DECISION AND INDECISION IN VALUE ANALYSIS

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ABSTRACT

Contemporary literature on group decision making is reviewed to examine the extent to which value analysis (VA) teams use effective approaches. I conclude that with regard to determination of subjective expected utility, use of reflective thought, and making criteria-based evaluations; VA team activity (at least as it is designed) is generally congruent with present principles of effective decision making. Suggestions are provided regarding the problems of prechoice screening of options.

INTRODUCTION

The success of value engineering (VE) programs depends on effective group dynamics throughout the entire job plan. In earlier papers, I have examined issues related to the information and speculation phases. The focus of the present paper is the selection phase--especially the aspects of screening and decision making. In general, the term "decision making" refers to the way(s) in which people consider a number of options and make choices based on those alternatives. There is an unfortunate paucity of team behavior studies done by those working in the field of VE/VA. However, researchers in related fields (e.g. psychology, economics, business management) have extensively studied the ways individuals make decisions. In this paper, some of those research results will be extended and applied to VE teams.

OPTIMIZING DECISION THEORIES

Classical economic theory assumes that human preference behavior is rational, that people weigh options carefully and choose the course of action that will give best value. Thus, by calculating the expected value of each option, people optimize their outcomes. Many contemporary researchers have demonstrated that often the optimizing assumption is not appropriate, leading classic theorists to label choice behavior that deviates from the model as "irrational".

In 1981, Tversky and Kahneman reported a study in which a large number of physicians were asked to consider the following alternative problem resolutions:[1]

Problem 1. Imagine that the U.S. is preparing for the outbreak of an unusual disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume that the exact scientific estimate of the consequences of the programs are:

If Program A is adopted, 200 people will be saved. [chosen by 72% of the sample group]

If Program B is adopted, there is a 1/3 probability that 600 people will be saved, and 2/3 probability that no people will be saved. [28%]

A second sample was asked to identify their favored approach from the same problem description as above, with new alternatives:

If Program C is adopted, 400 people will die. [22%]

If Program D is adopted, there is a 1/3 probability that nobody will die and 2/3 probability that 600 people will die. [78%]

It is relatively easy to see that the problems are indeed identical. The only difference is that the probabilities in problem 1 were framed in the number of lives that would be saved, whereas in problem 2 the frame involved the number of deaths. The inconsistency shown in these data is normative. Commonly, preferences identified are risk- aversive in the domain of gains. The guarantee of 200 lives being saved was much more attractive than taking the risk of an equal expected value, a one-in-three chance of saving 200 lives.

Conversely, in problem 2, framed in terms of numbers of lives that will be lost, the subjects demonstrated risk- taking behavior. They showed a pronounced preference for the two in three chance that 600 will die over the certain death of 400. This type of reversal, from risk-aversion in choices involving gains to risk-taking in choices involving losses has been observed across a wide range of situations and populations. Further, the researchers determined that the value function for losses was convex and steeper than the concave value curve for gains. Thus a difference between two options will seem larger when framed as a disadvantage of one option rather than as an advantage of the other.

Many value managers have observed similar behavior among executives who see VE projects as unnecessary at best when their organizations are "doing well", but are very open to such activity when the organizations are "in trouble". People generally will do more to keep from loosing a dollar than they will to gain one. Simon[2] accounts for such choice behavior as due to humans' "bounded rationality". That is, that people are not able or willing to expend the mental effort required to explore alternative frames and avoid potential inconsistencies. Somewhat different explanations can be developed by examining another study.

Pavitt and Curtis investigated preferences in a study which involved choosing between two different bets.[3] A wager on one horse, Flash, provided a 70% chance of winning $100 for a first place finish, but also a 30% chance that Flash would come in second and pay only $50. A wager on the other horse, Oats, carried a 30% chance for a 1st place win paying $150, as well as a 70% chance that Oats would come in second and pay only $25. Mathematically, the expected value (EV) of either bet can be computed by multiplying each outcome probability (odds) by the possible outcome (winnings). The results are an EV of $85 for Flash: [(0.7)($100) + (0.3)($50)], and $62.50 for Oats: [(0.3) ($150) + (0.7) ($25)].

