

Decision Analysis for Practical Negotiation Application

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Abstract

The family of decision analysis techniques can be applied effectively to support practical negotiators in international settings. These techniques are most appropriate in support of the prenegotiation phase, when parties are diagnosing the situation, assessing their own plans and strategies, and evaluating likely reactions and outcomes. The paper identifies how these approaches have and can be used to assist negotiation practitioners, offers a rationale for the application of decision analytic approaches in terms of the particular analytical requirements of the prenegotiation period, suggests how these process-oriented tools can be integrated with substantive tools, and discusses ways in which these tools can be presented and delivered to practitioners in a practical and confidence-building manner.

Keywords: Decision analysis, prenegotiation, multi-attribute utility analysis

Information and Analytical Requirements of International Negotiation

International negotiation is a process inherently dependent on information. For example, negotiators require information about their own country's goals and resistance points. They need reciprocal information about their counterparts. They require sufficient information to develop tactical and strategic approaches to joint problem solving, that is, effective ways of persuading other interested parties to come to the table and reach a mutually acceptable accord. Negotiators also need to have adequate knowledge to design innovative, but realistic options for solution and the ability to evaluate the costs and benefits involved in striving for each. That means that they need to understand in detail the substantive issues which they are debating; in this age, that often means a sophisticated knowledge of science, technology, and economics.

Negotiators and their staffs need the tools to adequately analyze this information to produce assessments that will help them make good decisions. For example, they need the analytical resources and skills to diagnose the situation, evaluate the cost benefit of their own strategy options, assess the impact of other party strategies, and trade off the efficacy of alternative negotiated outcomes.

Despite these information dependencies and analytical requirements, international negotiators usually confront their counterparts only with their wits, instructions from their home government, and minimal background information developed by their staffs. International negotiation is still viewed by practitioners as an art form, not a science. Unfortunately, much of the information required is either unavailable when needed or costly to obtain. Moreover, most nations can little afford the in depth analyses of issues, strategies, and outcomes that are required to understand the implications of one negotiation proposal over another. It is often the case that delegations arrive at complicated multilateral negotiations having performed minimal assessments of their own interests and positions, let alone that of other key nations and coalitions. In addition, negotiators lack the tools and techniques for effective joint problem-solving that have been developed in the management sciences and are

already being widely used in industry. International negotiation has clearly not entered the modern information era.

If the power of information and analysis can be harnessed to support international negotiation, will it help and how? More significant perhaps is the answer to the question, "What will it take to be used?" This paper focuses on one family of analytical methodologies, decision analytic techniques, which is central to understanding, and possibly recommending, the decision structure and logic employed by negotiators. The discussion examines the type of information needed to implement these techniques and what they can do to support the negotiation process, the prenegotiation phase, in particular.

Decision Analysis: Key Assumptions and Applications

Decision analysis is a methodology typically used to support decision makers actively in assessing alternative courses of action. Generated from statistical decision theory, decision analysis was developed in the field of business administration as a practical approach to assist corporate managers in weighing their options and designing logical solutions in a systematic fashion. It is usually applied in a consultative, prescriptive mode with decision makers, helping them work through immediate decision problems (Ulvila and Brown, 1982).

Decision analysis tools have been applied along these same lines with negotiators and policy makers to assist, for example, in prenegotiation strategy development over U.S. military bases in the Philippines (1978), the Panama Canal (1974), and international oil tanker standards (1978) (Raiffa, 1982; Ulvila and Snider, 1980; Ulvila, 1990). In these cases, decision analysts supported negotiating teams by eliciting practitioner preferences and values, generating models based on these subjective judgments, calculating the decision analytic results, and feeding these results back to the negotiators to help them evaluate alternative strategies.

Decision analysis targets one critical element in the decision making process that is a key driver in making and understanding effective choices, *personal preferences*. The decision maker's subjective judgment is incorporated into decision analysis models along with objective inputs. If these personal preferences can be defined and elicited directly from involved negotiators concerning particular negotiating interests, then the technique can be applied prescriptively as a supportive tool.

These models, applied to the negotiation process, can be most helpful in understanding strategy and outcome. The methodology is geared to evaluating alternate strategy options based on tradeoff analyses that take into account the expected value of the projected outcomes. Evaluation of strategy decisions is accomplished in decision analysis primarily in terms of negotiator preferences.

