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STRATEGIC ORGANIZATIONAL DECISIONS AND STRESS:
A TEST OF THE CONFLICT MODEL OF DECISION MAKING

By

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ABSTRACT

STRATEGIC ORGANIZATIONAL DECISIONS AND STRESS: A TEST OF THE CONFLICT MODEL OF DECISION MAKING

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This study was a test of Janis and Mann's (1977) conflict model of decision making, which proposes that information processing is more vigilant under conditions of moderate stress than under conditions of low or high stress. Questionnaires were returned by executives from 263 medium-size manufacturing companies which had opened or expanded plants in the last five years or were planning to do so. Only very limited support was found for the model. Of the four information processing vigilance measures, only one--the number of alternatives considered--demonstrated a weak curvilinear relationship with stress ($p < .08$). Two other vigilance measures were associated with stress in a positive linear relationship, and the fourth measure of vigilance was not associated with stress. In addition, stress was not related in a curvilinear fashion to any of the measures of the quality of a decision.

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INTRODUCTION

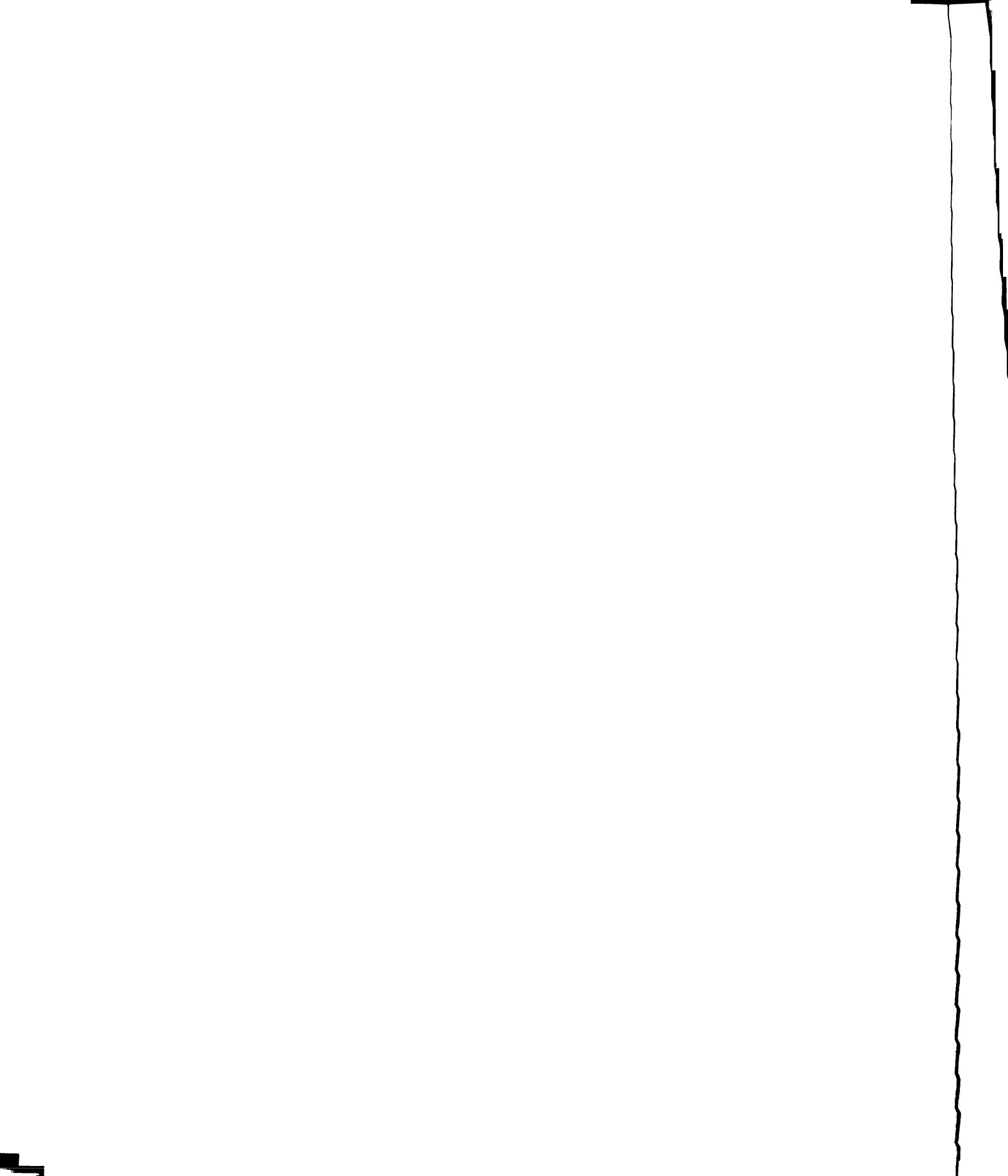
Decision theory began with a model of a rational decision maker. Subsequent theorists charged that the model made unrealistic assumptions about human information processing capabilities and lacked empirical support. A bounded rationality model was proposed by Simon and his colleagues (March & Simon, 1958; Simon, 1947). In the last decade, the debate about which model is superior has quieted, and a contingency view of decision making has become ascendant (Beach & Mitchell, 1978; Payne, 1976). The decision model selected by an individual is assumed to be a function of the decision environment and the decision maker. Most contingency models have focussed on cognitive factors and seem to assume a coolly rational decision maker. The emotional component of decision processes has been ignored. One exception is the conflict model of decision making of Janis and Mann (1977). This is a contingency model which proposes that the stress engendered by important decisions has an impact on the rationality of the decision process. The research described in this paper attempted to test the appropriateness of the conflict model as a description of strategic organizational decision making.

Decision Making

Decision making may be considered a subset of problem solving. A decision process involves the evaluation of a set of alternatives and the selection of a course of action, while problem solving deals with the larger process of problem formation, alternative generation, and information processing which preceeds the decision process (MacCrimmon & Taylor, 1976). Decision research is generally concerned with how people make difficult choices. Routine choices, which are matters of habit, or simple choices, in which one alternative is clearly better than all others, are generally dismissed as too trivial to merit study. The irony of decision research is that, while consequential decisions are the purported study domain, most research has examined hypothetical choices in the laboratory. Although this research has taught us a great deal, it ignores the emotions that important real world decisions produce. Only the Janis and Mann (1977) model deals explicitly with emotion as a moderator of decision making processes. Because it extends and in some instances controverts earlier rational choice and bounded rationality models, the latter theories will be reviewed before the Janis and Mann model.

Rational Choice Models

The concept of rationality is the foundation of decision theory, but rationality has different meanings (Clough, 1984). Objective rationality is achieved when a decision maker selects the alternative that maximizes



objectively measured gains, such as profit. Rationality may also be defined subjectively as being achieved when the decision maker selects the course of action that maximizes subjectively perceived gains, including outcomes which cannot be measured objectively.

Rational-choice models are the traditional or classical approach to decision making and were initially formulated by economists. These models assume that the decision maker chooses the alternative which maximizes desired outcomes. A number of assumptions about the decision maker and the decision environment are taken as "givens." It is assumed that the rational decision maker possesses knowledge about the entire set of alternatives. To each alternative is attached a set of consequences, which are characterized by certainty, risk, or uncertainty. The decision maker is assumed to have a preference ordering that ranks all sets of consequences from most to least preferred. Finally, the decision maker selects the alternative leading to the preferred set of consequences.

