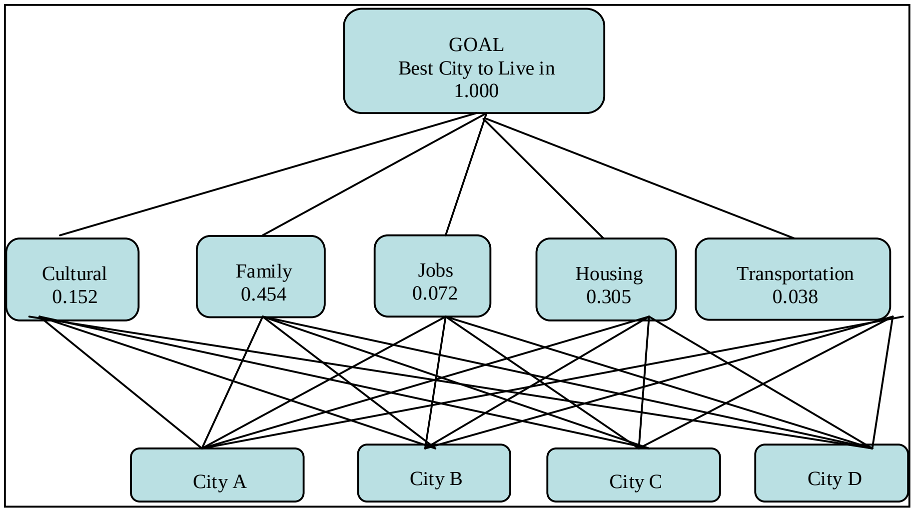

Fig. 1. relative model for choosing best city to live in.

3.1 Entering Judgments

For each cell in the comparison matrix there is associated a row criterion (listed on the left), call it X, and a column criterion (on the top), call it Y. One answers this question for the cell: How much more important is X than Y in choosing a best city in which to live? The judgments, shown in Table 2, are entered using the fundamental scale of the AHP. Fractional values between the integers such as 4.32 can also be used when they are known from measurement.

Table 2. Criteria weights with respect to the goal.

GOAL	Culture	Family	Housing	Jobs	Transportation	Priorities
Culture	1	1/5	3	1/2	5	0.152
Family	5	1	7	1	7	0.433
Housing	1/3	1/7	1	1/4	3	0.072
Job	2	1	4	1	7	0.305
Transportation	1/5	1/7	1/3	1/7	1	0.038

Inconsistency 0.05

3.2 The Number of Judgments and Consistency

In this decision, there are 10 judgments to be entered. As we shall see later, inconsistency for a judgment matrix can be computed as a function of its maximum eigenvalue l_{max} and the order n of the matrix. The time gained, from making fewer judgments than 10 along a spanning tree for example can be offset by not having sufficient redundancy in the judgments to fine tune and improve the overall outcome. There can be no inconsistency when the minimum number of judgments is used.

Next, the alternatives are pairwise compared with respect to each of the criteria. The judgments and the derived priorities for the alternatives are shown in Table 3. The priority vectors are the principal eigenvectors of the pairwise comparison matrices. They are in the distributive form, that is, they have been normalized by dividing each element of the principal eigenvector by the sum of its elements so that they sum to 1. The priority vectors can transformed to their idealized form by selecting the largest element in the vector and dividing all the elements by it so that it takes on the value 1, with the others proportionately less. The element (or elements) with a priority of one become the ideal(s).

Table 3. Alternatives' weights with respect to criteria.

Inconsistency .001

Culture	City A	City B	City C	City D	Priorities
City A	1	½	1	1/2	0.163
City B	2	1	2.5	1	0.345
City C	1	1/2.5	1	1/2.5	0.146
City D	2	1	2.5	1	0.345

Inconsistency .002

Family	City A	City B	City C	City D	Priorities
City A	1	2	1/3	4	0.210
City B	1	1	1/8	2	0.098
City C	3	8	1	9	0.635
City D	1/4	½	1/9	1	0.057

Inconsistency .012

Housing	City A	City B	City C	City D	Priorities
City A	1	5	1/2	2.5	0.262
City B	1/5	1	1/9	1/4	0.047
City C	2	9	1	7	0.571
City D	1/2.5	4	1/7	1	0.120