Decision analytic models offer the capability of disaggregating the decision rationale for selecting one strategy over another by evaluating negotiator preferences, criterion by criterion. In doing so, it is possible to understand not only the genesis of a country's bargaining interests and why certain outcomes are seen as attractive, but also the genesis of compromise solutions that provide a better distribution of benefits to all parties.

Two of the most commonly used forms of decision analytic models are decision tree analysis and multi-attribute utility (MAU) analysis; other variants in the decision analysis family are described later in this paper. In *decision tree analysis*, the decision options and calculations can be displayed graphically as a network, indicating sequentially the decision choices that can be made, the actions of other negotiating parties, and the occurrence of uncontrollable and situational events. This network can be designed in an iterative offer-counteroffer pattern between negotiating parties. It can present a dynamic picture of the probable future progress of the negotiation process. Along with the specification of this network, decision trees also present the probability of occurrence of future events, the value of the alternate final outcomes, and intermediate expected values at each node in the tree. Overall, decision tree analysis offers an assessment of probable outcomes given choices made and the probabilities of occurrence of other party actions or events.

While person variables (negotiator preferences) are clearly central to this decision analysis methodology, situation variables also play an important role in the approach. Nodes in the decision tree can represent changes in the negotiation situation -- changes in the other side's position or strategy, changes in home government instructions, changes in deadlines, introduction of new issues -- with associated probabilities of occurrence and revisions to the expected outcomes.

Multi-attribute utility analysis provides a structure to tradeoff multiple decision objectives across alternate decision options, resulting in a prioritization of those options. It requires the development of a model that replicates the decision maker's set of evaluation criteria applied to the decision problem. This model includes not only the criteria, but also the relative importance of each criterion. Decision options are rated against each criterion and calculations performed. MAU usually results in a prioritization of strategy choices, one party at a time. Unlike decision tree analysis, MAU provides a static snapshot of the negotiation process.

Ulvila's (1990) Philippine base negotiations case is a good example of the use of decision analysis to support strategy development in the prenegotiation phase of a bilateral situation. The U.S. negotiating team used a facilitator to elicit their own preferences as well as the likely preferences of the other side's negotiators. Two MAU models were developed -- one for each actor -- by weighting the multiple issues in the negotiation and rating the perceived attractiveness of actor positions on each issue. A compromise position that fell within the range of negotiating positions was also rated in terms of relative attractiveness. Using these quantified models, Ulvila was able to:

oIdentify the attractiveness of alternative packages of agreements across all of the key negotiating issues for each negotiating party. Many alternate packages were simulated across the issue areas and attempts were made to analyze their overall attractiveness to each party.

oIdentify an agreement space in which both sides could maximize their gains in the negotiation. The points along the optimal frontier were explainable in terms of the actors' issue weights and position preferences.

Raiffa (1982) describes a very similar application of decision analysis concerning the bilateral Panama Canal negotiations. Spector (1991a) applies MAU models to analyze two multilateral negotiations -- the Uruguay Round of the GATT talks and the Single Europe Act of the European Communities. Using sensitivity testing, he conducts a *preference adjustment* analysis to determine the extent of divergence in national interests and the degree of modification required by all parties to achieve a compromise agreement.

Ulvila and Snider (1980) provide an interesting case of the use of decision analytic models not only to support a particular negotiating team in an upcoming multilateral negotiation, but also to explain some elements of process. They used a MAU model in consultative mode with the U.S. negotiating team to the 1978 International Conference on Tanker Safety and Pollution Prevention to prepare alternate strategies and consider tradeoffs among them during the prenegotiation phase. In building the decision analytic model, U.S. negotiation interests had to be compared in relation to the interests of the other countries that would participate in the conference. This was accomplished by having the U.S. team role play their counterpart teams in 21 other countries.

A common set of criteria and negotiation proposals was identified for the MAU model structure and a common set of scores was elicited from the U.S. team to rate each proposal package against each criterion. In building the model, the authors assumed that this basic structure of the negotiations was essentially equivalent across participants. However, the relative importances given to the various criteria were conceived as different across participants; that is, each country's interests, while comprised of the same set of issues, are prioritized differently.

By analyzing the model and examining its component elements, the researchers and U.S. negotiating team were able to highlight some issues which were likely to be contentious in the negotiations and develop compromise solutions. They were able to explain, in terms of the differential interests of various countries on particular issues, why a specific U.S. strategy would not likely be successful in yielding agreement in the upcoming multilateral conference.