In an objective rational choice model, the decision maker employs socially agreed upon measures of performance or value, such as dollars or ounces, and accepted criteria for elimination and choice, such as return on investment. The rational decision-maker is presumed to act in conformance with these accepted social standards (Clough, 1984).

It has long been known that socially agreed upon

measures of value are not invariant across individuals or within individuals in different situations. The subjective approach to rational choice replaces value with utility, which is what an outcome is perceived worth to an individual. This concept dates back to Bernoulli (1738) who, observing the behavior of gamblers, proposed that the utility for money is a logarithmic function, exhibiting diminishing increases in utility for equal increments in wealth (i.e., the difference between \$505 and \$510 is not seen as important as the difference between \$5 and \$10). Another argument for the use of utilities is that they allow multiple diverse outcomes to be measured on a single utility scale.

When probabilities can be assigned to outcomes, the utility model becomes an expected utility (EU) model. EU models predict or prescribe that a decision maker selects the alternative which maximizes $\sum_{i=1}^n (p_i)U(x_i)$, where there are n outcome vectors x_i each with a utility U , and n associated probabilities p_i such that $\sum_{i=1}^n p_i = 1$.

Expected utility theory has been the major paradigm in decision theory since the Second World War (Schoemaker, 1982). The theory originated with Bernoulli (1738) and the axioms of the theory were formalized in von Neuman and Morgenstern's Theory of Games and Economic Behavior (1947).

When objective probabilities are replaced by the subjective estimates of the decision maker, the EU model

becomes a subjective expected utility (SEU) model. The subjective probability school was developed by Ramsey (1931); de Finetti (1937, 1970/1974); Savage (1954); and Pratt, Raiffa, & Schlaifer (1964). In objective probability models, probabilities are known or can be estimated via statistical inference from the outcomes of repeated trials. Phenomena which are not repetitive (such as the likelihood of a nuclear war) cannot be described in terms of probabilities. The subjective probability school defines probability as the decision maker's degree of belief, applicable to both repetitive and unique events. Subjective probability makes no restrictions about logical or empirical reasons, but mathematically this view is indistinguishable from other types of rationality in that the probability of elementary events sums to one (Schoemaker, 1982).

Both logically and empirically, rational choice models have come under attack. It is important to keep in mind, however, that much of decision research would not have resulted without the existence of EU theory. Even its critics acknowledge that it has contributed insights and helped refine inquiry (Schoemaker, 1982). Nevertheless, it is the conclusion of many reviewers that the value of EU models is limited (Einhorn & Hogarth, 1981; March & Simon, 1958; Schoemaker, 1982; Slovic, Fischhoff, & Lichtenstein, 1977). The axioms of the model are violated, the assumptions about human information processing capabilities are unrealistic, and the model does not predict decisions

well.

As a descriptive model of decision making, EU fails on a number of counts. Research shows that subjective probabilities are related nonlinearly to objective probabilities (Edwards, 1953, 1954), low probabilities are overweighted and high probabilities are underweighted (Lee, 1971), and subjective probabilities are influenced by wishful thinking in that they tend to be higher as outcomes become more desirable (Irwin, 1953; Marks, 1951; Slovic, 1966). In addition, people tend to be more conservative in revising their probabilities after receiving new evidence than is prescribed by Baye's theorem (Edwards, 1968).

One explanation for these errors in judgment has been offered by Tversky and Kahneman (1974). They suggest that in many cases, probability estimates are based on heuristics, or simplifying rules of thumb, that usually yield reliable estimates but sometimes do not. They enumerate several types of heuristics, but these are tangential to this paper and will not be discussed.

The EU model also falls short as a predictor of behavior in the real world. For instance, many homeowners in flood plains and earthquake areas fail to obtain insurance. Kunreuther, Ginsberg, and Miller (1978) surveyed such homeowners to obtain subjective estimates of the probability and the magnitude of loss and perceptions of the cost of insurance. They found that between 30 and 40 percent of the people acted contrary to SEU maximization.

Similar findings have been obtained in relation to crime insurance (Federal Insurance Administration, 1974) and seat belt use (Robertson, 1974). Other research demonstrated that Las Vegas gamblers playing with their own money exhibited the same biases and inconsistencies that had been observed in college students making hypothetical decisions (Lichtenstein & Slovic, 1973).

The weight of the evidence against the EU model has convinced many researchers that its value as a descriptive or predictive heuristic is limited. Among them, MacCrimmon and Larsson conclude that "since many careful, intelligent decision makers do seem to violate some axioms of expected utility theory, even upon reflection of their choices, it does seem worthwhile exploring the option of considering modifications of the standard theory" (1979, p. 83). The primary modification of the theory has been the inclusion of boundaries or limits on human information processing capabilities.

Limited Rationality Models

The concept of "bounded rationality" was first proposed by Simon (1947). He and his associates have developed the basic model of limited rationality (1955, 1957, March and Simon, 1958, Newell & Simon, 1972). They propose that the assumptions of the classical rational-choice model are not realistically related to how decisions are actually made. The classical model assumes, for instance, that the decision maker possesses knowledge about all the alternatives, all

the consequences associated with each alternative, and the probabilities of future events. Limited rationality models argue that such assumptions are not valid, and that in actuality, "the capacity of the human mind for formulating and solving complex problems is very small compared with the size of the problems whose solution is required for objectively rational behavior in the real world--or even a reasonable approximation to such objective rationality" (Simon, 1957, p. 198).

These conclusions are consistent with the findings of Miller (1956) that short-term memory capacity is limited to seven plus or minus two pieces of information. Real decision makers also have limitations on the time and other resources that they can expend on a decision. It must be remembered that these models do not contradict the basic assumption of the classical decision models that human beings exhibit rationality in decision making. March and Simon (1958), in fact, call their bounded rationality model a rational-choice model. The distinction is that limited rationality models add the proviso that decision makers are rational within the constraints of their perception of the decision problem.

March and Simon (1958) label traditional rational-choice processes "optimizing" and bounded-rational choice processes "satisficing." When optimizing, the decision maker identifies the entire set of alternatives through a comprehensive search. He or she establishes many criteria based on multiple objectives by which the alternatives are

evaluated. The alternatives are evaluated using a weighted additive model, and the alternative chosen is the one which maximizes utility.

The satisficing decision maker establishes only a few criteria and attaches minimum cutoff points to each one. Alternatives are identified sequentially. As soon as an alternative is found, it is evaluated against the minimum criteria. If it satisfies each criterion, it is selected, and no other alternatives are sought. If it fails to satisfy one or more of the criteria, it is eliminated, and the decision maker searches for another alternative until a satisfactory solution is found.

Limited rationality models appeal to our common sense comprehension of how decisions are made and appear to describe decision making more accurately than do traditional rational choice models. However, much of the empirical support for Simon's model comes from computer simulations of recurrent decisions, such as hiring and investment decisions (Cyert & March, 1963; Newell & Simon, 1972). Recent research indicates that actual decision behavior is even more diverse than the bounded-rationality model indicates, and that many factors influence how decisions are made, including factors which interfere with the assumed (albeit constrained) rationality of the decision maker. The focus of decision researchers has shifted to identifying these factors which moderate decision processes.