Inconsistency .012

Jobs	City A	City B	City C	City D	Priorities
City A	1	1/2	3	4	0.279
City B	2	1	6	8	0.559
City C	1/3	1/6	1	1	0.087
City D	1/4	1/8	1	1	0.075

Inconsistency .004

Transportation	City A	City B	City C	City D	Priorities
City A	1	1.5	1/2	4	0.249
City B	1/1.5	1	1/3.5	2.5	0.157
City C	2	3.5	1	9	0.533
City D	1/4	1/2.5	1/9	1	0.061

3.3 Synthesis

The outcome is shown in Table 4. The columns in Table 4 are the priority vectors for the cities from table 3 with respect to each criterion. The totals vector is obtained by multiplying the priority of each criterion times the priority of each alternative with respect to it and summing. The overall priority vector is obtained from the totals vector by normalizing: dividing each element in the totals vector by the sum of its elements. The final outcome of synthesis is that City C is the highest ranked city for this individual. The ratios of the final priorities are meaningful. City C is almost twice as preferred as City A.

Table 4. Synthesis using the distributive mode to obtain the overall priorities for the alternatives.

<u>Synthesis</u>	Cultural 0.152	Family 0.433	Housing 0.072	Jobs 0.305	Transport 0.038	Totals (Weight and add)	Overall Priorities (Normalize Totals)
City A	0.163	0.210	0.262	0.279	0.249	0.229	0.229
City B	0.345	0.098	0.047	0.559	0.157	0.275	0.275
City C	0.146	0.635	0.571	0.087	0.533	0.385	0.385
City D	0.345	0.057	0.120	0.075	0.061	0.111	0.111

4. Group Decision Making

The traditional way to perform such a task is to use an ordinal scale. Each member would simply assign numbers to rank the alternative candidates with respect to a given set of criteria, and then they would calculate the average for each candidate. Nevertheless, “Kenneth Arrow, who won the Nobel Prize for his work, proved the impossibility of fairly representing consensus in a democratic society if the preferences are represented in terms of ordinals” (Saaty 2001).

At least one of the following conditions will be violated:

a) Decisiveness: the aggregation procedure must generally produce a group order.

b) Unanimity: if all individuals prefer alternative A to alternative B, then the aggregation procedure must produce a group order indicating that the group prefers A to B.

c) Independence of irrelevant alternatives: given two sets of alternatives which both include A and B, if all individuals prefer A to B in both sets, then the aggregation procedure must produce a group order indicating that the group, given any of the two sets of alternatives, prefers A to B.

d) No dictator: no single individual preferences determine the group order.

The AHP considers two issues in group decision making:

1- How to aggregate individual judgments:

The reciprocal property plays an important role in combining the judgments of several individuals to obtain a judgment for a group. Judgments must be combined so that the reciprocal of the synthesized judgments must be equal to the syntheses of the reciprocals of these judgments. It has been proved that the geometric mean is the unique way to do that. If the individuals are experts, they my not wish to combine their judgments but only their final outcome from a hierarchy. In that case, one takes the geometric mean of the final outcomes. If the individuals have different priorities of importance, their judgments (final outcomes) are raised to the power of their priorities and then the geometric mean is formed. A detailed demonist ration of the application of AHP in group decision-making setting can be found in Bahurmoz, 1999 and a real life application is given in Bahurmoz 2003.

2- How to construct a group choice from individual choices:

Using the ratio scale approach of the AHP it can be shown that because now the individual preferences are cardinal rather than ordinal, it is possible to derive a rational group choice satisfying Arrow's four conditions mentioned above. It is possible because:

a) Individual priority scales can always be derived from a set of pairwise cardinal preference judgments as long as they form at least a minimal spanning tree in the completely connected graph of the elements being compared;
b) The cardinal preference judgments associated with group choice belong to an absolute scale that represents the relative intensity of the group preferences. (Saaty & Vargas, 2003).

5. AHP and Win-Win Management

Win/win is simply about positive conflict resolution. Conflict is said to be healthy when it brings about new ideas and strengthen rather than damages relationships. This requires dealing with conflict on win/win basis and not on win /lose basis. Conflict resolution is required when there are two parties in a conflict and involve a decision making process. However, it is different from group decision making where members of the group have common goal but different values for their criteria while conflict teams have conflicting objectives. Arbitrary procedures usually lead to a solution that involves risk to one of the parties in conflict. Such situation will call for negotiation. The purpose of the negotiation is to propose a satisfactory solution for both parties, based on some compensatory basis. This means that some loss in one dimension may be compensated by some gain in another one, namely, achieving a solution with no pains to either party. If this is the case, then AHP is a sound technique to practice win/ win management.