As illustrated by the Ulvila and Snider case described above, multiple decision analytic models can be built in the context of multilateral negotiations, each attempting to replicate the perspective of each negotiating party. One can assume that the model structures (the inventory of interests and outcomes) are the same, but actor preferences and priorities for the interests vary across participants. Players that are closely aligned with each other -- with high interest commonality -- have very similar interest preferences. That is, they perceive and address the negotiating problem in a very similar manner and their model weights are highly correlated. On the other hand, players with strong interest divergence likely have very different perspectives on the criteria weights and hierarchy by which courses of action are evaluated; their decision calculus is very different and thus is represented very differently when modeled.

When model structures are very similar, it is possible to compare directly *both* the assumptions of the analysis (ie., weights, scores, and probabilities) and the decision results directly. When model structures are dissimilar, it is still possible to compare the results of the decision analysis, that is, the prioritization of decision alternatives across actors.

Negotiation processes are dynamic, meaning that many decisions are made and modified by each negotiating party over time on multiple issues. For each issue area, different decision analysis models may be required. However, if countries practice a consistent policy concerning their national objectives and interests within a particular negotiation, one may assume that the evaluation criteria and weighting schemes will be similar across decision episodes.

While decision analytic models have been applied successfully in a limited number of instances, the methodology has come under some criticism. First, the mathematics of the technique assume that the evaluation criteria are mutually exclusive and independent. This assumption is very difficult to satisfy in application, especially when attempting to model the logic of negotiators and policy makers. It essentially rests with the good judgment of the model developer to assess that the independence assumption is approximated as well as possible. Second, it is very difficult to avoid cultural biases when estimating the preferences of the other side, thus yielding possibly misleading results. Third, the calculus of decision analysis models is linear and additive; this is usually an inappropriate assumption when dealing with decision makers whose reasoning processes often incorporate extensive feedback.

All of these technical criticisms can be refuted by the argument that decision analysis was never intended to yield precise, engineering results; after all, the technique attempts to model the nebulous region of human behavior. Although the method does produce quantitative results concerning the priorities of possible strategies or outcomes, these should be treated in a relative, not an absolute manner, given the admitted imprecision of the model's inputs, decision maker preferences. Hopple (1986) categorizes the decision analytic family under the rubric of "structured *qualitative*," thus downplaying its quantitative aspects. Based on the model's calculations, it is sufficient for the decision analyst to present the negotiator with a rank ordering of options.

One of the greatest benefits of decision analysis is its capacity to present decision makers with a systematic way of structuring and restructuring a problem; the model-building exercise sometimes provides more insight to the decision makers than the model's calculations. It is the process of logically thinking through, representing, and reevaluating relationships and preferences that decision makers often find most valuable in the method.

Applying Decision Analysis to the Prenegotiation Process

The application of decision analytic techniques to the prenegotiation process is particularly appropriate. This is the phase of negotiation in which the need for information, planning, and tradeoff assessment is instrumental in determining whether conflicting parties will in fact decide to come to the negotiating table or settle their disputes by unilateral means. It is a suitable time for each party to conduct a diagnosis of the situation: generating alternate formulas, defining its own interests clearly, inferring the motives and interests of the other parties, identifying opportunities for tradeoffs and compromises between opposing perspectives, and developing expectations for the final outcome of the negotiations. Decision analysis methods are relevant to supporting these activities.

Satisfying User Needs in the Prenegotiation

Saunders (1985) describes the prenegotiation process as one of defining the problem both unilaterally and with the other parties to the conflict. It is a testing or experimental phase before commitments are made to use the negotiation table as the accepted venue to resolve the dispute. Zartman (1989) expands upon this description by specifying the functions served by the prenegotiation process in transforming conflictual into mixed-motive perceptions. Performance of each of these functions serves a purpose in the transition from unilateral to multilateral perspectives on solution options. They include:

1. *Risks*. Prenegotiation helps nations identify and assess the risks involved in future negotiation within a low risk environment.
2. *Costs and Benefits*. In the prenegotiation phase, nations can estimate the costs and benefits of

concessions and agreement, thereby sorting out their motives for negotiating.