Contingency Theories

Contingency theories of decision making are based on two assumptions (a) that decision makers have an array of possible decision strategies available to them, and (b) that conditions in decision making settings influence the types of strategies that are employed. The focus of research, therefore, shifts from determining whether optimizing or satisficing models better describe decision processes to identifying the circumstances which influence the choice of strategies. Janis and Mann's conflict model is a contingency theory but one that has a manifestly different focus than that of most contingency theory research. In the following sections, as a way of providing a background for the understanding of contingency theories, I will first describe various decision strategies and then will discuss some of the conditions which may determine which strategies are used.

Decision Strategies

A decision strategy is "(a) the set of procedures that the decision maker engages in when attempting to select among alternative courses of action, and (b) a decision rule that dictates how the results of the engaged-in procedures will be used to make the actual decision" (Beach & Mitchell, 1978, p. 439). Rational-choice and limited-rationality models are two very broad sets of strategies. More specific strategies have been identified, and because a discussion of contingency theories requires some understanding of

Table 1

Characteristics of Decision Strategies (Modification of Svenson's [1979] Taxonomy)

Strategy	Compensatory or noncompensatory	Single dimension of value	All minimum criteria must be met	Attributes given differential importance	Minimum diff. between all attributes required	Minimum diff. on most important attribute	Objective probabilities attached to attributes	Subjective probabilities attached to attributes
Type I:								
Conjunctive	noncomp	no	yes	no	no	no	no	no
Disjunctive	noncomp	no	no	no	no	no	no	no
Type II:								
Lexicographic	noncomp	no	no	yes	no	no	no	no
Elimination by aspects	noncomp	no	yes	yes	no	no	no	no
Type III:								
Minimum diff. lexicographic	noncomp	no	no	yes	yes	no	no	no
Lexicographic semiorder	noncomp	no	no	yes	no	yes	no	no
Type IV:	comp	no	no	no	no	no	no	no
Type V:								
Choice by greatest attractiveness difference	comp	no	no	no	no	no	no	no
Type VI:								
Additive utility	comp	yes	no	yes	no	no	no	no
Additive differences utility	comp	yes	no	yes	no	no	no	no
Type VII:								
Expected utility	comp	yes	no	yes	no	no	yes	no
Type VIII:								
Subjective expected utility	comp	yes	no	yes	no	no	no	yes

terminology, I will summarize Svenson's (1979) taxonomy of decision strategies as a means of providing definitions and as a framework for comprehending the relationships between decision strategies.

Svenson's Taxonomy

Svenson identifies seven types of decision rules. The characteristics of the decision strategies subsumed by the decision rules are outlined in Table 1. The first three types of rules are noncompensatory and the remaining four are compensatory (or commensurable). Compensatory models allow attractive attributes to compensate for unattractive attributes. Rational-choice and optimizing models are compensatory strategies. In noncompensatory models, such as satisficing, unattractive dimensions result in the elimination of alternatives.

Type I: Ordinal attractiveness and no commensurability. The two strategies which fall into this category are conjunctive and disjunctive strategies. Conjunctive decision making is basically the same as satisficing: the decision maker specifies a set of minimum criterion values for each attribute and eliminates all alternatives which fail to meet the criterion on at least one attribute. Elimination of alternatives continues until only one alternative remains. A disjunctive decision rule specifies that the chosen alternative must have at one least attribute value greater than the criterion, and all the attribute values of the other alternatives should fall below

or be equal to the criterion values.

Type II: Ordinal attractiveness, lexicographic order and no commensurability. These strategies differ from the preceding set in that the attributes, or dimensions, can be ordered in terms of importance. A lexicographic strategy requires that the alternative selected is the one that has the best value on the most important attribute. If there is a tie, the alternative that is best on the second most important dimension is chosen, and so on. An elimination by aspects rule (Tversky, 1972) prescribes that the decision maker specifies a set of minimum criterion values for each attribute and orders the attributes in terms of importance. All alternatives that fail to meet the cutoff on the most important attribute are eliminated. Then all alternatives that fail to meet the minimum criterion on the second most important attribute are eliminated. Elimination continues until only one alternative remains.

Type III: Ordinal attractiveness differences, lexicographic order and no commensurability. This decision rule includes two strategies: (a) minimum difference lexicographic, and (b) lexicographic semiorder. The minimum difference lexicographic rule is like the lexicographic rule but an alternative can be chosen only if it surpasses all the other alternatives on the most important dimension by a minimum amount. If the difference between two alternatives on the most important attribute is perceived as being insignificant, the decision maker moves on to the next most

important attribute. With the lexicographic semiorder rule (Tversky, 1969), a minimum difference is specified only for the most important attribute. For all other attributes, any difference is sufficient for elimination. The minimum difference lexicographic rule assumes that minimum differences are defined for each attribute.

Type IV: Ordinal attractiveness and commensurability.

These strategies require that, for each attribute, the alternatives are classified relative to one another as better, equal or worse. The decision maker then chooses the alternative with the greatest number of attractive attributes or eliminates the alternative with the most unattractive aspects.

Type V: Ordinal attractiveness differences and commensurability. The decision strategy of "choice by greatest attractiveness difference" specifies that the decision maker identifies the attribute on which the alternatives are most different and selects the alternative that is most attractive on this attribute, irrespective of the other attributes. Although Svenson classifies this strategy as commensurate (or compensatory), this is clearly not the case.

Type VI: Interval attractiveness (utility) and commensurability. Svenson states that a number of different procedures for weighting and combining alternatives have been presented (Anderson, 1974a, 1974b,; von Winterfeldt & Fisher, 1975; Shanteau, 1977), but the additive and additive

differences rules have received the most attention. The additive utility rule states that the decision maker sums the utilities for each alternative and chooses the alternative with the greatest sum of utility. The additive utility differences rule implies that only two alternatives can be compared at a time. The decision maker totals the differences between two alternatives on each attribute. The same alternative should be chosen with an additive or an additive difference strategy.

Type VII: Ratio attractiveness and commensurability.

The SEU model is the only strategy mentioned as following this rule. The name of this rule is inaccurate because SEU is concerned with probability estimation not ratio attractiveness. It would be more accurate to specify as the seventh and eighth rules, "utility, objective probability and commensurability" (EU) and "utility, subjective probability and commensurability" (SEU).

Characteristics that Influence Decision Strategies

Contingency models attempt to predict which strategies will be selected in different situations. These theories are based on the assumption that strategy selection is contingent upon both the characteristics of the decision maker and the decision task (Beach & Mitchell, 1978).

One of the most fully developed descriptive contingency models of decision making is that presented by Beach & Mitchell (1978). They propose that the strategy selected is a function of the characteristics of the decision maker, the

decision problem, and the decision environment. According to them, the characteristics of the decision maker that will have an impact on the selection of a decision strategy include knowledge about the available strategies and the ability and motivation to use a given strategy. The primary characteristics of the decision problem are its unfamiliarity, ambiguity, complexity, and instability. The decision environment is characterized by the irreversibility and significance of the decision, the accountability of the decision maker, and the constraints on time and/or money.

Complexity

A number of experiments have tested the impact of the above characteristics on decision processes. The aspect that has received the most attention is the complexity of the decision problem. This is operationalized as information load, which is often defined as the number of alternatives or dimensions presented to the decision maker.

In one experiment, Payne (1976) presented students with a hypothetical decision--choosing an apartment. The students were given either 2, 4, 8, or 12 apartments as alternatives. When only two alternatives were presented, subjects used a compensatory strategy (additive or additive difference), but with six or twelve alternatives, subjects used a two-stage strategy. They first quickly eliminated some of the alternatives by using a noncompensatory strategy (elimination by aspects or conjunctive), and then evaluated the remaining alternatives with a compensatory strategy.

