Synthesis of Complex Criteria Decision Making:
A Case Towards a Consensus Agreement for a Middle East Conflict Resolution

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1. INTRODUCTION

The title of this paper reflects both the process and the outcome of the current undertaking. Frustrated with the current state of the Middle East but encouraged by earlier attempts at modeling complex problems, the authors participated in a panel discussion assembled to address the conflict and propose a possible road-map to peace. However, the participants of this project did not come to a single course of action that will result in peace in the Middle East but did reach a consensus agreement about a resolution that needs to be managed. This paper explores the process, the outcome and the factors that influence the decision as well as potential pitfalls. The Analytic Network Process (ANP), a well known multicriteria decision making approach, applied frequently in recent years to examine conflicts around the world, is used in this analysis. It provides a framework for synthesizing judgments on the diverse aspects of the problem represented in the structure of the decision. It pieces together these judgments in a holistic and logical way. Why do such a study when numerous others have been made and failed? Because the ANP methodology takes into consideration all of the factors that are difficult for other methodologies to take into consideration in a sufficiently refined way based on an accurate and valid representation of not the judgments themselves but their intensities and hence this study is unlike any other conducted before.

2. BACKGROUND

The Middle East conflict is not a series of wars tending toward peace, but a state of continued belligerency interrupted by war. It is not a single isolated problem to be solved but a system of people with conflicting aspirations. Physically, the problem is geographic with two parties desiring the same piece of land, but its origins are deeply rooted in people's beliefs and in their attachments to a land consecrated by their great religions. There are claims made by these people of rights to live in the land and to have a state to maintain an identity. The problem is greatly compounded by widespread activities in the area, to include arms supply, cause support and the development of vested interests, thereby placing the problem in a complex global framework. Although one might expect that the global framework might accelerate a solution, in fact it complicates it due to the diversity of each participant's interests. Hence, a solution has eluded the global community. The Israeli-Palestinian conflict continues to plague the Middle East and threaten stability, not just regionally, but also globally by inciting some terrorist claims. Despite the best efforts of diplomats and world leaders, a satisfactory resolution has not emerged. Hence, it is with some degree of hubris that we present a solution that we expect will outperform other efforts. What we suggest is a holistic model that explores feedback from various criteria and input from key constituents.

Peace is almost always secured through accommodation, bargaining, and compromise – even after an overwhelming victory is obtained by one side. Our approach utilizes the Analytic Network Process, because it fits the realism in eliciting and capturing the intensity of judgments regarding the dominance of some factors over other factors, the synthesis of group judgments, and the performance of sensitivity analysis for the stability of the outcome. The study involved a mixed group of Palestinians, knowledgeable pro-Israeli experts, and others from the outside, like Saudi Arabia, Turkey, China and the US.

Over a three day period, the panel structured the problem, defined the constituents and developed several potential alternatives. The process was not without conflict and negotiation of its own. At times, the

panel differed on various definitions, on the structure of the model, and on the potential solutions. However, there was nearly always unanimous agreement on the nature of the conflict, with little debate within either side about the underlying concerns or where the power and influence belonged that could bring about termination of a 58 year old confrontation. Similarly, there was practically no problem in identifying the key constituents. However, since the beginning of the conflict, leaders and others have proposed many alternatives solutions. These influenced the perception of the participants in regard to potential alternatives. In fact, one person suggested that the participants could have difficulty "thinking outside the box." He thought that the group was so influenced by previous attempts that they experienced difficulty in conceptualizing 'creative' alternatives that had not been proposed previously.

What follows is a brief account of the method employed, the model, the structure of the problem as a decision with benefits, opportunities, costs and risks and how comparisons were made in the analysis of the outcomes, recommendations for implementation, summary, and recommendations for getting others to look at the problem in this integrated and comprehensive framework.

3. METHODOLOGY

In making a decision, we need to distinguish between the hierarchic and the network structures that we use to represent that decision. In a hierarchy we have levels arranged in a descending order of importance. The elements in each level are compared according to dominance or influence with respect to the elements in the level immediately above that level. The arrows descend downwards from the goal even if influence, which is a kind of service, is sought for in elements in lower levels that contribute to the well-being and success of elements in higher levels. We can interpret the downward pointing of the arrows as a process of stimulating the influence of the elements in the lower level on those in the level above.

In a network, the components (counterparts of levels in a hierarchy) are not arranged in any particular order, but are connected as appropriate in pairs with directed lines. Again an arrow points from one component to another to simulate the influence of the elements of the second component on those in the first. The pairwise comparisons of elements in a component are made according to the dominance of influence of each member of a pair on an element in the same or in another component. Influence may be evaluated in terms of importance, preference or likelihood.

In addition, in a network, the system of components may be regarded as elements that interact and influence each other with respect to a criterion or attribute that is outside the system of influences. That attribute itself must be of a higher order of complexity than the components and thus of higher order than the elements contained in the components. We call such an attribute a control criterion. Thus even in a network, there is a hierarchic structure that lists control criteria above the networks. Also, in any decision one expects to consider favorable and unfavorable concerns. Some are sure things, others are less certain and have a likelihood of materializing. The sure concerns are called Benefits and Costs, while the uncertain concerns are called Opportunities and Risks. We refer to the four concerns collectively as BOCR. For each of the four BOCR merits we have a system of control criteria that we use to assess influence. The result is that such control criteria and/or their subcriteria serve as the basis for all comparisons made under them, both for the components and for the elements in these components. In a hierarchy one does not compare levels according to influence because they are already arranged in a predetermined order of importance from top to bottom. The criteria for comparisons are either included in a level, or more often implicitly replaced by using the idea of "importance, preference or likelihood" with respect to the goal, without being more finely detailed about what kind of importance it is. The control criteria for comparisons in a network are intended to be explicit about the importance of the influence that they represent.

In a hierarchy, we ask the question for making a comparison, which of two elements is more dominant or has more influence (or in the opposite sense is influenced more) with respect to a certain element in the level above? In a network we ask, which of two elements is more dominant in influencing another element

in the same or in another component with respect to a control criterion? **In both hierarchies and networks the sense of having influence or being influenced must be maintained in the entire analysis**; the two should not be mixed together.

The ANP frees us from the burden of ordering the components in the form of a directed chain as in a hierarchy. We can represent any decision as a directed network. While the Analytic Hierarchy Process (AHP) has a visibly better structure that derives from a strict understanding of the flow of influence, the ANP allows the structure to develop more naturally, and therefore is a better way to describe faithfully what can happen in the real world. These observations lead us to conclude that hierarchic decisions, because of imposed structure are likely to be more subjective, dependent on expert knowledge and predetermined. Further, by including dependence and feedback and by cycling their influence with the supermatrix, the ANP is more objective and more likely to capture what happens in the real world. It does things that the mind cannot do in a precise and thorough way. Putting the two observations together, the ANP is likely to be a strongly more effective decision-making tool in practice than the AHP.

The ANP has a four phase structure of complex decisions: (1) *the hierarchies or networks of influences* and "objective" facts that make one alternative of the decision more desirable than another for each of the control criteria under the BOCR merits; (2) pairwise comparisons of the elements in each component according to inner or outer influences and derivation of the priorities of the elements and then also of the component of these elements according to their influence on each components to make the supermatrices of priority vectors stochastic and raise it to limiting powers; (3) *a relatively subjective value system for evaluating whether or not to make a decision and if it is made what the different priorities of each of the BOCR merits are* used to combine the four outcomes and obtain an overall ranking of the alternatives; and (4) sensitivity analysis to determine the stability of the best outcome subject to perturbations in judgments . In each of these phases there are major concerns that are subdivided into less major ones and these in turn into still smaller ones. Knowledge about the level of subjective values where one must use the absolute mode of measurement of the AHP can be enriched by information from what goes before it, but does not depend on them for its priorities. It provides the intensities on which the BOCR merits are rated one at a time and then normalized. This level cannot be conveniently integrated into a single structure with the other two that precede it, and thus it appears that most decisions, despite their use of network structure due to the subjective thinking involved, are embedded in a higher order hierarchic structure. A decision may involve three or four adjacent ranges of homogeneous elements in each to represent personal values (Maslow put them into seven groups). Roughly speaking, we have lumped them in decreasing order of importance: 1) Survival, health, security, family, friends and basic religious beliefs some people were known to die for; 2) Career, education, productivity and lifestyle; 3) Political and social beliefs and activities; 4) Philosophical thoughts and ideas and things that are changeable, and it does not matter exactly how one advocates or uses them. There are similar values for a group, a corporation, a country and for the entire world as represented for example by the United Nations.