Decision theorists in the optimizing camp view a wager on Flash as clearly the "rational" choice based on the assumption that rational people choose alternatives that result in the best possible outcomes. The problem with this assumption is that it presumes a hierarchy of values, with tangible extrinsic outcomes highest on the list.

Many value analysts have recognized that there may be many values associated with "best" worth beyond "bottom line" benefits. People often make choices that enhance their sense of comfort, excitement, safety, or in any number of ways are consistent with their own personal value system. In the wagering case above, even if an individual had determined the expected values correctly, she might reasonably place her bet on Oats. It is possible that the bettor is facing imminent bankruptcy and that she needs to raise $150 immediately. If this is the only race left in the meet, a bet on Flash--even if the horse won--would not meet the need. Thus, a bet on Oats, although it carries a lower expected value probability, is still a rational act. Optimizing theories ignore the validity of subjective utility. Fortunately, value analysts using customer-oriented techniques, focus panels and the like, do take such utility into account.

Another serious limitation related to "expected value' formulations is that people tend to judge probabilities of some occurrence by the number of examples they can readily think of. Of course, the most salient response may be the most appropriate one. In such cases, the "satisficing" approach results in the optimum choice. Sometimes, however, the use

of the availability approach can lead decision makers astray.

When asked by an experimenter whether English words starting with the letter "r" were more or less common than words with an "r" as the third letter, many more participants respond that the former case is more common. This choice is probably due to the fact that it is easier to think of relevant examples such as "rose", "ruby", or "red" than to think of words with a third letter "r". Unfortunately, this approach leads to an incorrect decision. Looking at any random passages, one can observe the greater occurrence of words with "r" as a third letter. Indeed, one clear example of this phenomenon is the sentence above that described the experiment and included the words "participants", "words", "were", "more", and "first". The difficulty in identifying examples where "r" is in the third position is due to our use of the first letters to organize words in our minds.

These and many other studies have demonstrated that often people do not use optimal methods for determining preferences. We have also seen, however, that subjective estimates can often prove adequate for the decision maker's needs. Edwards[4] thoroughly investigated the outcomes of using what he called a "subjective expected utility" (SEU) model and found it to be generally useful.

In this approach, groups determined the utility of various options as they perceived it to be rather than use calculated objective probabilities. The decisions groups reached in this manner were frequently the same as those reached by using the original EV model. Where the outcomes of the two models differed, the SEU model produced better predictions of actual human choice behavior.

The operation of the SEU model may be seen in a number of ways in VE studies, including techniques as qualitative screening, paired comparisons, rank and rate, and the "Gut Feel Index". Care should be taken when using such variations of the SEU model as we know humans are prone to a number of biases (e.g. the availability bias described above). Reliability, at least, could be checked by using at least two SEU approaches.

Given the vast number of group techniques that have been developed for decision making tasks, it is somewhat surprising that systematic studies of group effectiveness have not resulted in the demonstrated superiority of any one practice. While we have known for a long time that procedures are valuable in a general sense, it appears that performing "critical functions" is more important than using a specific procedure. In 1985, Hirokawa examined decisions that were made by a large number of groups that used no particular procedure. By comparing the best and worst decisions, the researchers identified three critical functions that differentiated more successful from less successful groups. These include:[5]

1. The group needs to understand its dilemma thoroughly and accurately. The members must understand the nature of the problem, as well as its extent, seriousness, causes, and results.

2. The group has to come up with a range of realistic and acceptable alternatives.

3. The group must assess, thoroughly and accurately, both the positive and negative consequences of each alternative choice.

In a further study, Hirokawa had groups make decisions using one of four assigned procedures. Somewhat surprisingly, the procedures, in and of themselves, had no effect on the quality of the groups decisions. However, the extent to which the critical functions were performed was a significant predictor.

From these and similar studies, it is clear that groups must guard against assuming that merely going through the steps of a given procedure or set of procedures will produce good results.

Unlike Hirokawa's conclusion that specific procedures used make no difference, I still believe that adoption of the VE job plan accounts for the success of many teams. Perhaps this is because the job plan includes the critical functions in its design. Thus, VE teams that use the plan are more likely to fulfill the critical functions than groups that do not.

SOME PITFALLS TO AVOID

Even with effective models and procedures, decision making groups may derail due to poor implementation. Some of the more common impediments include the phenomenon of "groupthink", and ineffective coherence in analysis due to poor communication in screening and choice phases.