Similar results have been found by other researchers (Billings & Marcus, 1983; Lussier & Olshavsky, 1980; Olshavsky, 1979).

Researchers have also examined the impact of the number of dimensions on decision making. In general, it has been shown that increasing the number of attributes increases the variability of the responses (Einhorn, 1971; Hayes, 1964; Hendrick, Mills & Kiesler, 1968; Jacoby, Speller, & Kohn, 1974), but does not increase the likelihood that noncompensatory strategies will be used (Einhorn, 1971; Payne, 1976; Olshavsky, 1979).

The impact of the complexity of the attributes has also been examined in an experiment comparing a two point attribute valuation (has/does not have) with a five point scale (Olshavsky, 1979). It was found that when attributes were complex, subjects used a three-stage strategy, employing two separate noncompensatory screenings. Park (1978) found that when subjects were presented with a seven point scale for each attribute, they tended to reduce the scale to a simpler three point scale (negative, neutral, positive).

Significance, Accountability and Reversibility

The effects of significance, accountability, and reversibility were examined by McAllister, Mitchell, and Beach (1979). Subjects were presented with business case studies and four solution strategies that varied in the amount of computation and analysis necessary to generate an

answer. In the first two experiments, the manipulations were presented as part of the case. The decision was portrayed as significant or not significant (usually in terms of the impact on the financial states of the companies). The central character was or was not held personally accountable for the decision. And the decision was described either as temporary and reversible or as irreversible. In the third experiment, the independent variables were manipulated directly. Significance was manipulated by telling the subjects that the experiment they were involved in was important or that it was a pilot study with little expected impact. Half of the subjects were made to feel accountable for their decisions by telling them that they would have to defend their responses in front of a group of their peers. Reversibility was manipulated by telling half of the subjects that they could change their decisions at the end of the research period if they wished. In general, the results of these experiments indicate that more analytical strategies are chosen when the decision maker is accountable and the decision is significant and irreversible. The results were weakest, though, in the third experiment which had the highest external validity. In this experiment, strategy selection and the amount of time spent on the task were influenced only by accountability and marginally by significance.

Time Constraints

Another characteristic of the decision situation is the presence of deadlines. Christensen-Szalanski (1980) proposed that deadlines and other time constraints truncate the array of possible strategies by eliminating highly complex strategies from consideration. In an experiment in which business students analyzed case studies, it was found that subjects with five minute deadlines were much more likely than were students with 45 minute deadlines to report that they would have preferred to have used different and more complex strategies than the ones that they had employed. The subjects with the greater time constraints were also less confident of their solutions (Christensen-Szalanski, 1980). Wright (1974; Wright & Weitz, 1977) also examined judgments under time constraints and found that as time pressure increased the negative bias model (a noncompensatory model in which the decision maker focuses on negative information) fit the data better than did a linear compensatory model.

In summary, more analytic compensatory strategies are likely to be employed when the number of alternatives is limited, the decision maker feels accountable, the decision is significant and irreversible, and time constraints are not oppressive.

The experimental evidence summarized here seems to support a contingency view of decision making. The theory explaining these results is less satisfactory. Beach and

Mitchell (1978) propose that "strategy selection is contingent upon a [cost/benefit] compromise between the decision maker's desire to make a correct decision and his or her negative feelings about investing time and effort in the decision making process" (p. 448). They propose that the cost/benefit mechanism is an SEU model. This implies that irrational, suboptimal strategies are selected in a rational way. Christensen-Szalanski (1978), a student of Beach, formalized the cost/benefit mechanism with a strategy selection curve, thus further increasing the complexity of the calculations presumed to be involved in selecting a strategy.

There are two arguments against this cost/benefit explanation. The first is that the assumption that additional costs are calculated and balanced violates what we know about cognitive limitations. The second argument was advanced by Einhorn and Hogarth (1980). They proposed that the mechanisms by which decision strategies are selected are themselves decision strategies or metastrategies. They argued that if highly analytic strategies involve costs that the decision maker would prefer to minimize, then an SEU metastrategy would also involve costs and should only be employed when the decision maker perceives that the use of a complicated metastrategy will provide enough benefit to offset these costs. In other cases, a less complex metastrategy, such as elimination by aspects, should be used. This implies that there is a

superordinate strategy for selecting metastrategies, and so on without end.

Janis and Mann (1977) offer another explanation for contingent decision processing. They argue that the use of optimal decision processes is contingent on the level of stress experienced by the decision maker. Their model, thus, focuses on the emotional aspects of decision making--an area neglected by most contingency research and by decision research in general.

On the face of it, Janis and Mann's theory could be readily integrated into a contingency theory such as Beach and Mitchell's. The characteristics of the individual and the characteristics of the decision environment interact to produce a perceived level of stress which determines the decision strategy used. Structurally, this is consistent with traditional contingency theories, but the underlying premise of Janis and Mann's theory is completely at odds with Beach and Mitchell's theory and with most other theories of decision making. Although rational models can potentially build in affectively-loaded outcomes, historically they have not. In this sense, then, the conflict model might be thought of as a nonrational theory of decision making because decisions are seen not merely as the products of rational calculation but of emotion as well.

Janis and Mann's Conflict Model of Decision Making

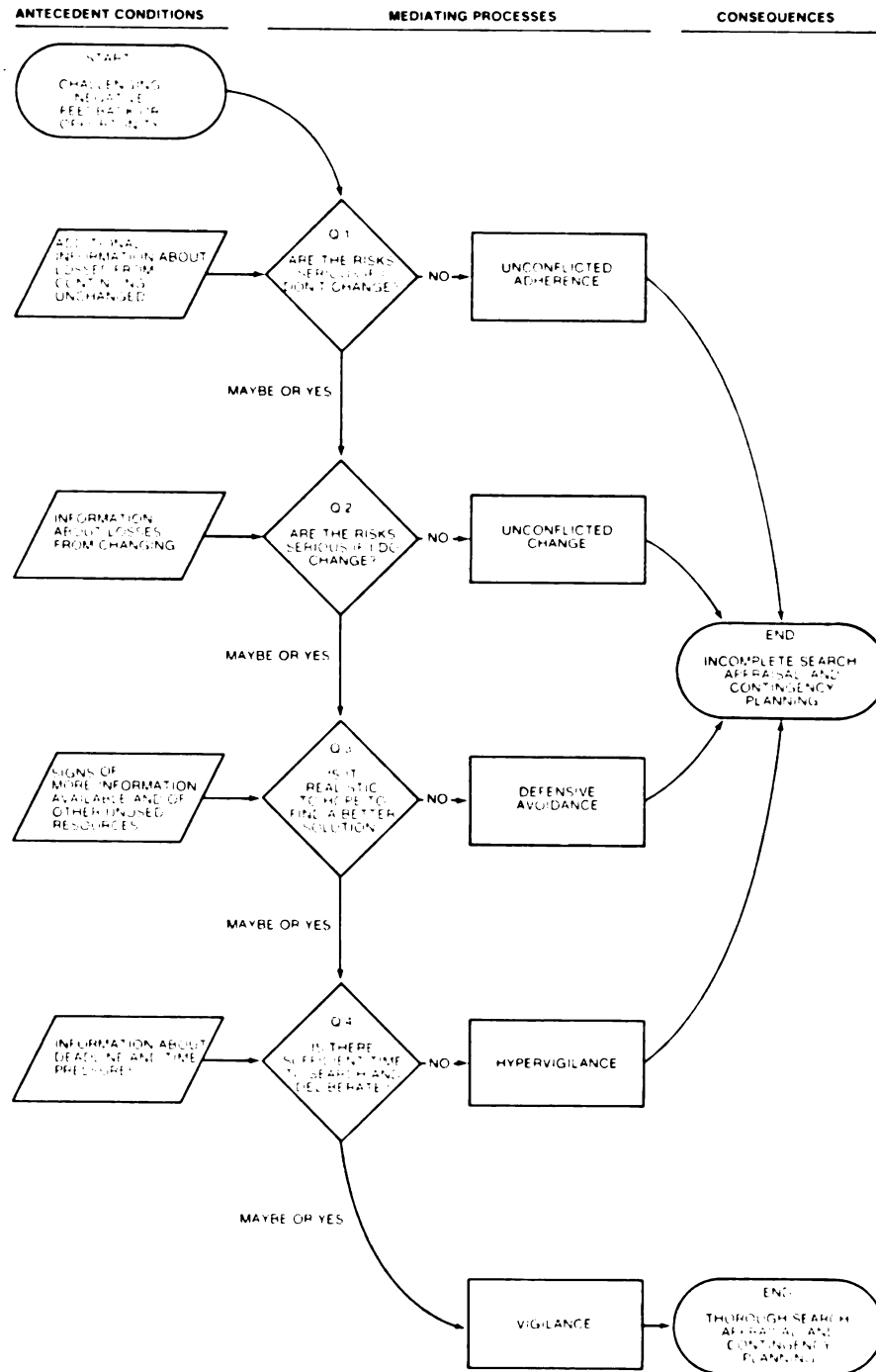
The central thesis of Janis and Mann's (1977) book is that important decisions generate psychological stress which imposes limitations on the rationality of decision making. The relationship between stress and decision making is such that both too little stress and too much stress may result in defective information processing.