3. *Requitement*. This is the period during which each side can persuade the other that concessions will be responded to in a positive manner.
4. *Domestic Support*. Prenegotiation can serve to build and consolidate domestic support for a negotiated outcome.
5. *Problem Solving*. This phase offers the opportunity to define the problem and search for options -- ways out of the conflict. The identification of negotiable issues begins and parameters are defined that help evaluate and eliminate alternatives.
6. *Coalition Building*. The prenegotiation period presents the opportunity to evaluate the benefits of building minimum winning or blocking coalitions.
7. *Confidence Building*. This is the phase in which trust-building measures can be evaluated and implemented to develop bridges from conflict to cooperation.

Each of these prenegotiation functions has its informational counterpart -- information and analysis are required to conduct them effectively. As an experimental or testing period, prenegotiation is particularly useful if it helps parties evaluate, estimate, and simulate "what would happen if" scenarios. The analytical requirements implied by each function and the specific types of decision analytic approaches that can provide meaningful support to each function are described in Figure 1.

Fig. 1. Prenegotiation Functions, Analytical Requirements, and Decision Analytic Approaches

<u>Prenegotiation Functions</u>	<u>Analytical Requirements</u>	<u>Decision Analysis Techniques</u>
Risks	Examine range of national interests; evaluate extent of preference adjustment required; evaluate impacts of reaching a negotiated agreement	Cross-Impact Analysis
Costs and Benefits	Tradeoff costs and benefits of potential concessions	Multi-Attribute Utility Analysis
Requirement	Evaluate likely external responses to concessions	Decision Tree Analysis
Domestic Support	Evaluate likely reactions of internal interest groups to alternate outcomes	Stakeholder Analysis
Problem Solving	Generate alternative formulas; evaluate alternatives	Cost-Benefit Analysis
Coalition Building	Tradeoff costs and benefits of alternate coalitions; evaluate extent of preference adjustment required to form coalitions	Multi-Attribute Utility Analysis
Confidence Building	Generate alternate trust-building measures; tradeoff costs and benefits of alternatives	Multi-Attribute Utility Analysis

This table suggests that the family of decision analytic tools are likely to be useful to negotiation practitioners in managing prenegotiation functions. Each of these tools has similar methodological foundations in decision theory, but provides different results that are tailored to prenegotiation analytical requirements. Specifically,

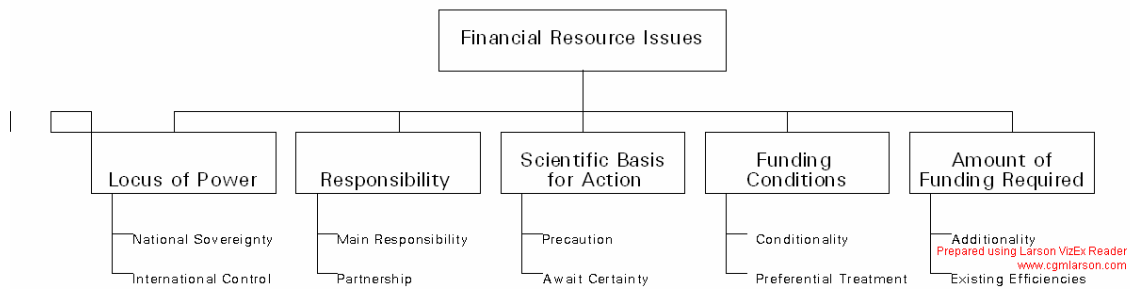
1. *Cost-Benefit Analysis* models (Raiffa, 1982) evaluate tradeoffs in cost-benefit terms of alternative proposal packages. They are appropriate, therefore, to aid in the assessment of alternative negotiation formulas, each comprised of different combinations of approaches and principles to achieve a mutually acceptable outcome.

2. *Cross-Impact Analysis* (Institute for the Future, 1983) is a methodology that facilitates the modeling of complex situations with the purpose of simulating the impact of particular policy decisions that may affect that situation. It is appropriate to conduct a risk analysis, examining the many internal and external factors that can impact upon achieving a convergence of interests.
3. *Decision Tree Analysis* (Raiffa, 1968), as described earlier in this paper, creates a sequential network of events and decision points, with probabilities attached to each node, that can help in an assessment of response behavior to earlier concessions.
4. *Multi-Attribute Utility Analysis* models (Raiffa, 1982) structure decision problems so as to facilitate selection among alternate decision options based on multiple criteria and objectives. It is an appropriate technique to assess tradeoffs and examine the extent of adjustment required in preferences to achieve compromise solutions.
5. *Stakeholder Analysis* (Weiner and Brown, 1986) uses information on the positions, interests, priorities and preferences of various stakeholders on a particular issue to facilitate analysis of the range of differences among stakeholders and the potential for coalition formation.