In 1977, Janis and Mann[6] refined their conception of "Groupthink", a view of group decision making behavior identified earlier when it was

defined as a circumstance in which a group establishes a norm that consensus is the group's highest priority. According to their later investigation, there were five preconditions for this phenomenon to develop.

First, the group had to have a difficult or complex task which causes a moderated level of anxiety among the members.

Secondly, the group leader must be authoritarian. Democratic leaders and groups that expect to be largely self-governing rarely experience "groupthink".

The third precondition is high cohesiveness which tends to increase conformity.

Fourth, the group is not highly tied to "real world" considerations which anchor their ideas through reality-testing.

Finally, groups that experience the groupthink problem rarely have a definite procedure or approach for making a decision.

Common effects of "groupthink" include severe limitation of alternative courses of action to consider, limited critical analysis (especially regarding the favored option), lack of tapping external resources for information or feedback, and lack of contingency plans to be considered in case the chosen alternative becomes unacceptable.

Value analysis (VA), with its characteristics of democratic leadership, empowered team members and clear job plan should be able to avoid the problems described. Nonetheless, it is a good idea to have a group member take on the role of "critical evaluator", to question facts, assumptions and/or opinions voiced by all members of the group, including the leader.

PRECHOICE SCREENING EFFECTS

Beach [7] developed a model of decision-making called "image theory". While the theory and its underlying research are too extensive to describe here, some of aspects are especially relevant to the present discussion. Generally, decision theory and research have focused on choice--the actual selection of the best option from a set containing two or more alternatives. Beach was interested in the question of how the options got on the list to begin with--why those particular aspects and not others that might have been included. This work also deals with the relationships between screening and subsequent choice behavior.

Defined as the process that governs admission of options to the choice set, screening reduces effort required for decision making by reducing both the number of options that must be evaluated as well as the probability that the choice selected could be a bad one. Beach's research involved decision options (e.g. candidates for a position, housing alternatives) that are easily understood and evaluated. Subjects were instructed to examine an array of options (along with a set of standards or preferences regarding the nature of the choice) and to form a "short list". Finally, the subjects were instructed to choose the best alternatives from the short list.

Results demonstrated that group screening behavior relies almost exclusively on violations of standards. Rejection thresholds are developed, and as soon as that level of violation (standards not met) reaches that point, the option is eliminated.

The next step, in which the groups go on to make an actual choice, has been extensively investigated. In a series of studies conducted by van Zee, Paluchowski and Beach [8], the options were rooms to rent. Groups of subjects were told that they were to select a room for a friend who was coming to live in the area. They were given a list of the friend's criteria for housing and for each of five rooms, the kind of information usually found in newspaper classified advertisements. After screening and development of a short list, the subjects were given additional information about the surviving alternatives that would normally be obtained by actually visiting the rooms. Then the final choice was made. By correlating information given with the ratings made during short-list formation and again just before the choice was selected, the researchers identified a most interesting yet disturbing phenomena. The information used initially to screen the options had little impact on the evaluations that preceded choice (correlations ranged from 0.02 to 0.07). However, the information given after screening had a major impact (correlations between 0.67 and 0.86). Apparently, the subjects felt the initial information regarding criteria was all "used up" after screening and had no further value in the choice decision. This same phenomenon was clearly demonstrated in additional studies across a variety of treatments and problem contents. Attempts to increase use of the initial information by repeating the old data along with the new information, or by reminding subjects to use all the information provided

were not successful--the "screening effect" was still robust.

As the screening decisions are based on a simple violation principle, final choices based largely on the additional data were frequently suboptimal. Criteria in the form of customer expectations, reliability standards, amount of weight supported, etc., are clearly important in VE decision-making. Indeed, extensive effort during the information phase is directed to explication of such standards. Given the number of studies in which screening effects have been demonstrated, special effort should be made to maintain attention to criterial attributes of the choice throughout the entire job plan. Otherwise, we risk final evaluation and selection based more on personal perspective and political action rather than the original standards identified.