Janis and Mann propose a conflict model of decision making. In this usage, decisional conflict does not refer to interpersonal conflict, rather it is the "simultaneous opposing tendencies within the individual to accept and reject a given course of action" (p. 46). Intense conflicts are likely to develop whenever a person has to make an important decision because such decisions involve vital, affect-laden issues, or "hot" cognitions, using Abelson's (1963) terminology.

Decisional conflicts are sources of stress. Janis and Mann define psychological stress as "a generic term to designate unpleasant emotional states evoked by threatening environmental events or stimuli" (p. 50). The degree of stress generated by a decisional conflict is a function of the number of goals the decision maker expects to remain unsatisfied by the decision. Janis and Mann make two assumptions about stress. The first is "the more goals expected to be unfulfilled and the more important the needs to which those goals correspond, the greater the stress." The second assumption is, "When a person encounters new

Figure 1

A conflict model of decision making. [From Decision making: A psychological analysis of conflict, choice, and commitment (p. 70) by I.L. Janis and L. Mann, 1977, New York: Free Press.]



threats or opportunities that motivate him to consider a new course of action, the degree of decisional stress is a function of the degree to which he is committed to adhere to his present course of action" (p. 50).

The conflict model is presented in Figure 1. It shows the relationship between antecedent conditions, mediating processes, and consequences. The antecedent conditions include information about the environment. Although not explicitly shown in the model, Janis and Mann state that other factors also function as antecedent conditions. Personality variables and prior experience with similar decision situations are two examples.

The mediating processes link perceptions of stress and modes of decision making. The four key questions determine the level of perceived stress, which determines which coping pattern will be used to arrive at a decision.

Janis and Mann describe five coping patterns, or ways that individuals make decisions under different levels of stress:

1. Unconflicted adherence: the individual continues the current course of action without surveying any other alternatives.

2. Unconflicted change: the individual chooses a salient alternative without a thorough canvassing of available alternatives or a careful evaluation of the consequences.

3. Defensive avoidance: the individual becomes

pessimistic about finding a suitable alternative and will attempt to avoid cues that stimulate anxiety. The decision maker will (a) procrastinate, (b) shift responsibility for the decision to someone else, or (c) bolster the chosen alternative (i.e., cognitively distort information about the alternative by exaggerating its favorable consequences and minimizing its unfavorable consequences).

4. Hypervigilance: The individual becomes very anxious and begins to lose hope of finding a solution in time. After superficially scanning the most obvious alternatives, the decision maker chooses the first one that seems to hold promise of escaping the aversive situation.

5. Vigilance: the individual carries out a thorough search for alternatives and makes a careful evaluation of consequences before selecting an alternative.

The first four coping patterns represent defective decision processes. Vigilant information processing is more likely to result in a satisfactory decision. Janis and Mann define vigilant decision making in more detail in terms of the following seven procedural criteria:

The decision maker, to the best of his ability and within his information-processing capabilities:

1. thoroughly canvasses a wide range of alternative courses of action;
2. surveys the full range of objectives to be fulfilled and the values implicated by the

choice;

3. carefully weighs whatever he knows about the costs and risks of negative consequences, as well as the positive consequences, that could flow from each alternative;
4. intensively searches for new information relevant to further evaluation of the alternatives;
5. correctly assimilates and takes account of any new information or expert judgement to which he is exposed, even when the information or judgment does not support the course of action he initially prefers;
6. reexamines the positive and negative consequences of all known alternatives, including those originally regarded as unacceptable, before making a final choice;
7. makes detailed provisions for implementing or executing the chosen course of action, with special attention to contingency plans that might be required if various known risks were to materialize. (p.11)

When a decision maker meets all seven procedural criteria, then his or her orientation is characterized as vigilant information processing. But as Janis and Mann state, "vigilant information processing is not an all-or-nothing affair; it is manifested to varying degrees

under different conditions. We can conceive of each of the seven criteria as forming a scale, with ratings varying from zero to, let us say, ten" (p. 12). Decisions which satisfy these criteria have a better chance than others of attaining the decision maker's objectives, of being adhered to, and of leading to satisfaction with the decision.

Vigilant information processing is similar to an optimizing strategy. Janis and Mann state that four of their criteria (numbers 1, 2, 3, and 6) overlap with optimizing criteria. They characterize vigilance as a quasi-optimizing strategy because the seven vigilance criteria are less stringent than those of "pure" optimizing strategies. However, the actual procedures used to select an alternative are not clear. A weighted additive decision rule would appear consistent with vigilance but does not seem to be mandated.

The functional relationship between decisional conflict, stress, and the five coping patterns is defined by the following assumptions:

1. When decisional conflict is severe because each alternative poses a threat of serious risks, loss of hope about finding a better solution than the least objectionable one will lead to defensive avoidance of threat cues.
2. In a severe decisional conflict, when threat cues are salient and the decision maker anticipates having insufficient time to find an

adequate means of escaping serious losses, his level of stress remains extremely high and the likelihood increases that his dominant pattern of response will be hypervigilance.

3. A moderate degree of stress in response to a challenging threat induces a vigilant effort to scrutinize the alternative courses of action carefully and to work out a good solution, provided the decision maker expects to find a satisfactory way to resolve the decisional dilemma. (pp. 50-51)

These assumptions can be summarized in the following hypothesis: extremely low stress and extremely high stress are likely to be associated with defective information processing, whereas moderate levels of stress are more likely to be associated with vigilant information processing.