In sum, the ANP provides:

1) A methodical approach that is useful for making it possible for different individuals and groups to provide and combine their judgments according to their own importance, which is included in the judgments. Although both theory and software can do it, in this exercise consensus was used to record each pairwise comparison judgment;

2) A structure to represent all the elements of the problem proposed by anyone present or known from other sources so that nothing is left out because of complexity. The comprehensive structure puts people at ease that nothing is hidden or left out. It facilitates agreement on the judgments used to derive the best alternative outcome;

3) The stability of the outcome to possible changes or future threats. (For further details on the AHP/ANP methodology readers are referred to: Saaty, 1999, 2001, 2005).

4. Structuring the ANP Model for the Middle East Conflict Resolution

We defined the problem as an attempt to understand what forces and influences, because of their relative importance, would implicitly drive the outcome towards a consensus peace accord for the conflict between Israel and the Palestinians. To accomplish this task, a panel of 8 individuals was assembled to represent a cross section of people: international thinking representatives (3), Israeli thinking representatives (2), a Palestinian (1) and Muslim thinking representatives (3). In most cases, the individuals crossed the various categories and interests and did not fall into discrete separate groups. It was recognized that the panel did not represent a valid cross-sample or that the size of the panel was adequate to represent the different population sizes involved. It was agreed that the work is exploratory in nature, intended to demonstrate how the method can be used over a short period of time to arrive at a reasonable solution that is not outlandish to any of the sides.

It was agreed by all participants that no part of the decision would be done without consensus agreement whether it is what to add or delete from the model or to make or not make comparison judgments on low priority criteria in order to save time to arrive at an answer in three days. It was justified to do that because it was clear that such factors and their contributing judgments were not worth the effort. It was the role of the moderator to facilitate the process and ensure that all parties agreed before moving on to the next step in the process. However, the moderator made no contribution to the agreement but facilitated mutual understanding among the participants. Since pairwise comparisons are made in the prioritization stage of the ANP, it is critical that all parties understand the definitions of the terms used. Moreover, as illustrated later in the paper, many questions about what dominated what with respect to a certain factor and how strongly it dominated it was often difficult to understand and even more difficult to conceptualize in practice. Hence, many of the questions were developed at length and repeatedly until they were well understood by all. This underscores the specific nature of the Middle East conflict and the necessity for consensus. Language and understanding matter!

To ensure mutual understanding, the moderator needed to track the events on a screen projected for the participants and to use an additional measure to track the questions that were currently under consideration. In addition, the moderator maintained on the first screen the following items:

1) The software used for the ANP model;

2) Documentation of the definitions, terms and criteria agreed upon;

3) Notes on the ‘process’ and the steps taken to reach consensus;

4) Agenda.

Although the level of detail and effort taken to document the process seemed excessive at first, it was clear from the start that not only were the initial steps taken helpful but they had to be augmented further. The augmentation included the use of other visualization tools in order to gain consensus. Hence, the steps taken to document the panel’s efforts are a nontrivial event. In fact, the use of the various ‘tools’ were necessary on multiple occasions to overcome objections. We believe that without these various tools, the group would have experienced greater hardships in reaching consensus.

As mentioned above, at no point in the development and evaluation of the problem was the process easy and we caution against the belief that this was anyone’s intention. In fact, the “purpose” of the exercise was not easily agreed upon and on several occasions in the three days over which the panel met, the question about the purpose of the exercise was repeatedly readdressed. The panel agreed that its goal was to move toward a consensus agreement for what outcome is the best resolution of the Middle East Conflict. The group looked at the purpose of the project from various perspectives. First, the panel suggested that potential definitions for the panel’s purpose could include:

- Peace in the region;
- Impact on global peace;
- Recognition of defined borders;
- Long-term future stability.

It was also recognized that there is an equally legitimate claim to view the problem from the vantage point of a more extremist Palestinian whose goals might include:

- Let them return (the Israelis) to where they came from;
- Right to return that creates a Palestinian majority;
- Allocation of natural resources including land;
- Infiltration of patriots - 'terrorists';
- Elimination of Israeli nuclear threat.

Finally, one might take the position of more extremist Israeli views whose goals might include:

- Status quo; Palestinians remain squeezed into small territories with restricted movement;
- Deport all Palestinians;
- Continued control of all resources;
- NO pro-Palestinian country should be able neutralize Israel's nuclear power.

After considerable discussion and we overly compress the process here, the panel agreed that any resolution is a process that requires consensus and it is consensus "buy-in" that encourages participation of all constituents.

Agreement on the 'purpose' of the panel was not the only portion of the model that needed some dialogue. In fact, every step along the 'process' required negotiation and consensus. Several ways were proposed within the panel about how to construct the model and develop the issues. It was agreed that any solution would have benefits, opportunities, costs and risks (BOCR). However, it was not as easy for the panel to agree on the strategic criteria in terms of which they would evaluate and synthesize.

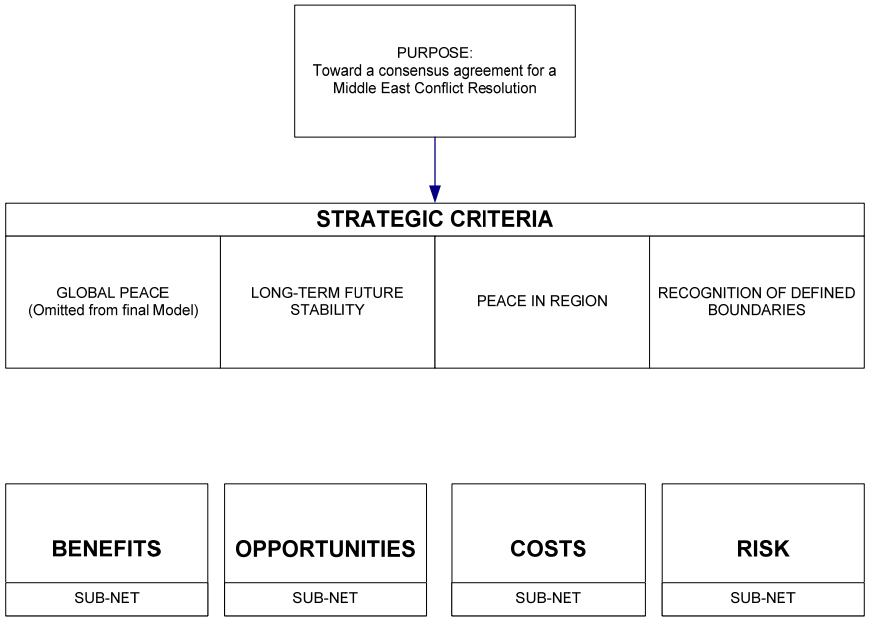

Figure 1 The ANP Main Top-level Structure for the Middle East Conflict Resolution model

The Strategic Criteria used to evaluate the BOCR are representative of the impact that a selected alternative would have on Global Peace, Long-Term Stability, Peace in the Region, and Recognition of Defined Boundaries. Although the panel selected the four strategic criteria in Figure 1, they later agreed that Global Peace should be removed from the comparisons since stability and regional peace are believed to be strongly correlated with Global Peace.

While the strategic criteria and their meanings were still fresh and prior to moving into the development of the BOCR sub-networks (subnets), the panel evaluated the Strategic Criteria with respect to the purpose of the undertaking. The results of the comparisons are shown in Section 5, Prioritization. However, we believe that it is useful to detail the nature of the comparison for the Strategic Criteria at this point in order to mirror the efforts and document the methodology that we used in this case. The panel was presented with the pairwise comparisons of the four Strategic Criteria with the following questions involving pairs of criteria: "Which factors contribute more strongly and how much more strongly to resolving the conflict in the Middle East according to the desire of all the parties for 1) Global Peace or for Long-Term Future Stability in the Region, 2) Global peace or Peace in Region, 3) Global Peace or Recognition of Defined Boundaries, 4) Long-Term Future Stability or Peace in Region, 5) Long-Term Future Stability or Recognition of Defined Boundaries and finally 6) Peace in Region or Recognition of Defined Boundaries? Because Global Peace was eliminated, only the last three comparisons were made. Now we consider what numbers to use to express the judgments about dominance. Physics depends on measurements and on experts to interpret the meanings of those measurements. The ANP depends on individuals in each decision problem to represent what they think the people involved prefer or think is more important in that decision. The Fundamental scale of absolute numbers to represent the judgments is shown in Table 1.