Frei and Ruloff (1989) and Mitchell, et al. (1977) provide good explanations, illustrations, and step-by-step guidance on how to apply most of these decision analytic methods. One illustration of the use of decision analytic methods to support ongoing prenegotiations can be found in Spector (1991b), who describes the application of multiple MAU models to evaluate coalition building and preference adjustment in the context of the United Nations Conference on Environment and Development (UNCED). Two central negotiation issues were addressed by the modeling effort: developing a viable funding mechanism for future environment-development projects and agreeing on acceptable funding target levels. Two months before the formal negotiation conference was held, a

handful of proposals had been tabled on these two issues; these were defined as options in the MAU model. A content analysis of statements presented by most of the key national participants on financial issues yielded a hierarchy of criteria upon which policy decisions would be made affecting negotiation choices and strategies. These criteria formed the basis of the MAU model (see Figure 2). The relative importance of each decision criterion for the three nations/coalitions of interest (the United States, the European Community, and the Group of 77) were coded on the basis of their public statements on a five-point scale and transformed into numerical values. Finally, an assessment of how well each option satisfied each lowest level criterion was also conducted and quantified into scores based on the national statements and proposal descriptions.

Figure 2. Criteria for Financial Resource Decisions at UNCED



Exercise of the models revealed the comparative preferences of the three actors for each option. As a mirror of reality in the prenegotiation period, the preference space across the parties for the available options was rather large. Sensitivity analysis was conducted to assess the extent of adjustment required of each actor to achieve a compromise proposal. This sensitivity analysis

identified the specific preferences, in terms of decision criteria, that must be modified by each negotiator to make a compromise proposal feasible.

The model structuring itself yielded useful insight for the UNCED Secretariat at a point when it was developing the content for a proposed global action plan for future environment-development activities. The sensitivity analysis results were highly suggestive of the feasibility of various compromises. Although the analysis was conducted after the actual negotiation was completed, it could have served as an important decision support tool during the course of the prenegotiation to identify where the gaps in preference lie and the extent of flexibility required to achieve compromise. In particular, the results indicated that the United States position on financial issues required the greatest modification to achieve a compromise formula; movement in the bargaining space appeared much less stressful for the Group of 77. The United States had to give way on some of its key interests and demands in the negotiation, in particular, the demand to postpone serious negotiation until there is greater scientific certainty on the issues. For the Group of 77, the strong demand for preferential treatment and concessions on future financial and technological assistance had to be dispensed with somewhat. Overall, the preference adjustments required of all parties, when viewed together, suggested the precarious balance of negotiating tradeoffs to achieve compromise outcomes.

A toolkit comprising the entire methodological family of decision analytic techniques could enhance the effectiveness of early negotiation phases by supporting the array of prenegotiation functions described earlier.

Presentation and Confidence-Building in the Approach

How can these techniques best be incorporated into the prenegotiation process? Software packages are now available to make the design and exercise of this family of models extremely accessible. However, without formal training and dedicated staff analysts, it is unlikely that such decision analytic modeling packages can become integrated fully in supporting prenegotiation

diagnoses. Moreover, the use of decision analytic models involves more than just operating computer-based software; the meaningfulness and validity of such models depends largely on the way in which the models are structured, and preferences, priorities, and values of the negotiators and policy makers are elicited. In this regard, the use of independent facilitators of group workshops involving the key decision makers has proved to be effective (as described in Raiffa, 1982; and Ulvila and Snider, 1980).

Facilitated group policy exercises enable participants to analyze, evaluate, and explore important decision opportunities in a controlled environment (Spector, 1990). Trained external facilitators help participants work their way through the systematic processes of assessing likely scenarios, effective decisions, and the logical implications of these futures using decision analytic methodologies.

Structured policy exercises seek to identify key issues, uncover problem areas, define opportunities for important breakthroughs, generate alternate solution paths, evaluate options, and project future implications. A successful policy exercise may sometimes be measured by the consensus that is achieved on key issues by the participants. Success, though, can also be measured merely by the degree to which the group facilitator helps to open communication channels among various parties within the session.