Janis and Mann base their conflict model of decision making on research findings about emergency decision making, i.e., reactions to warnings about approaching life threatening disasters, such as severe illness, radiation poisoning, earthquakes, tornadoes, floods, and air raids (Appley & Trumbull, 1967; Janis, 1951, 1958; Leventhal, 1973). They propose that the model can be extended to all consequential decisions. Consequential decisions are those that "evoke some degree of concern or anxiety in the decision maker about the possibility that he may not gain

the objectives he is seeking or that he may become saddled with costs that are higher than he can afford, either for himself personally or for a group or organization with which he is affiliated" (p. 69).

Research Related to the Conflict Model

Now that the model has been summarized, the evidence Janis and Mann offer in support of their model will be reviewed. Subsequent research bearing on the model will also be presented.

The work of Lewin (1947, 1951) and Festinger (1964) is cited by Janis and Mann as related antecedent research. Lewin was the first to propose an analysis of decision making in terms of psychological conflict. He pointed out that erroneous judgments and resistance to change were often the consequence of social pressures. Festinger's experiments on cognitive dissonance indicate that decision processes are not entirely rational, but are, on the contrary, subject to cognitive distortion.

Other research bears more directly on the conflict model, including experiments exploring the hypothesized relationship between consequential decisions and stress. In one experiment, Mann, Janis and Chaplin (1969) presented college students with a choice between two forms of unpleasant stimulation (noxious taste or loud noise). In order to assess emotional tension during the decision sequence, each subject's heart rate was monitored (a) near the beginning of the session, (b) during the predecision

period, (c) during the decision period, and (d) after the experimental debriefing. Heart rate was highest during announcement of the decision and dropped after the debriefing when subjects found out that they would not have to undergo the unpleasant ordeal after all. Janis and Mann conclude that this experiment demonstrates that demand for a decision acts as a stressor. While this may be the case, an equally plausible explanation may be that the threat of unpleasant stimulation produces stress.

Two other experiments have reported similar changes in autonomic responses in decision situations. Fleischer (1968) required subjects to choose between two disliked foods, and Jones and Johnson (1973) presented subjects with a choice of drug doses with various unpleasant side effects. In both of these experiments, continuous recordings were made of subjects' finger pulse amplitude, so it was verified that stress began to drop before debriefing. But in both studies, stress continued to rise even after the decision was made, before it declined to the initial level.

Another major hypothesis of the conflict model is that very high levels of stress, particularly when accompanied by time constraints, can cause defective decision making. Janis and Mann cite a number of studies that have shown that when a person is in a hypervigilant state, errors in judgment occur partly because of impaired efficiency in cognitive functioning (Beier, 1951; Easterbrook, 1959; Hamilton, 1975; Osler, 1954). In fact, high emotional arousal appears to be

most disruptive of performance on the most demanding tasks, those requiring utilization of the largest number of cues (Easterbrook, 1959).

The studies mentioned in the preceding paragraphs were proffered by Janis and Mann as a theoretical foundation for their model. A convincing test of their model is not presented, however. The evidence they present consists primarily of post hoc analyses of decisions and quasi-experiments comparing the conflict model to other psychological models.

Some of the public policy decisions that they review as illustrations of defensive avoidance are the Nixon administration's failure to heed warnings about the oncoming energy crisis, ineffectual planning for school desegregation in San Francisco, and Admiral Kimmel's failure at Pearl Harbor.

Most of the actual research, as opposed to anecdotes, offered by Janis and Mann is concerned with comparing the model with other social psychological theories. An experiment by Mann, Janis, and Chaplin (1969), for instance, demonstrates that, contrary to the predictions of cognitive dissonance theory, bolstering the preferred choice can occur before commitment to the choice. In another experiment, the selective exposure hypothesis (Klapper, 1949) is refuted because exposure to challenging information is shown to be dependent on the coping pattern being employed (Janis & Rausch, 1970). In another instance, reactance theory

predictions (Brehm, 1966; Wicklund, 1974) are compared to those of the conflict theory (Mann & Dashiell, 1975).

Much of the research presented by Janis and Mann seems to be tangential to the basic predictions of the model. In no case do they attempt to test their basic hypotheses, operationalizing the variables as they are presented in the definitions and key assumptions. They acknowledge that "none of the studies carried out so far was intended to be a 'crucial' experiment that would definitively test the model" (p. 419).

Nine years after the publication of that statement, a definitive test of the model has yet to be performed. This does not appear to be because the model has been dismissed as unimportant or inaccurate. In fact, Janis and Mann's book has been cited by other authors more than 200 times according to the Social Sciences Citation Index. However, only one study has attempted to test the model.

Perry, Lindell, & Green (1982) tested the predictions of the conflict model in relation to public responses to the threatened eruption of Mt. St. Helens. 230 citizens living at three distances from the volcano were interviewed during the time that the Governor had declared a state of emergency. The authors hypothesized that the closer one lived to the volcano, the greater the perception of risk, and the greater the likelihood that a pattern other than unconflicted inertia would be dominant. Vigilance was defined merely as high information seeking. This definition

covers only part of the vigilant information process and in fact does not even deal with actual decision making.

Unfortunately for the test of the theory, the researchers found no differences between the groups at varying distances from the volcano in their perceptions of risk. Even though this meant that they could not test their hypothesis, they still concluded that Janis and Mann's model was supported because everyone seemed to perceive high risk and they all seemed to be vigilantly seeking information. Of course, this post hoc classification of subjects is meaningless and cannot be accepted as valid support for the model.

There are a number of other studies that do not actually test the conflict model but are relevant to its hypotheses. Brecher (1979), for instance, proposed a model of international crisis based on Janis and Mann's model. To test the model, descriptions of Israel's 1967 and 1973 crises were content analyzed by two coders (with .85 intercoder agreement). He concluded that the relationship between stress and group performance in the consideration of alternatives was curvilinear (an inverted U)--"more careful as stress rises to a moderate level, less careful as stress becomes intense" (pp. 476-477).

Many of the contingency theory experiments discussed earlier are also relevant here. The experiments that dealt with the complexity of the decision or information load are not as pertinent because stress is defined by Janis and Mann

only in terms of the riskiness and importance of the decision. In the real world, it is assumed that the number of alternatives and dimensions is usually not given; instead this is determined by the decision maker's search. One experiment (Weiss, 1982) did examine the relationship between complexity and strain. Managers were given public policy case studies to analyze. They reported greater feelings of strain when the cases involved more alternatives, but the number of alternatives did not affect information seeking or the quality of the justifications of their solutions.

The previously described contingency experiment of McAllister et al. (1977) that dealt with the accountability of the decision maker and the significance and irreversibility of the decision is directly related to Janis and Mann's theory. These factors should increase stress and thus facilitate decision processes up to a point. But if stress becomes too great, decision processes should be impaired. In this study, the researchers found that increasing the accountability of the decision maker and the significance of the problem led to more analytical decision making.

Finally, the conflict model proposes that when extreme time pressure is added to an already stressful decision situation, decision processes may be very impaired. In the experiments mentioned earlier, the imposition of deadlines did tend to result in less analytic decision strategies

(Christensen-Szalanski, 1978; Wright, 1974; Wright & Weitz, 1977). In another study, in which executives and students participated in a simulation of organizational decisions, time pressure resulted in decreased information search and poorer group performance (Bronner, 1973/1982).