Intensity of Importance	Definition	Explanation
1	Equal Importance	Two activities contribute equally to the objective
3	Moderate importance	Experience and judgment slightly favor one activity over another
5	Strong importance	Experience and judgment strongly favor one activity over another
7	Very strong or demonstrated importance	An activity is favored very strongly over another; its dominance demonstrated in practice
9	Extreme importance	The evidence favoring one activity over another is of the highest possible order of affirmation
2,4,6,8	For compromise between the above values	Sometimes one needs to interpolate a compromise judgment numerically because there is no good word to describe it.
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 comparison mandated by choosing the smaller element as the unit to estimate the larger one as a multiple of that unit.

Rationals	Ratios arising from the scale	If consistency were to be forced by obtaining *n* numerical values to span the matrix
1.1-1.9	For tied activities	When elements are close and nearly indistinguishable; moderate is 1.3 and extreme is 1.9.

Table 1: The Fundamental Scale

The numbers used in this scale are absolute and not ordinal numbers. To say that one thing is five times more important than another is a much stronger and meaningful statement than just to assign a number conveniently to it. The number cannot be changed to another number and still convey the same sense. The idea is that in the hands of an expert in a given area, one can obtain by using the judgments of that expert or experts a relative scale of values that is close to the actual relative values were there an underlying relative scale of measurement for those values. More examples which show that the scale works well to capture people's strength of judgments in making pairwise comparisons are given in Appendix 1. Let us illustrate for our problem by entering numbers from the scale in answering the first three questions asked above.

Figure 2 represents a sample of how the software package structures the comparison between the importances of the Figure 2 Strategic Criteria Questionnaire

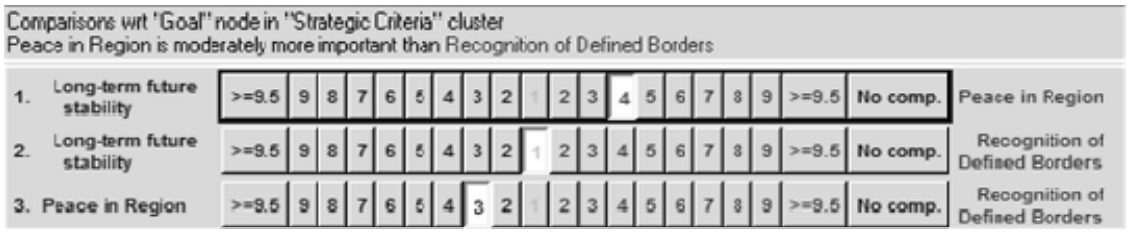

Figure 2 Strategic Criteria Questionnaire

Merits

Returning to our conflict problem, the top-level structure has the four Benefits/Opportunities/Costs/Risks (BOCR) merits and their sub criteria shown in Figure 1 which represents the total initial model. Some of the nodes in both the Strategic Criteria and the subordinate networks of the BOCR were eliminated after the initial ratings due to the level of insignificant contributions that they added to the overall result because of their low priorities as compared with the other factors. The subnets under each of the four BOCR merits were developed independently. The benefits and costs were conceptualized as the short-term or internal aspects of the alternative evaluation while the opportunities and risks were thought of as those elements that have long-term influences.

The Benefits Subnet: benefits are defined as the short-term gains that any group might experience given the criteria below.

- *Economic Status* in this network is defined as the short-term potential gains that might be realized given the implementation of one of the alternatives.
- *Human Rights* are defined as the short-term improvements in how the United Nations state what constitutes basic human liberties / freedoms.
- *Safeguard the oil supply* is defined as the incremental stability to the consistent delivery of oil; i.e. limited disruption to oil production.
- *Saves Lives* is defined as the reduction in the loss of lives.
- *Standard of Living* is defined as the incremental improvement for overall living conditions.

In the initial phases of developing the model, the panel faced the challenge to build a 'robust' model that includes all the criteria that they felt were important to accurately reflect those elements that would be important to reach a resolution. With respect to the short-term gains that might be realized by the constituents, the foregoing five criteria are the full set of short-term benefits necessary to realize a full benefits model. As the panel developed the connections among the various nodes in the cluster, they reached a consensus that not all five of the nodes were essential. *Economic Status* and *Human Rights* were retained, but it was believed that *Saves Lives* and *Standard of Living* were subsumed under them. *Safeguarding the oil supply* was not a valid criterion for the benefits network. In addition, the model provided legitimacy for what the members of the panel felt intuitively; the two excluded criteria were not significant to the model. In fact at first the two deleted criteria were included and were omitted after their priorities turned out to be very low in relation to the other three criteria.

The Benefits subnet is shown in Figure 3 as a sample of what the subnets under the BOCR model look like. The circular arrow shown in Figure 3 represents the fact that the "Constituents" cluster has feedback within the cluster. The implication of feedback within the alternative cluster is that each of the various constituents within this cluster influences the others within the cluster. For instance, a decision made by one party in the cluster influences the other parties in that cluster so that a movement toward peace by the Israelis and the Palestinians for example would have positive implications for both the United States and 'Others'. More detail about the implications of feedback and dependency will be discussed in the findings section of the paper.

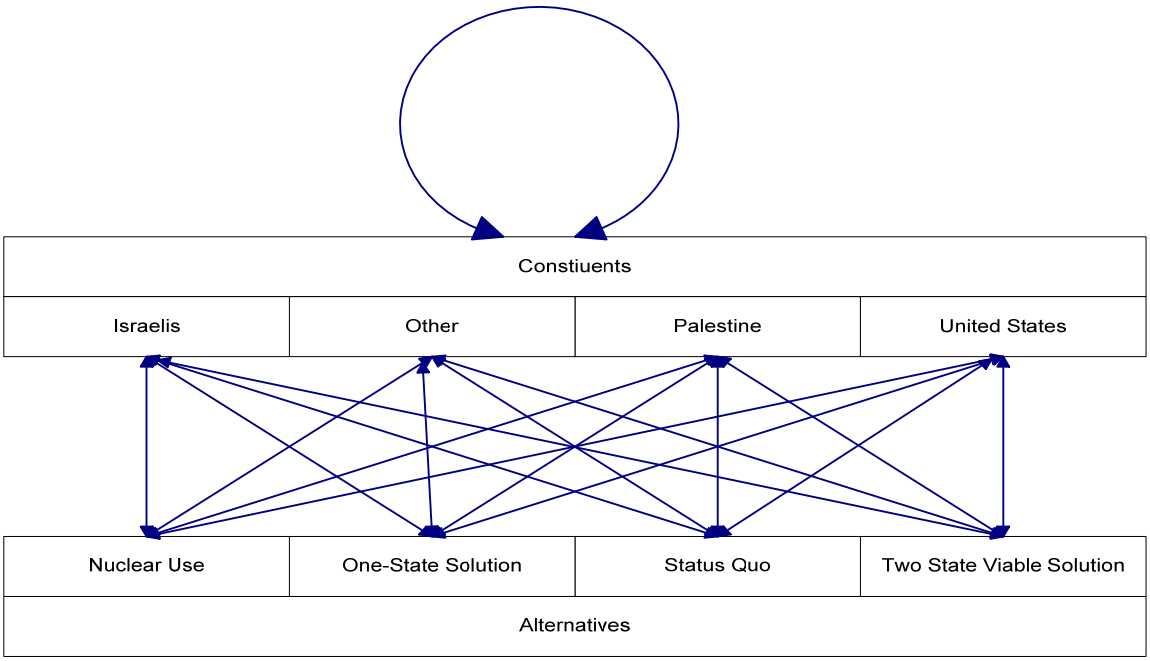

Figure 3 Benefits Subnetwork

b. The Costs Subnet represents the short-term expenses and pains incurred by the constituents.

- *Arms industry* includes those costs that would be experienced by the arms industries through either loss of income or additional limitations to trade / sale placed on suppliers.

- *Internal chaos in Israel* is the attempt to capture the 'price' paid for disruption to lives that may be realized through the selection of any resolution alternative.
- *Making sacrifices* identifies the real expense incurred through both monetary and non-monetary forfeitures that may be incurred through any one of the various alternatives.
- *Relocation / dislocation* node represents the real expense of dislocation caused by the option of any one of the alternatives.
- *Reparations* are the price that would need to be paid for conciliatory actions.

The panel used the same process for the Costs subnets that they used for the Benefits subnet. Once the initial comparisons were made, the *Arms Industry* and *Relocation / Dislocation* were omitted since these two criteria accounted for insignificant priorities. The two omissions are not surprising since *Relocation* was captured by the *Reparations* criteria and the costs to the *Arms industry* are significantly outweighed by the potential costs of the other criteria.

c. The Opportunities Subnet is the long-term positive potentials that exist for the constituents.