It is the facilitator's responsibility to create a situation in which participants can freely communicate their preferences and points of view. The facilitator must foster and focus discussion to uncover points of difference and disagreement, determine the range of positions, and find opportunities for convergence of opinions. During the course of the exercise, the facilitator will use several approaches to elicit valid preferences, priorities, and judgments from the participants. Facilitation techniques such as paired comparisons (for example, do the probabilities assigned to Events X and Y appear proper in relation to one another?), option anchoring (given Event X has a

probability of n, how are Events Y and Z likely to fare?), and in-context assessments (given a described negotiation environment, how would you assess the probability of Event X?) will be used to ensure logical and consistent data collection.

The facilitator uses decision analytic models to structure the policy exercise. These models provide the systematic and logical basis for representing the decision environment and help the participants to test the implications of alternate decisions before they are selected. As an experienced methodologist, the facilitator seeks to satisfy the technical assumptions of decision analysis described earlier. Exercises are often preceded by in depth interviews of key participants that result in strawman models to get the exercise off to a fast start.

Ultimately, the policy exercise provides a forum that allows participants to debate issues, communicate preferences, and find common ground. There are two principal products of a facilitated policy exercise. First, decision analytic models are built, values and preferences elicited, the models exercised, results presented, and sensitivity analyses conducted. Second, improved communication among the participating decision makers yields a mutually developed, examined, and understood conclusion in which all share ownership.

Integrating Process and Substance

The family of decision analytic models discussed in this paper are process-oriented models, focused on enhancing the process by which prenegotiation is conducted. Policy maker preferences, priorities, and values on substantive issues constitute the content of these models. But these judgments are not resident in the models to begin with; they must be elicited for the models to be applied. In one sense, this substance-free state makes decision analysis models highly mobile and independent -- capable of being applied to most any negotiation issue. On the other hand, it handicaps their application; other, more substantive, approaches are required prior to their use to identify the issue

parameters and limitations and generate alternative formulas for possible negotiated agreement.

Integration of these process and substance models should yield effective support to prenegotiation teams. Perhaps the linkage can be fostered in the following way. Substantive models can help identify alternate formulas of the outcome and can simulate their implications. Based on these parameters, decision analytic process models can be structured to reflect on and examine the political acceptability of the components of specific formulas that are viewed as reasonable and negotiable.

Attempts to foster such a collaboration between substance and process has been made at the International Institute for Applied Systems Analysis (IIASA) in connection with its project in support of the UNCED secretariat. One research team was focused on developing a systems model that explained the substantive linkages between the issues, in this case, among economic development, agricultural production, lifestyle, population dynamics, and environmental issues (Shaw, et al., 1991). The results of exercising this model point to the factors that need to be modified for environmental constraints and developmental drives to be in harmony. Together, these factors suggest alternative solutions that are the subject of negotiation. Such packages were presented to a second research team focused on supporting the negotiation process. As indicated earlier, decision analytic methods were used to evaluate the policy implications and the political feasibility of these packages given the interaction of a range of national interests and objectives in the negotiation (Spector, 1991b).

Conclusions

Decision analytic methods are suitable for practical implementation in international negotiation settings. This methodological family can be engineered to satisfy the four challenges to application posed in the introductory paper of this issue.

oConceived of as a practitioner's tool from the outset, decision analysis is designed inherently to provide normative and prescriptive advice.

oWhile innately a highly transportable process tool, decision analysis can be integrated with substantive models. The range of possible negotiation outcomes, often produced by substantive models, can be fed into decision analytic models to assess tradeoffs on political feasibility.

oFrom an end-users' perspective, the need for diagnosis, analysis and planning for negotiation is significant in the prenegotiation period. This is when the capabilities of decision analytic methodologies appear most suitable.

oThe presentation and delivery of decision analytic tools for use by practical negotiators is best accomplished through the assistance of a facilitator who can serve both as a methodologist, ensuring a valid model development process, and as an effective independent third party, stimulating communication, understanding, and group acceptance of the structural and logical, if not quantitative, results of the modeling exercise.

Several issues still need to be addressed in preparing decision analytic methods for practical implementation.

oAlternate data collection methods to calibrate the other parties' preferences should be developed to cross-check for possible cultural and perceptual biases that might be introduced by the first party.

oAlternate facilitation protocols should be generated and tested to design an effective third

party interface.

Fuzzy measurement approaches, such as those designed by White and Eldeib (1986) and others at the Systems Engineering Department of the University of Virginia, should be examined to reduce the criticism of false precision in decision analytic findings.

Overall, decision analytic approaches can make a practical contribution in supporting negotiators and their staffs at points in the process when the assessment of options and tradeoffs is significant.

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