Saaty (1996) suggested implementing The AHP to address conflict resolution. The judgments used are those of the parties. The process make it possible to vary the judgments from the most optimistic to the most pessimistic to show the parties what possible outcomes can be achieved and what responses are available to them to press a point or to check excessive demands made by the opposition. It makes possible to point out significant difference and to learn where tradeoffs can be made on other issues on the hierarchy that may be important to one party but not to another. Among many examples that illustrate solutions to such problems is conflict in Northern Ireland and in The Middle East.

It was demonstrated that the application of the AHP to a typical case of conflict that raise in the discussion of labor union contracts. They proposed a general formulation based on AHP and multiattribute utility theory. The optimal solution was far better than the one reached through regular negotiation process and the solution was found in a shorter time.

Most win/win software systems include the AHP as a helping tool, either alone or combined with other quantitative methods. For example, Quantitative Win Win for decision support is an approach uses the AHP for a stepwise determination of the stakeholders' preferences in quantitative terms. Quantitative WinWin offers decision for selecting the most appropriate requirements based on the preferences of the stakeholders, the business value of the requirements and a given maximum development effort. (Gunther *et al.*, 2002).

6. Advantages of Implementing the AHP

Its practical nature and its suitability for solving complicated and elusive decision problems have made it the subject of a huge body of research. AHP has been applied in a wide variety of decision areas including those related to economy, planning, energy policy, health, conflict resolution, project selection, budget allocation (Zahidi, 1985), operations management (Partovi *et al.*, 1990), benchmarking (Eyrich, 1991), total quality management, win-win management (Gunther *et al.*, 2002), site selection, and education (Bahurmoz, 1999 & 2003). In addition to being used alone, the AHP has been combined with a number of quantitative analysis techniques such as linear programming, goal programming, Data Envelopment Analysis, game theory, conjoint analysis and SWOT analysis (ISAHP 1999 & 2001).

A series of international symposiums addressing the development of the AHP methodology, its extension and its applications have been organized periodically, since 1988. The crucial contribution of the AHP is that it enables us to make practical decisions based on a "pre-causal" understanding-namely, on our feelings and judgments about the relative impact of one variable on another (Saaty, 2000).

In what follows are just few examples as reported in the literature by researchers and practitioners and far from being comprehensive:

I. Narasimhan (1983) who implemented the AHP methodology in supplier selection outlines the following benefits of using AHP:

1) It formalizes and makes systematic what is largely a subjective decision process and thereby facilitates "accurate" judgments.
2) As a by-product of the method, management receives information about the evaluation criteria's implicit weights;
3) The use of computers makes it possible to conduct sensitivity analysis of the results.

II. Wu & Wu (1984) adapted the AHP technique for the selection of the best single plant location reported:

1) AHP is an effective management tool. It can handle many alternatives at one time and so permit comparisons to be made. Other popular techniques, such as the Relative Merit Method or Dimensional Analysis, can only handle two alternatives at a time.

2) The AHP can handle complex situations where different weights are assigned to the same attributes. Judges' opinions may vary when determining how important an attribute is. Also, a weight could be assigned to the Judges' authority in the decision-making process. For instances, the President of a firm may have more say than the Vice President. Therefore, his opinion can be weighted at 0.65 and the Vice President's at 0.35. This rationale could also be applied to several stockholders.

III. Hedge and Tadikamalla, 1990, implemented the AHP in site selection in reported that when they first presented a workshop on the mechanics of AHP, the management embraced the idea of using this method of analysis. Several factors that made management embraced the idea of using AHP:

1. They were used to seeing numbers and recommendations come out of a 'black box'. Here was a method they could both understand and participate in.
2. They were not asked to supply monetary values for either the tangible or intangible attributes. This was to the relief of the managers who had always been asked to supply a host of data whenever a consulting team arrived in the past.
3. The inclusion of the managers at every step of the decision analysis in the AHP method gave them a feeling of ownership that nearly insured the implementation of the findings.

IV. An important benefit of the AHP should be its formal approach for achieving consensus on the various evaluation factors and their influence on the final ranking decisions. This, in turn, should allow the committee members to reach agreement with much less effort. (Libertore *et al.*, 1992).