- *Global Stability* is the opportunity for greater stability throughout the world in order to foster a secure environment.
- *Regional Stability* focuses on the regional stability surrounding the immediate parties to the conflict.
- *Return 'home'* represents the right of return for all displaced parties.
- *Safeguard the oil supply* refers to the long-term safety to the global distribution of oil.

The panel went through similar efforts in the Opportunities subnet as they did with the Benefits subnet. In the initial development of this subnet, four criteria were included as given above; the final model only contained *Regional Stability* and *Return 'home'*. Once again, *Safeguard the oil supply* was not deemed appropriate for the final consideration due to its low priority.

d. The Risk Subnet

- *'Wrong' people return* is the risk that the people who would return under the right to return option will be subversive types looking to incite further disruption instead of the type who want to foster a *sensus communitas*.
- *Further increase in radicalism* is the risk that selection of any one of the alternatives would lead to an increase in radical activities.
- *Further instability in region* is the potential of an alternative to lead to increased instability via continued fighting.
- *Limited longevity that promotes return to conflict* refers to the fact that an alternative, if opted for, may not be viable for long-term. Hence, the probability that it returns to a state of conflict may increase the problem since it may be seen as a continued failures of the leadership to implement a resolution.

Under the Risk subnet, only *'Wrong' people return* had sufficiently low priority to delete it from the model; the remaining criteria were maintained throughout the analysis.

Figure 4 summarizes the BOCR merits networks. In other words, it highlights both the short-term and long-term aspects of the model as well as the gains and loses that impact the alternatives.

Each of the criteria in Figure 4 under the BOCR merits model was evaluated with respect to the various constituents that influence the outcome of the model. Figure 5 illustrates the network of the various constituents. The constituent network captures the feedback and interdependence among the various parties. Although it may appear intuitive that choices made by Israel impact the Palestinians, the nature of

the feedback and dependence involving the other parties (the U.S., Arabs, Muslims and the rest of the world) was not adequately understood until implemented in the model. The outcome of the dynamics between the various constituents is further explored below.

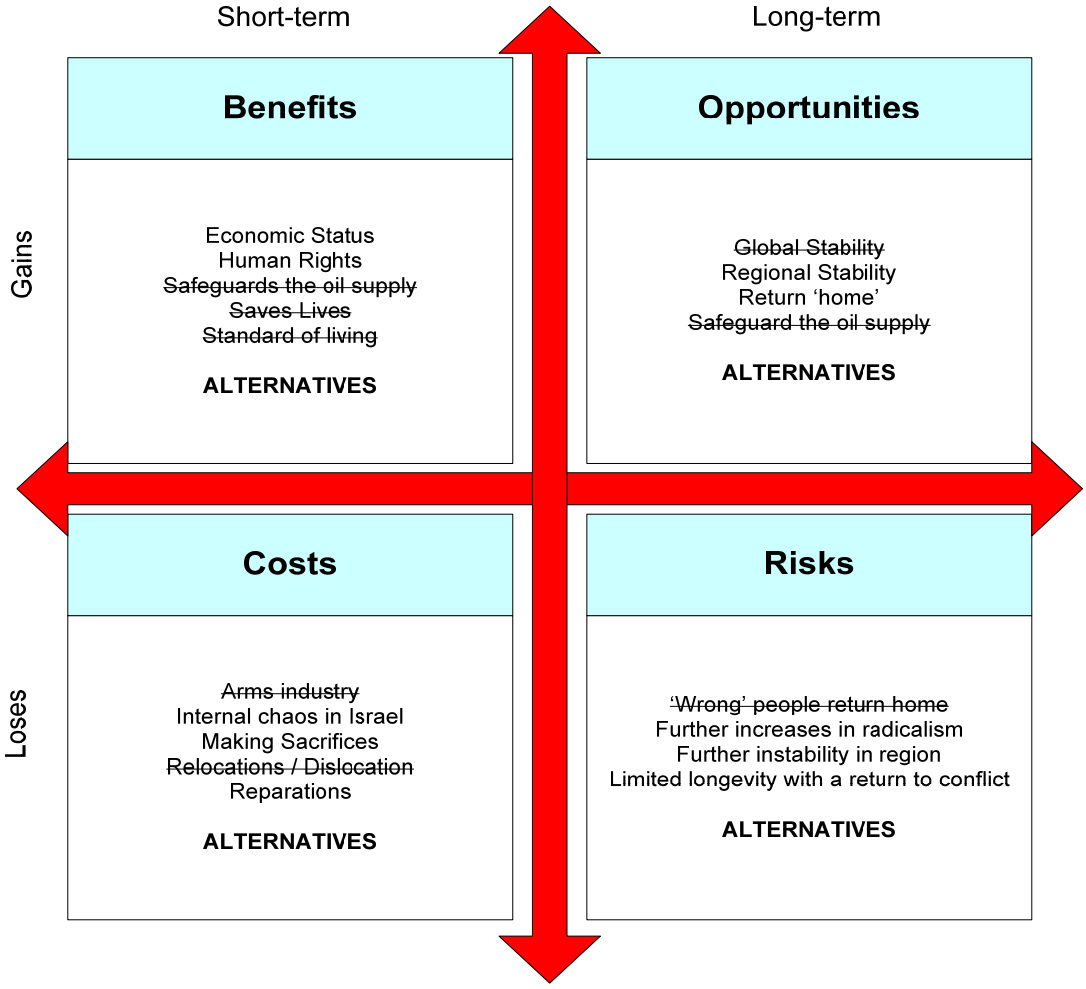

Figure 4 Summary of the merits networks

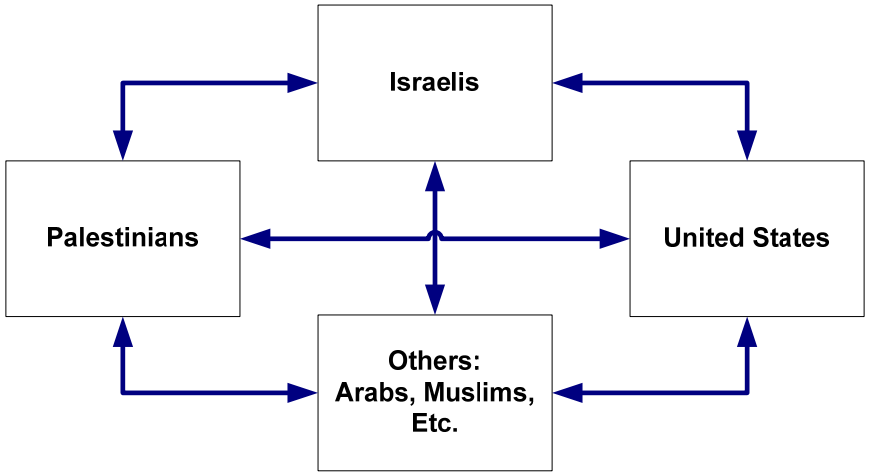

Figure 5 Constituent Network

Alternatives

The panel had to consider not only those initiatives that are 'popular' but also to develop 'creative' alternatives that may not have been explored or even present novel approaches. Furthermore, the group was instructed to think of alternatives as if there were no limits or boundaries. However, it was not easy to develop novel alternatives because of the enduring nature of the conflict and because of the scope of alternatives that have been developed thus far.

The full list of alternatives considered is as follows:

- **Status Quo**
- **Two-viable-state solution**
- **Nuclear use**
- **One-state solution**
- Legal solution enforced by the U.N.
- Two-viable-state solution (Positive initiative by Israel, economic contribution, etc…)
- Two-viable-state solution (Change in U.S. policy)
- Two-viable-state solution (Saudi initiative (2002) / Beirut Declaration).
- United Nations partition (1947)
- Jewish state

We consider the four highlighted bullets above as the final alternatives to determine which has the greatest likelihood of long term success according to the projected ability of the parties to exert the influences needed to bring them about. The most significant part of the 'process' to note is that reducing the list to a select few options was the result of the group negotiating an agreement. The panel came to a consensus that the various two-viable-state solutions could be captured under one alternative with the understanding that the details of implementation would be worked out as part of the long-term process. The Two-viable-State Solution captures the various forms that include the Bush Model, or the Saudi Initiative. This model recognizes the various independent states as autonomous.

The threat of Nuclear Use captures the potential of a party in the conflict using a nuclear device to influence the outcome. The threat of use means Israel's possession of nuclear weapons as a deterrent for other groups to use but it also captures a potential radical group's ability to obtain and utilize nuclear weapons. Of all of the alternatives, this was the most difficult one to conceptualize when assessing the priorities in the evaluation process. In general, the group agreed that this was the least likely alternative but that it was necessary to include in the model since the threat exists and remains an option.