While many of the experimental results discussed here are compatible with Janis and Mann's model, the authors emphasize that the model is not necessarily applicable to the simulated or hypothetical decisions investigated in the laboratory because such decisions are unlikely to generate stress. They argue, though, that the model is a good representation of all consequential decisions:

So far we have been applying the conflict model to vital decisions that could affect a person's future welfare or the attainment of his major life goals. But we propose to apply the model, as well, to the more commonplace decisions made by executives in routine meetings, in executive committees, and in the privacy of their offices.... The subjective utility values of these everyday decisions certainly do not generate red-hot cognitions like those involved in the examples from disaster studies on which the model is based. Still, these more routine decisions are not at the other extreme of completely cold cognitions, like the hypothetical decisions posed in questionnaires given to college

students. We make the working assumption that the same series of basic questions will occur, so long as the decision maker is aware of at least one mildly worrisome consequence.... We also expect the motivational and behavioral consequences of whatever coping pattern becomes dominant to be essentially the same as in the case of emergency decisions. (p. 75)

In a review of Janis and Mann's book, Aldag (1980), however, questions the model's generalizability, particularly to organizational decision making:

Almost all of the cases for which solid supporting evidence is presented--such as anticipation of major surgery, resistance to the draft, evacuation in the face of a flood, fleeing from a fire, and attempting to quit smoking after exposure to strong fear appeals--are characterized by levels of stress substantially greater than those typically faced by organizational decision makers. (p. 143)

The present study was an attempt to test if the conflict model of decision making is relevant to the study of strategic organizational decision processes and, if so, whether it is an accurate representation.

Strategic Organizational Decision Making

Several authors have suggested that a decision making framework should be used to study business policy (Hatten,

1979; Hofer & Schendal, 1978; Mintzberg, 1978; Shirley, 1982). However, there has been little empirical research on organizational decision making. The research that has been conducted consists primarily of case studies of a few isolated decisions within a single organization (Cyert, Simon, & Trow, 1956; Cyert & March, 1963; Carter, 1971a, 1971b; Dufty & Taylor, 1962). Moreover, the research has tended to focus on routine operating decisions, neglecting the perhaps more important domain of unstructured strategic decisions (Mintzberg, Raisinghani, & Theoret, 1976).

Mintzberg et al. (1976) define strategic decisions as decisions that are important "in terms of actions, the resources committed, or the precedents set" (p. 246). Strategic decisions are unstructured if they have not been encountered before in the same form and if no set of ordered responses to the problem exists in the organization.

Clearly, unstructured strategic decisions possess many of the characteristics of "hot" cognitions, in that they are important and solutions are not immediately apparent. Furthermore, Janis and Mann's caution about appropriate modes of research is echoed by Mintzberg et al. (1976), when they conclude that laboratory simulations of decision making can not be employed to study strategic decisions "...because the structure of the strategic decision process is determined by its very complexity; oversimplification in the laboratory removes the very element on which the research should be focused" (p. 247).

The only study that has attempted to model strategic organizational decisions in the real world was done by Mintzberg et al. (1976). The authors analyzed interviews with executives from 25 companies about recent unstructured strategic decisions. They concluded that the decision makers made little use of a strictly analytical approach. Because the data were of a qualitative nature, however, it is possible that the authors' preconceptions influenced their subsequent integration and interpretation of the information.

Mintzberg et al. (1976) organized the decisions that they analyzed into a hierarchy based on complexity. The most complex decision processes encountered were "dynamic design decision processes." Two examples of this type of decision are "development of a new plant for a small firm" and "development of a new headquarters building for a bank."

If Aldag's (1980) conclusion that organizational decisions do not generate significant stress is correct, then even with complex strategic decisions, such as those described above, we should not expect defective decision processes. A test of the generalizability of Janis and Mann's model to organizational decision making, therefore, demands an inclusion of highly complex decisions.

In the present study, the strategic decisions examined were similar to the complex decisions identified by Mintzberg et al. (1976). The research focused on the decisions of manufacturing firms to locate new facilities or

expand current facilities. These decisions are among the most complex and important decisions an organizational decision maker can encounter, but they may also provide a range of perceived stress because of individual differences and because expansion decisions might involve less uncertainty than relocation decisions, and decisions to locate out-of-state may involve more unknowns than do decisions to remain in-state. However, if even these decisions fail to generate substantial stress in some of the subjects, then Aldag's (1980) assertion that the model is not applicable to organization decision making will gain some support.

Previous research on location decisions is limited and has, for the most part, been concerned with merely identifying the dimensions of the alternatives that are most important to the decision maker (Malinowski & Kinnard, 1961; Mandell, 1975; Mueller, Wileen, & Wood, 1961; Stafford, 1979). Therefore, an additional contribution of this study is that it is the first to examine how location and expansion decisions are actually made. More specifically, the purpose of this study was to assess the impact of stress on the quality of strategic organizational decision processes.

Overview of the Study and Hypotheses

Executives of companies that have recently opened or expanded a new facility were surveyed to see if the level of stress associated with the decision was related to (a) the

Table 2

Predelisional Behavior Characteristics of the Five Basic Patterns of Decision Making

Criteria for High-quality Decision Making								
	(1)	(2)	(3)		(4)	(5)	(6)	(7)
PATTERN OF COPING WITH CHALLENGE	THOROUGH CANVASSING OF ALTERNATIVES	THOROUGH CANVASSING OF OBJECTIVES	CAREFUL EVALUATION OF CONSEQUENCES		THOROUGH SEARCH FOR INFORMATION	UNBIASED ASSIMILATION OF NEW INFORMATION	CAREFUL RE-EVALUATION OF CONSEQUENCES	THOROUGH PLANNING FOR IMPLEMENTATION AND CONTINGENCIES
			a. of current policy	b. of alternative policies				
Unconflicted adherence	-	-	-	-	-	+	-	-
Unconflicted change	-	-	+	-	-	+	-	-
Defensive avoidance	-	-	-	-	-	-	-	-
Hypervigilance	-	-	±	±	±	-	-	-
Vigilance	+	+	+	+	+	+	+	+

KEY: + = The decision maker meets the criterion to the best of his ability.

- = The decision maker fails to meet the criterion.

± = The decision maker's performance fluctuates, sometimes meeting the criterion to the best of his ability and sometimes not.

All evaluative terms such as *thorough* and *unbiased* are to be understood as intrapersonal comparative assessments, relative to the person's highest possible level of cognitive performance.

Note: From Janis, I.L., and Mann, L. (1977). Decision making: A psychological analysis of conflict choice and commitment. New York: Free Press, p.77.

vigilance of the decision process, (b) satisfaction with the decision, (c) an additive-difference rational choice model, and (d) information distortion.

Janis and Mann describe five patterns of decision making (also called coping mechanisms). To support the model, one should demonstrate that each of the five levels of stress is associated with one and only one set of behaviors defining a particular coping mechanism. This type of test is not feasible because the decision behaviors associated with the four defective coping patterns are practically indistinguishable (see Table 2). However, vigilance can clearly be differentiated from the other decision patterns on the basis of the predecisional behaviors. A simplified model was tested, therefore. Instead of five decision patterns, decision processes were characterized simply as more or less vigilant.

The first hypothesis to be tested is:

H1: Information processing will be more vigilant when perceived stress is moderate than when perceived stress is low or high.

Another assertion by Janis and Mann is that the quality of the decision procedures predicts whether a given decision is likely to lead to satisfaction or regret:

H2a: Satisfaction with the decision will be higher when information processing is more vigilant.

H2b: Satisfaction with the decision will be

higher under conditions of moderate stress than high or low stress.