V. Carlsson & Walden, 1995, who implemented the AHP in political group decision, cited few advantages:

1. It permits users to collect all the relevant elements of the problem into one model and then to interactively work out their interdependencies and their perceived consequences. Frequently, users noted that it was the first time they actually had an overall consistent idea of problem in question and that they had been able to work through all the factors and to find out their relative importance and their consequences.
2. The hierarchy used in the AHP proved to be useful in structuring the problem. Most of the time decision makers have difficulty deciding which factors are important, and using a hierarchy quickly proved very effective.
3. The AHP's reliance on the pairwise comparisons forces AHP users to articulate the relative importance of criteria and then to decide the relative contributions of the alternatives of the criteria.
4. Inconsistency measure helped users to know when they made inconsistent judgments, especially if they are working as a group. People want to be logically consistent in making decisions, especially regarding politically sensitive issues that have been the target of heated public debate. Users can

take care to be consistent, by repeatedly work through their inconsistent judgments until they obtain acceptable results.

5. Sophistication and user-friendliness of the Expert Choice software enabled an AHP-user to build quickly a model of a multi-criteria decision problem. The software summarizes all the comparisons and works out a synthesis over all the criteria; this synthesis is used to rank the decision alternative over all the criteria. Group members found this features very useful; in their experience, summing up a group session and reaching some consensus on what had been achieved is usually a very demanding task; they found it hard to reach agreement, and skillful group players can manipulate the results. They found the summary given by Expert Choice objective and a true representation of their session. The synthesis was printed out in seconds, so that the participants had their deliberations documented right after the session. The added feature of a sensitivity analysis also proved useful, the sensitivity analysis explained why some alternatives are dominant.

VI. The AHP also provides the objective mathematics needed to process the inescapably subjective and personal preferences of individuals or groups in making a decision. It is well suited to decisions in which the criteria are qualitative and have a large subjective component, thus requiring judgments. It can accommodate some of the behavioral and political factors that influence the decision process. (Bahurmoz, 2003).

VII. Using AHP in group setting results in better communication, leading to clearer understanding and consensus among the members of decision making group, and hence a greater commitment to the chosen alternative (Bahurmoz, 2003).

7. Conclusion

To summarize, the AHP is a very handy tool for managers in many fields, social, political as well as economical and business sectors. It has been shown how the AHP works. A thorough review of its concept and how many managerial areas can benefit from the AHP in making valid decisions when data are scarce or there is variety of criteria qualitative and quantitative and/or there are many actors or more than one decision maker. Managers and decision makers facing difficult choices amongst often-complex alternatives would benefit greatly from learning and using this technique.

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عملية التحليل الهرمي: المنهج الإداري الهادف إلى فوز جميع الأطراف

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أستاذ مشارك - قسم إدارة الأعمال - كلية الاقتصاد والإدارة
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المستخلص. تهدف جهود حل النـزاعات (الخلافات) إلى الوصول إلى نتيجة تمثل بالنسبة لبعض الأطراف المشاركة تحسناً في وضعهم الحالي، بينما بالنسبة للأطراف غير المشاركة قد يزداد الأمر سوءًا. إن المحاولات الجماعية في اتخاذ القرارات غالباً ما تؤدي إلى حدوث خلافات في الرؤية الصحيحة، خاصةً عندما يتعلق الأمر بمشكلة عصية التشكيل و تتضمن استخدام معايير كمية ونوعية. ويواجه المديرون التنفيذيون المعاصرون مشاكل يومية تحتوي على واحده أو أكثر من هذه العناصر، لذا فإنهم يحتاجون أدوات علمية، وفي نفس الوقت عملية، لمساعدتهم في اتخاذ القرارات الصائبة. يهدف هذا البحث إلى شرح طريقة (التحليل الهرمي) التي طورت من قبل. وتتميز هذه الطريقة في أنها أداة فعالة لاتخاذ القرار على مستوى الإدارة التنفيذية. وتعالج هذه الطريقة ثلاثة جوانب في اتخاذ القرار الإداري: تعدد المعايير واتخاذ القرار الجماعي وحل المنازعات. يقوم هذا البحث بشرح مفهوم (التحليل الهرمي) وكيفية استخدامه وأمثلة عملية لهذا الاستخدام، إضافة إلى المزايا المكتسبة من تطبيقية.