One-state solution combines both the Palestinians and the Israelis into a single unified state that recognizes all individuals as politically and socially equal as in a democracy. Status Quo is a continued condition that has periodic rises in hostility and warfare. To make this alternative sound plausible, one of the Palestinian participants humorously suggested that the most rapid way to resolve the conflict is for all Palestinians to convert to Judaism; he was told by an Israeli friend that many Russians had been brought into Israel and later converted to Judaism.

5. PRIORITIZATION

Strategic Criteria and Their Priorities

As explained above, the three strategic criteria were evaluated and their priorities shown below were used as the guiding factors of the BOCR merits. A sample of the questionnaire that uses the fundamental scale of absolute numbers and questions is shown in Figure 2 Strategic Criteria Questionnaire and the results of those comparisons are shown in Figure 6 and explained below.

- *Long-Term Future Stability* captures the belief of the panel that any alternative that does not address and promote continuous stability in the region may contribute more harm than benefit. Additionally, the panel's consensus is that economic, political, and social developments in the region are dependent upon the 'stability' of the environment.

- *Peace in Region* identifies the panel's conviction that economic, social, and political growth in the region are dependent upon long-term peace. Hence, any alternative must be evaluated against the potential of the choice to promote regional peace.

- *Recognition of Defined Boundaries* was identified by the panel as a strategic criterion because agreed upon boundaries are a necessary component in selecting a resolution alternative.

Among the three strategic criteria to evaluate the BOCR merits, Peace in the Region has the highest priority (0.634) in contrast with Recognition of Defined Borders (0.192) and Long-Term Future Stability of (0.174). Therefore, we can qualify these priorities with the observation that any alternative selected must contribute to the long-term future stability of the region. The significant difference in the priorities underscores the overall importance that the panel placed on long-term stability since economic, social, and political development in the region depend on stability.

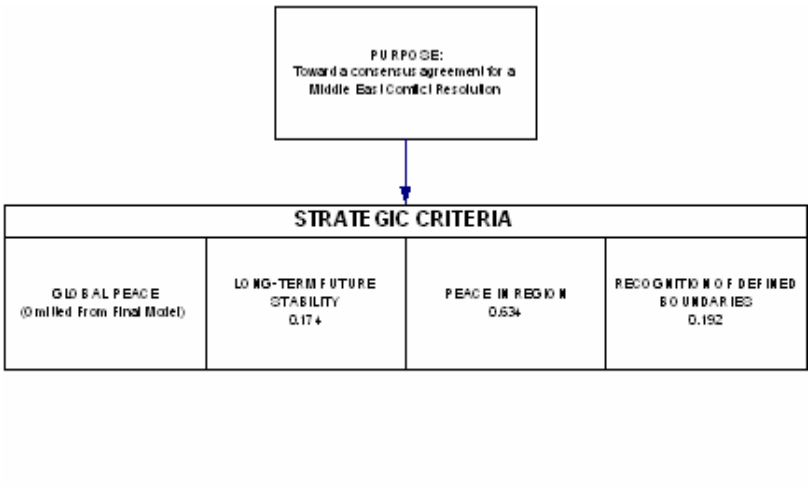

Figure 6: Hierarchy for Rating the BOCR Merits

BOCR Merits and Their Priorities

The importance of the four BOCR merits with respect to the strategic criteria is determined by prioritizing them according to the following five intensities and their priorities derived through pairwise comparisons:

	Very High	High	Medium		Very Low
Intensities	0.42	0.26	0.16	Low .10	0.06

along with their priorities that are obtained at the outset and shown in figure 6.
The rating outcome and final weights for each of the four merits are summarized in Table 2. These values are used as default values in an additive formula in developing the ANP model later on. For example, we asked the question for each of the merits: "what is the 'merit' of the top alternative under Benefits with respect to each of the Strategic Criteria?" This process was carried out in a similar way for Opportunities, Costs, and finally Risks. For instance, it was observed that there is a very high potential Benefits with respect to the first strategic criterion, i.e., Long-Term Future Stability. Once consensus was reached on the ratings for each of the merits, the resultant weights of the merits were derived as given in column 6 of Table 2.

Table 2 Priority Ratings for the Merits: Benefits, Opportunities, Costs and Risks with respect to the Strategic Criteria

Merits	Long-Term Future Stability 0.174	Peace in Region 0.634	Recognition of Defined Boundaries 0.192	Sum of Weighted Values	Normalized
B	Very High	High	Medium	0.64	0.20
O	High	High	High	0.61	0.19
C	Very High	Very High	Very High	1	0.31
R	Very High	Very High	Very High	1	0.31

Decision Networks

Considerable time was invested in defining terms, constructing the model, and reaching agreement on various aspects of the pairwise comparisons made in the evaluation of the BOCR merits. Substantial use of the various media was made during this portion of the evaluation in order to reach consensus. Figure 7 shows a sample of the ratings that the panel used to reach a consensus. Note that each of the numbers entered into the comparison sheet was agreed on by the group. At times, the discussion that ensued from the nature of the question was lengthy. Conversely, there were some questions on which the group was able to reach immediate agreement.

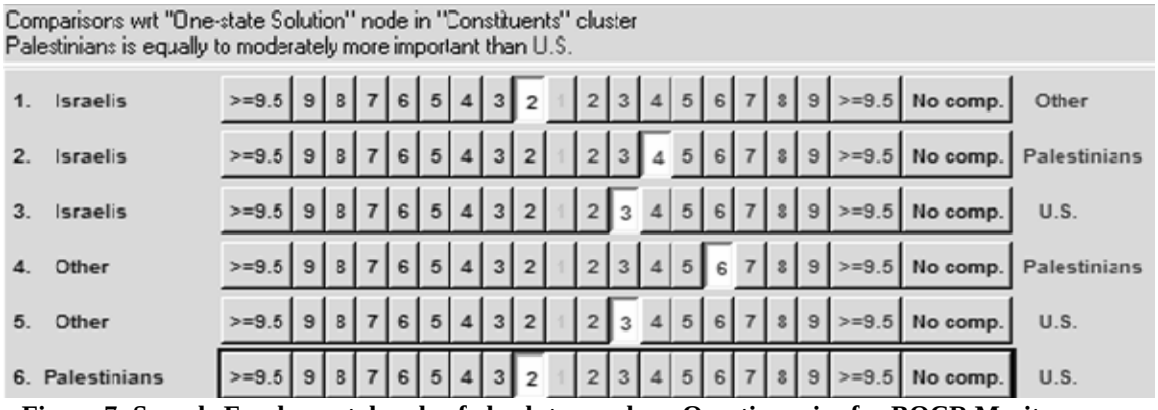

Figure 7: Sample Fundamental scale of absolute numbers Questionnaire for BOCR Merit

Ten decision networks were created, one for each of the surviving BOCR criteria. As explained earlier each decision network contains the cluster of alternatives in addition to a cluster of the constituents. Table 3 shows each of a total 10 ratings for the BOCR constituents prioritized by pairwise comparisons and its corresponding value in relation to the criteria whose priorities were also obtained through pairwise comparisons. Both the local and global priorities are shown with respect to the various merits in the model. The values of global priorities were obtained as the product of BOCR rating (Table 2) times the corresponding local priority times the priority of its constituent:

a) Benefits

Among the two benefits criteria, the human rights criterion has the highest priority of 0.9 as compared with the economic benefits criterion of 0.1. Among the benefits criteria, the highest priority given by those representing the Palestinians with respect to human rights is (0.340). Interpretation of the priorities suggests that with respect to benefits, the Palestinians have the most to gain in the short run due to immediate improvement in human rights.