UNCOVERING HIDDEN PROFILES

Assuring use of significant information during group decision making extends beyond the criteria to be applied. One of the major reasons heterogeneous teams are used for VE projects is the belief that group decisions can be better informed than individual ones due to the synergistic benefits provided by diverse knowledge, experience and points of view. Recently, researchers have re-opened the issue of whether such pooling benefits are actually realized in practice. As illustrated in Figure 1 (below), some of the information available to team members is shared by all; some shared by two or more, and some is unshared--known by one member only.

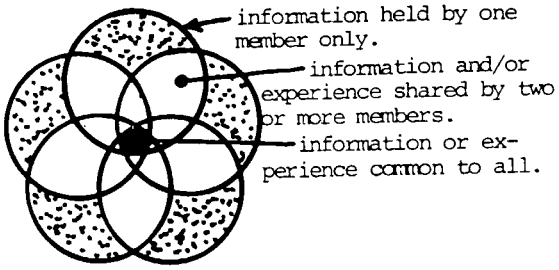

Figure 1

To obtain best results, uniquely held information must be mentioned and considered during group discussions. This is especially true in cases of hidden profiles. A hidden profile exists when the superiority of one solution alternative over all others is masked because each individual member has only a fraction of the supporting data, but when such data is pooled, the superior option can be revealed. This is precisely the situation present in many, if not most, VE project studies. Historically, the lack of effective pooling has been attributed to member laziness, diffusion of responsibility, dysfunctional pressures to conform, and even to the "inherent ineffectiveness" of groups themselves.

After extensive research, Stasser suggested a very different consideration. This researcher examined group discussion as a process of information sampling and reported that: "Other things being equal, shared information often is more likely to be discussed than is unshared information" [9]

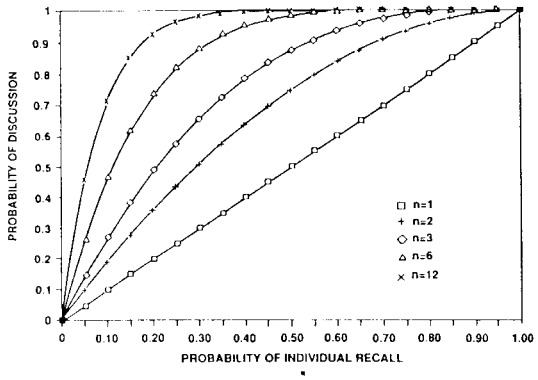

Figure 2

As shown in Figure 2 (above), groups tend to talk about what all the members already know rather than to exchange information that is held by single members. If, for example, members of a 33 person group mention 30 percent of the information that they bring to a discussion; then the probability of an unshared item being discussed is 0.3, but the probability of a shared item being mentioned is 0.66. Indeed, this disparity increases as group size increases.

This tendency is of special concern in VE. The key to realizing the benefits of team heterogeneity is that the unique information and/or skills will be experienced during group discussion. Some managers presume that the job plan will provide for effective interaction. Unfortunately, Stasser showed that the tendency to focus on shared information occurs even when some of the groups were instructed to use a structured decision-making approach. The researchers recorded the relative discussion of frequencies of shared and unshared information that had been distributed to three- and six-member groups charged with selecting the most qualified candidate for a hypothetical position. Overall, groups discussed 45% of the shared information, but only 18% of the unshared. In groups that followed a structured

approach, the disparity increased. While the percentage of unshared information was increased to 23% mentioned, the percentage of shared information discussed rose to 67%. It seems clear that we cannot simply rely on application of the structured job plan to assure that crucial information will be made available and used effectively in VE discussions.

CONCLUSIONS AND RECOMMENDATIONS

In many ways, the present organization and management of VE activity meets best practice implications of research on group decision making. Team attention to specific criteria for evaluating options, determination of subjective expected utility--especially in those efforts that clearly focus on customer expectations, and team composition emphasizing diversity and member expertise are particularly appropriate. These congruencies, however, must not lead to complacency. Continuous improvement in VE practice requires careful attention and accomodation of systematic study. From the investigations reported here, I suggest that VE managers provide for continuous process monitoring and feedback to team members to provide a check on the ways in which decisions are being made. Members should be helped to recognize that each has special expertise and unique information. Additionally, all members must believe that sharing information is necessary to reach the best decision. Finally, we must all recognize the need for development of a local knowledge base--obtained from individuals directly involved in VE activity- to continue developing our practice in a professional manner.

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