Table 3 Criteria and Their Priorities

Merits	Criteria	Constituents	Local Priorities	Global Priorities
Benefits	Human Rights 0.90	Israelis	0.141	0.025
		Palestinians	0.340	0.061
		United States	0.300	0.054
		Others	0.218	0.039
	Economic Status 0.10	Israelis	0.154	0.003
		Palestinians	0.274	0.005
		United States	0.310	0.006
		Others	0.263	0.005
Opportunities	Regional Stability 0.50	Israelis	0.340	0.032
		Palestinians	0.232	0.022
		United States	0.268	0.025
		Others	0.159	0.015
	Return Home 0.50	Israelis	0.141	0.013
		Palestinians	0.507	0.048
		United States	0.112	0.011
		Others	0.240	0.023
Costs	Internal Chaos In Israel 0.12	Israelis	0.460	0.017
		Palestinians	0.397	0.015
		United States	0.058	0.002
		Others	0.084	0.003
	Making Sacrifices 0.74	Israelis	0.395	0.091
		Palestinians	0.392	0.090
		United States	0.099	0.023
		Others	0.114	0.026
	Reparations / Relocations 0.15	Israelis	0.253	0.012
		Palestinians	0.336	0.016
		United States	0.201	0.009
		Others	0.210	0.010
Risks	Further Increase in Radicalism 0.46	Israelis	0.421	0.058
		Palestinians	0.332	0.046
		United States	0.125	0.017
		Others	0.122	0.017
	Further Instability in Region 0.34	Israelis	0.277	0.028
		Palestinians	0.330	0.024
		United States	0.110	0.011
		Others	0.282	0.029
	Limited Longevity that Promotes Return to Conflict 0.21	Israelis	0.493	0.031
		Palestinians	0.318	0.020
		United States	0.079	0.005
		Others	0.111	0.007

Table 4 Benefits' Overall Results

Criteria / Alternatives	Economic Status 0.10	Human Rights 0.90	Final Outcome
Nuclear Use	0.113	0.111	0.111
One-state Solution	0.944	0.960	0.959
Status Quo	0.633	0.588	0.592
Two-viable-state Solution	1	1	1

Although the United States has the next highest priority under economic benefits in Table 3, it also had the next highest priority for human rights since under the benefits node, human rights has the highest priority and the global rating for the United States is higher under this cluster. We interpret the United State's high rating under the benefits cluster to be indicative of public perception and political motivation. The overall results of the Benefits subnets are given in Table 4.

b) Opportunities

Within the opportunities cluster, both criteria had the same weighting which demonstrates that both regional stability and the right to return home have equal weights (0.50). However, it is interesting to note that within the regional criterion, the Israelis have the greatest weight (.340) while in returning home (0.507), the Palestinians have the greatest weight. In the long run, the Israelis perceive the greatest opportunity in the region's stability whereas the Palestinians believe that they have the greatest opportunity with the right to return home. Further, given that the Palestinians have the greatest global weight (0.048), suggests that overall the Palestinians' right to return home has the greatest global opportunity within the model. Table 5 presents the overall ranking of the alternatives with respect to opportunities.

Table 5 Opportunities' Overall Results

Criteria / Alternatives	Regional Stability 0.5	Return Home 0.5	Final Outcome
Nuclear Use	0.32	0.13	0.23
One-state Solution	0.96	0.55	0.76
Status Quo	0.54	0.16	0.35
Two-viable-state Solution	1	1	1

c) Costs

Among the three costs criteria, the Making Sacrifices costs criterion has the highest priority of 0.74 compared with the Reparations / Relocations costs criterion of 0.15 and the internal chaos costs criterion of 0.12. Among the costs constituents, the highest priority emerged from the rather evident conviction that both the Palestinians (0.392) and the Israelis (0.395) would have to make many sacrifices in the short run. Given that the global ratings of the other constituents on the other cost criteria are relatively low, we believe that implementation of a best alternative to a peace agreement will need to pay attention to the short term sacrifices that both groups will have to make. Table 6 shows the overall results of the alternatives with respect to the costs.

Table 6 Costs' Overall Results

Criteria / Alternatives	Internal Chaos in Israel 0.12	Making Sacrifices 0.74	Reparations / Relocations 0.15	Final Outcome
Nuclear Use	1	1	1	1
One-state Solution	0.38	0.38	0.26	0.36
Status Quo	0.56	0.71	0.16	0.61
Two-viable-state Solution	0.30	0.31	0.44	0.32

d) Risks

Among the three risk criteria, the criterion Further Increase in Radicalism has the highest priority of 0.46 compared with Further Instability in the Region (0.34) and with Limited Longevity with a Return to Instability (0.21). Interpretation of the results given in the risks merit is that the greatest long-term risk is that a selected alternative might result in an increase in radicalism that would further promote conflict in the region. This is followed by the risk that there might be an increase in instability due to implementation of one of the alternatives. Among the risks constituents, the highest priority is Israel's for both Increase in Radicalism (0.421) and for Limited Longevity with a Return to Instability (0.493). The findings presented here suggest that the Israelis are most concerned with the long-term risk of violence in the region (0.058). Similarly, with respect to the global priorities, we see that the Palestinians are also concerned with Long-Term Violence in the region (0.046). The final outcome for risks is given in Table 7.

It is worth noting that the local and global priorities are significant from a conflict resolution management perspective. These outcomes provide leaders with information important to overcoming obstacles toward a consensus agreement for a Middle East Conflict Resolution. For instance, the panel's evaluation under Benefits indicates that Human Rights have the higher of the two priorities. Furthermore, the Local Priorities under Human Rights suggests that both the Palestinians and the United States are fairly equal. Therefore, those leaders managing the process will know that with respect to Benefits (i.e. short-term gains); one ought to focus on the two groups with the highest ratings in order to ensure success. The remaining entries in Table 3 may be used similarly.

Table 7 Risks' Overall Results

Criteria / Alternatives	Further Increase in Radicalism 0.46	Further Instability in Region 0.34	Limited Longevity with Return to Conflict 0.21	Final Outcome
Nuclear Use	0.60	1	1	1
One-state Solution	0.40	0.24	0.43	0.43
Status Quo	1	0.55	0.76	0.98
Two-viable-state Solution	0.35	0.17	0.37	0.36

6. SYNTHESIS OF THE BOCR MERITS

The results obtained from the rating system (Table 2) and the over all results of the BOCR Merits are normalized and synthesized in order to capture the final outcome of the entire process. For our purpose, we used the multiplicative power weighted formula which is expressed as ((Bb)(Oo))/((Cc)(Rr)). For the Additive synthesis, we used the negative formulation expressed as ((Bb)+(Oo)-(Cc)-(Rr)). Multiplicative synthesis illustrates which of the alternatives is preferable in the short term given all of the criteria under consideration; the additive synthesis illustrates the alternative that is preferable in the long term. We see that under both short and the long term the Two-State option is the best alternative.

Table 8 Synthesis of the Alternatives (Over all results)

Alternatives	Benefits 0.196	Opportunities 0.190	Costs 0.307	Risks 0.307	**Multiplicative Synthesis**	**Additive Synthesis**
Nuclear Use	0.11	0.23	1.00	0.82	0.00	(0.49)
One-state Solution	0.96	0.76	0.36	0.35	0.34	0.11
Status Quo	0.59	0.35	0.61	0.80	0.26	(0.25)
Two-viable-state Solution	1.00	1.00	0.32	0.29	0.62	0.20

After three days of discussion, analysis and evaluation, it turned out that the best alternative is a Two-state Solution and this was neither voiced nor explicitly subscribed to in advance. Recall that the group defined the Two-state solution to include the various forms suggested through the years which includes for example the rather well-known Bush Model, or the Saudi Initiative which also recognizes two independent autonomous states. The priorities also highlight points to keep in mind in the process of reaching agreement on a solution to resolve the Middle East Conflict where 'trouble' might arise and give leaders prior indication in order to avoid those pitfalls.

The results shown in Table 8 suggest also that the One-state Solution may be a viable option but with nearly half the priority of the best alternative. Recall that the One-state Solution was defined by the panel as the commingling of both the Palestinians and the Israelis under one unified state structure that recognizes all individuals as politically and socially equal under the generally understood notion of democracy. Given the relative nearness of the outcomes, leaders will need to monitor the process to gain insight into which direction seems more likely to succeed.

It is the Two-state-viable solution that comes out as the best alternative under all situations. Table 8 demonstrates that under both the multiplicative and the additive forms of synthesis, the Two-state solution is the best alternative.

There are far reaching implications for both the decision and implementation of the alternative derived in the model. Given that the Status Quo and the Nuclear Use options come out as clear negatives in the long run, we conclude that under no circumstance should either option be considered. This seems intuitive for the nuclear use option but may not have appeared so for the status quo. However, it is not difficult to determine that the current situation is not working given the periodic unrest in the Middle East and hence a negative outcome arises in the model that the panel put together.

Interpretation of the difference between the one-state solution and the two-state solution needs further elaboration. In table 8, we see that there is a sizable difference between the one-state and the two-state solutions. One might expect that the one-state solution is a more viable option given the efficiencies that might arise from the two peoples coming together and in the integration of the land. However, given the BOCR results above, we see that there is greater B and O and less C and R in the two-state solution then there is in the one-state solution; this provides some insight into where our investigation into the management of resolving the conflict ought to begin. For instance, Table 3 shows that the Israelis could have the greatest 'risk' of increased radicalism and limited longevity whereas for the Palestinians the greatest risk is that there will be greater instability in the region. When we consider it along with the results

presented in Table 7 Risks' Overall Results), we conclude that for the panel the concern was that the One-state solution poses the greatest risk for an increase in radicalism and limited longevity for the Israelis whereas for the Palestinians there is a concern that this solution will promote an increase in regional instability.

The major difficulty that we experience when we attempt to reach a conflict resolution roadmap in a conventional way is that it is difficult to keep all of the alternatives in mind at once in order to evaluate them. It is even more difficult to maintain cognitive attention of all of our judgments simultaneously in order to measure the importance of the alternatives with respect to the criteria that one puts forth. The outcome would be a matter of which of the highly respected or dominant participants puts forth the best argument that captures the minds of the others. The result of dominance over rational participation as described in this paper is that one of the parties does not have a buy-in to the solution. A program such as the Analytic Network Process facilitates the cognitive mapping, simultaneous prioritization, and participation that make 'buy-in' possible. Further, what was once viewed as an esoteric prioritization process of the decision makers is now reduced to codified decisions by all the parties. The result of the codification process is joint-agreement and documentation for future review and follow-up.

7 SENSITIVITY ANALYSIS

An interesting aspect of the model is that no matter how the criteria are adjusted or perturbed, the outcome remains stable. Figure 8 is a sample sensitivity analysis that is indicative of all of those produced in this model. The sensitivity results from this model suggest that the model is extremely insensitive implying that if the decision-makers focus on the simple outcomes suggested in this model that a long-term solution may be reached.

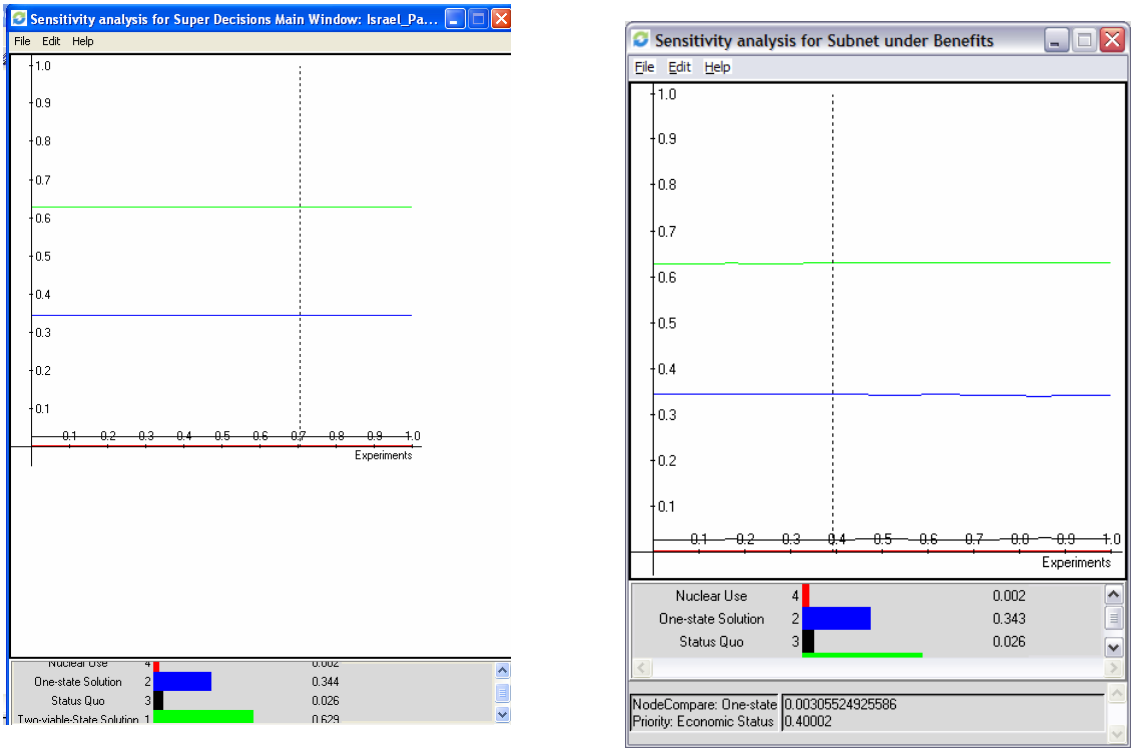

Figure 8: Sample Sensitivity Analysis

8. CONCLUSIONS

The final outcome suggests that the best policy to resolve the Middle East Conflict is to establish a two state solution. Since there is more than one proposal on the details of such solution, it is equally important to develop each proposed model in such a way that address a given set of criteria that would guarantee the long term stability and peace in the region. Only then another ANP model must be developed to evaluate each proposal against its criteria to select the most viable one that will serve the ultimate goal of this project. The authors agree that this work should be expanded to explore the opinions of those who are living in the region, regardless of their ethnic background or religion. An ANP based questionnaire might have an interesting result for academia and politicians as well. Such investigation should cover this phase of the research and the second one regarding the best outcome.

The model and the results given in this paper suggest a variety of ways to manage the conflict resolution process and the implementation. The work presented here provides the reader with areas of potential concern for the leaders that must address the concerns of the various constituents and the people who must live in the environment. The most significant results of the model do not come from the numbers that are generated form the process, but rather the efforts and road-map that are generated. The results suggest that in order for any solution to work, the Israelis must recognize the Palestinians and their cause as an independent people with certain rights and concerns and the Palestinians will need to recognize Israel as an independent people with certain rights and concerns. The priorities generated reinforce the need for both parties (Israelis and Palestinians) to embrace the Middle East resolution as the leaders of the process in order to facilitate the development of *communitas* toward the resolution.

Finally, the reader might question why would he accept the judgments of the particular set of judges? Would different experts produce a different result? We believe that the structure of the problem is sufficiently general that people are not likely to differ on what factors to include. Let us consider the judgments. Had the audience included radical thinkers such for example as those Palestinians who are very angry and do not wish Israel well, or Israelis who wish the Palestinians would simply go away and disappear, the outcome would have been different. There are people in Israel who look at things in the long term and would like to keep the land a hostage in the hope that time would be on their side, but it is certain that the majority of people in Israel would like to live in peace with the Palestinians but do not know exactly how to bring that about because of a great feeling of insecurity. Had a different rational group done the exercise we feel certain that their answer would have been similar. The way to test that which we also did but perhaps not exhaustively is through sensitivity analysis. Doing that by varying the emphases provides considerable reassurance that the outcome is stable to variations in the judgments hen they are not too radical on important items.

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Appendix 1

Here are several examples which show that the Fundamental Scale of Absolute numbers works well to capture people's strength of judgments in making pairwise comparisons.

1) Relative sizes of Areas: Figure 1 shows five areas. The object is to compare them in pairs to reproduce their relative weights. The reader can apply the paired comparison process using the 1-9 scale and find its principal eigenvector and compute the compatibility index with the actual values given below to test the validity of the procedure.

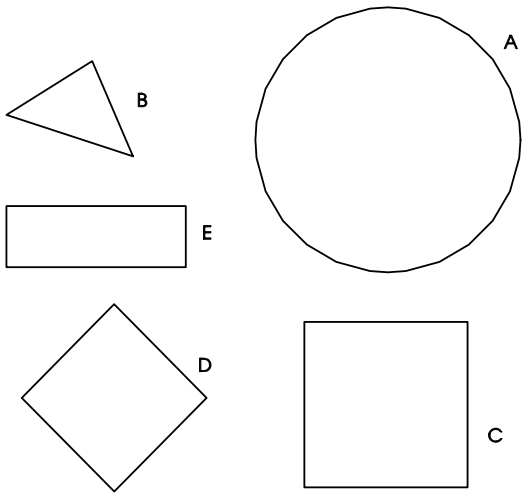

Figure 1 Five Figures Drawn with Appropriate Size of Area

Table 1

Relative Areas of Five Geometric Figures

	FIVE FIGURES					Estimated Relative Areas	Actual Relative Areas
	A	B	C	D	E		
A	1	9	2.5	3.5	5	0.490	0.471
B	1/9	1	1/5	1/2.5	1/2	0.050	0.050
C	1/2.5	5	1	2	2.5	0.235	0.234
D	1/3.5	2.5	1/2	1	1.5	0.131	0149
E	1/5	2	1/2.5	1/1.5	1	0.094	0.096

2) Optics Example

Four identical chairs were placed on a line from a light source at the distances of 9, 15, 21, and 28 yards. The purpose was to see if one could stand by the light and look at the chair and compare their relative brightness in pairs, fill in the judgment matrix and obtain a relationship between the chairs and their distance from the light source. This experiment was repeated twice with different judges whose judgment matrices we now give.

Relative visual brightness (1st Trial)

	C_1	C_2	C_3	C_4
C_1	1	5	6	7
C_2	1/5	1	4	6
C_3	1/6	1/4	1	4
C_4	1/7	1/6	1/4	1

Relative visual brightness (2nd Trial)

	C_1	C_2	C_3	C_4
C_1	1	4	6	7
C_2	1/4	1	3	4
C_3	1/6	1/3	1	2
C_4	1/7	1/4	1/2	1

The judges of the first matrix were the author's young children, ages 5 and 7 at that time, who gave their judgments qualitatively. The judge of the second matrix was the author's wife, who was not present during the children's judgment process.

Relative brightness eigenvector (1st Trial)	Relative brightness eigenvector (2nd Trial)
0.61	0.62
0.24	0.22
0.10	0.10
0.05	0.06
λ_{max} = 4.39, C.I. = 0.13, C.R.= 0.14	λ_{max} = 4.10, C.I. = 0.03, C.R.= 0.03

Table 2 *Inverse square law of optics*

Distance	Normalized distance	Square of normalized distance	Reciprocal of previous column	Normalized reciprocal	Rounding off
9	0.123	0.015 129	66.098	0.607 9	0.61
15	0.205	0.042 025	23.79	0.218 8	0.22
21	0.288	0.082 944	12.05	0.110 8	0.11
28	0.384	0.147 456	6.78	0.062 3	0.06

First and second trial eigenvectors should be compared with the last column of Table 2 calculated from the inverse square law in optics. It is interesting and important to observe that the judgments have captured a natural law here. It would seem that they could do the same in other areas of perception or thought, as we shall see later.

Note that sensitivity of the results as the object is very close to the source, for then it absorbs most of the value of the relative index and a small error in its distance from the source yields great error in the values. What is noteworthy from this sensory experiment is the observation or hypothesis that the observed intensity of illumination varies (approximately) inversely with the square of the distance. The more carefully designed the experiment, the better the results obtained from the visual observations.

The RMS of (0.62, 0.22, 0.10, 0.06) and (0.61, 0.22, 0.11, 0.06) is $\{1/4[(0.01)^2 + 0 + (0.01)^2+0]\}^{1/2} = 2.23\text{x}10^{-3}$. The MAD is as follows. The differences between the two vectors are given by (0.01, 0, –0.01, 0). The median of these numbers is 0+0/2 = 0. The deviations about this median are (0.01, 0, –0.01, 0). Their absolute value is taken and the median of the result is $(0.01+0)/2 = 0.005 = 5\text{x}10^{-3}$. The significance of both RMS and MAD may be determined by dividing their values by the average value of the vector components which is simply 1/*n*, where *n* is the number of components. Two vectors are nearly the same if either or both ratios are, for example, less than 0.1.

3) Relative Consumption of Drinks

Table 3 shows how an audience of about 30 people, using consensus to arrive at each judgment, provided judgments to estimate the *dominance* of the consumption of drinks in the United States (which drink is consumed more in the US and how much more than another drink?). The derived vector of relative consumption and the actual vector, obtained by normalizing the consumption given in official statistical data sources, are at the bottom of the table.

Table 3 Relative Consumption of Drinks

Which Drink is Consumed More in the U.S.?
An Example of Estimation Using Judgments

Drink Consumption in the U.S.	Coffee	Wine	Tea	Beer	Sodas	Milk	Water
Coffee	1	9	5	2	1	1	1/2
Wine	1/9	1	1/3	1/9	1/9	1/9	1/9
Tea	1/5	2	1	1/3	1/4	1/3	1/9
Beer	1/2	9	3	1	1/2	1	1/3
Sodas	1	9	4	2	1	2	1/2
Milk	1	9	3	1	1/2	1	1/3
Water	2	9	9	3	2	3	1

The derived scale based on the judgments in the matrix is:

Coffee	Wine	Tea	Beer	Sodas	Milk	Water
.177	.019	.042	.116	.190	.129	.327

with a consistency ratio of .022.

The actual consumption (from statistical sources) is:

.180	.010	.040	.120	.180	.140	.330

4) Relative Amount of Protein in Seven Foods

Table 4 Which Food has more Protein?

Protein in Food	A	B	C	D	E	F	G
A: Steak	1	9	9	6	4	5	1
B: Potatoes		1	1	1/2	1/4	1/3	1/4
C: Apples			1	1/3	1/3	1/5	1/9
D: Soybean				1	1/2	1	1/6
E: Whole Wheat Bread					1	3	1/3
F: Tasty Cake						1	1/5
G: Fish							1

The derived scale and actual values are:

Steak	Potatoes	Apples	Soybean	W. Bread	T. Cake	Fish
.345	.031	.030	.065	.124	.078	.328
.370	.040	.000	.070	.110	.090	.320

with a consistency ratio of .028.

5) Relative Weights of Objects

The matrix in Table 5 gives the estimated pairwise comparisons of the weights of the five objects lifted by hand, made by the then President of the Diners Club, a friend of the author. The two vectors appear to be very close but are they compatible?

Table 5 Pairwise Comparisons of the Weights of Five Objects

Weight	*Radio*	*Type-writer*	*Large Attaché Case*	*Projector*	*Small Attaché Case*	*Eigen-vector*	*Actual Relative Weights*
Radio	1	1/5	1/3	1/4	4	.09	.10
Typewriter	5	1	2	2	8	.40	.39
Large Attaché Case	3	1/2	1	1/2	4	.18	.20
Projector	4	1/2	2	1	7	.29	.27
Small Attaché Case	¼	1/8	1/4	1/7	1	.04	.04

6) Relative Electric Consumption of Household Appliances

In Table 6, we have paired comparisons done by students in Electrical Engineering estimating the consumption of electricity of common household appliances. How compatible are the derived and actual vectors?

Table 6 Relative Electricity Consumption (Kilowatt Hours) of Household Appliances

Annual Electric Consumption	*Elec. Range*	*Refrig*	*TV*	*Dish Wash*	*Iron*	*Radio*	*Hair Dryer*	*Eigen-vector*	*Actual Relative Weights*
Electric Range	1	2	5	8	7	9	9	.393	.392
Refrigerator	1/2	1	4	5	5	7	9	.261	.242
TV	1/5	1/4	1	2	5	6	8	.131	.167
Dish-washer	1/8	1/5	1/2	1	4	9	9	.110	.120
Iron	1/7	1/5	1/5	1/4	1	5	9	.061	.047
Radio	1/9	1/7	1/6	1/9	1/5	1	5	.028	.028
Hair-dryer	1/9	1/9	1/8	1/9	1/9	1/5	1	.016	.003

The hairdryer is of such a small magnitude that it probably should have been left out of the other homogeneous comparisons.

7) Relative Wealth of Seven Nations

Very early in the history of the subject, T. Saaty and M. Khouja "A Measure of World Influence," *Journal of Peace Science*, Spring, 1976, did the following exercise on an airplane in 1973. They simply used their common knowledge about the relative influence and standing of these countries in the world and without referring to any specific economic data related to GNP values. The two results are close and demonstrate that the general understanding an interested person has about a problem can be used to advantage to make fairly good estimates through paired comparisons.

Table 7 gives the judgments using the AHP 1-9 scale and Table 8 provides the derived priorities, the actual and relative GNP values.

Table 7 Paired Comparisons of the Relative Dominance in Wealth of Seven Nations

	U.S	*U.S.S.R*	*China*	*France*	*U.K*	*Japan*	*W.Germany*
U.S	1	4	9	6	6	5	5
U.S.S.R	1/4	1	7	5	5	3	4
China	1/9	1/7	1	1/5	1/5	1/7	1/5
France	1/6	1/5	5	1	1	1/3	1/3
U.K	1/6	1/5	5	1	1	1/3	1/3
Japan	1/5	1/3	7	3	3	1	2
W.Germany	1/5	1/4	5	3	3	1/2	1

Table 8 The Outcome of Estimated relative Wealth and the Actual and Relative Values

	Normalized Eigenvector	Actual GNP (1972)	Normalized GNP Values
U.S	.427	1,167	.413
U.S.S.R	.23	635	.225
China	.021	120	.043
France	.052	196	.069
U.K	.052	154	.055
Japan	.123	294	.104
W. Germany	.094	257	.091