The classical rational-choice decision school evaluates decisions in terms of rationality. This is usually defined as the employment of a decision rule in which the sum of subjectively weighted attributes for the chosen alternative is greater than the sum of the subjectively weighted attributes of all unchosen alternatives. The conflict model does not specify that vigilant decision makers employ linear additive decision rules, but they do survey the full range of objectives and carefully weigh the positive and negative consequences associated with each alternative. Therefore, decision rationality should be more highly associated with vigilance than with nonvigilance.

The decision to be predicted in this case was a location/expansion in Michigan or in another state. Decision makers were asked to compare two alternatives: a location in Michigan and a location in another state at the time the decision was made. Each respondent was asked to compare a specific location within Michigan where his or her company was located with a specific location in another state where one or more company plants had been located. If no plants had been located outside of Michigan, respondents were asked to use the location in another state that would be the next best place to locate company facilities.

The subjects were asked to evaluate their Michigan alternative and their other-state alternative on a list of

attributes which previous research has shown to be relevant to location decisions (Malinowski & Kinnard, 1961; Mandell, 1975; Mueller, Wilken & Wood, 1961; Stafford, 1979). These attributes included such things as wage rates and distance to customers (see Appendix A for a complete list). Rather than rate both alternatives separately on these attributes, the decision makers were asked to compare a location in Michigan to a location in another state and assign a comparative rating. This is an additive difference model and is mathematically equivalent to an additive model.

Subjects were also asked to rate how important each attribute was to their companies in making decisions to relocate or expand. These assessments were the subjective weights of the dimensions. The magnitude of the multiple correlation between the subjectively weighted attribute ratings and the decision to locate in Michigan was a measure of decision rationality. It was proposed to be related to the other variables of the model as follows:

H3a: Decision rationality (the correlation between weighted attributes and the final decision) is higher when information processing vigilance is high than when vigilance is low.

H3b: Decision rationality is higher when the perceived level of stress is moderate than when perceived stress is high or low.

Although a rational assessment of the weighted

attributes might indicate that a particular location is the more rational choice, other considerations, such as the cost of relocating, may result in the selection of a different and apparently less rational decision. Nevertheless, it was predicted that people who employed more vigilant information processing procedures would utilize information in a more consistent manner than would individuals who were less vigilant in their information processing. A rational decision maker should be able to make an overall assessment of Michigan's business climate that is highly correlated with his or her evaluations of specific information related to business climate, such as state taxes or labor relations. This correlation was labeled assessment rationality and was hypothesized to be related to vigilance and stress:

H3c: Assessment rationality (the correlation between weighted attributes and an overall assessment of business climate) is higher when information processing vigilance is high than when vigilance is low.

H3d: Assessment rationality is higher when the perceived level of stress is moderate than when perceived stress is high or low.

According to the conflict model, under moderate levels of stress, the decision maker evaluates and selects alternatives rationally and consistently. But when stress is very high, the decision maker distorts information to make the chosen alternative appear to be the most rational

choice. This is called bolstering. If a highly stressed decision maker has bolstered his or her choice, the previous test of the rationality of the decision may not be able to distinguish the vigilant information processors, who accurately evaluated the alternatives and selected the one which maximized the expected benefits, from the nonvigilant decision makers, who distorted the values associated with the alternatives to make the chosen one appear to be most rational.

Distortion of information was checked by comparing the subjective ratings of the attributes with objective information about the dimensions. While some of the variables have no objective equivalent (for instance, personal preferences of company executives), a subset of 14 of the variables were compared to available documentary information which is published for each state.

For each company, data on each attribute for Michigan and for the comparison state at the time of the decision were collected. The correlation between the objective information and the subjective rating is a measure of unbiased information processing.

This is only a weak measure of cognitive distortion because the objective information that I used may have been less appropriate than the actual information that a company used. Published wage rates are available, for instance, but would be less accurate than a wage survey conducted by a company in a specific location and for a specific type of

industry and class of worker.

Unbiased information processing should be related to the other variables of the model in the following manner:

H4a: Unbiased information processing (the correlation between objective and subjective comparisons) is higher when perceived stress levels are moderate than when perceived stress is high or low.

H4b: Unbiased information processing is higher when vigilant information processing is high than when vigilance is low.

METHOD

Description of the Sample

Questionnaires were mailed to executives of approximately 950 manufacturing companies in September and October of 1984. Completed questionnaires were returned from 438 people. This represents a response rate of 46%.

To identify companies which had recently engaged in location/expansion decision making, respondents were asked three questions (see Appendix A). Executives from 189 companies indicated that they had opened at least one new facility in the last five years. Expansions of existing facilities were made by 171 companies. One hundred fifteen companies were planning to open or expand facilities in the next two years. All together, 60% (n = 263) of the respondents had made at least one location/expansion decision between 1978 and 1984. This subset of the total sample of respondents will be referred to as the decision makers. All of the hypotheses except the last one were tested against this sample of 263 decision makers. Hypothesis 4 used a subset of the decision making sample because objective information could only be obtained for 130 subjects. This group was labeled the objective information sample.

Subjects who had made location decisions were asked to indicate the location of their most recent new, expanded, or planned facility. About half of the new facilities were located in Michigan ($\underline{n} = 92$), and about half were located elsewhere ($\underline{n} = 95$). More than three-quarters of the expansions were located in Michigan ($\underline{n} = 130$), with only 20% located out-of-state. Finally, 26% ($\underline{n} = 30$) of those who were planning to open or expand a facility had decided upon a location in Michigan. Fifty-four percent ($\underline{n} = 62$) were planning an out-of-state location, and the remaining 20% ($\underline{n} = 23$) had not yet decided.

In the objective information group, 46% had selected a Michigan site in their most recent location/expansion decision, and 54% had chosen an out-of-state location.

All companies in the sample were members of the Michigan Chamber of Commerce and were engaged in one of the following types of production:

- (a) processing of food or kindred products
(Standard Industrial Classification [SIC] 20),
- (b) lumber and wood products, furniture, or
paper and allied products (SICs 24, 25, 26),
- (c) chemicals, petroleum refining, rubber,
plastics, stone, clay, glass, concrete, or
primary metals (SICs 28, 29, 30, 32, 33),
- (d) fabricated metal products (SIC 34),
- (e) machinery (SICs 35, 36), or

Table 3

Number and Percentage of Establishments in Each Manufacturing Group in Michigan in the Total Sample and in Subsamples

Manufacturing group	Michigan ^a	Total respondents	Decision makers	Objective info. sample
Food processing	528 (5.0%)	32 (7.3%)	19 (7.2%)	6 (4.6%)
Lumber, wood, furniture, paper	980 (9.3%)	54 (12.3%)	26 (9.9%)	10 (7.7%)
Chemicals, petroleum, rubber, plastic, stone, clay, glass, concrete, primary metals	2117 (20.2%)	85 (19.4%)	56 (21.3%)	35 (26.9%)
Fabricated metals	2353 (22.4%)	188 (42.9%)	115 (43.7%)	59 (45.4%)
Machinery	4031 (38.5%)	52 (11.9%)	27 (10.3%)	12 (9.2%)
Transportation equipment	472 (4.5%)	24 (5.5%)	17 (6.5%)	7 (5.4%)
Not classified	---	3 (0.7%)	3 (1.1%)	1 (0.8%)
Total	10,481 (100%)	438 (100%)	263 (100%)	130 (100%)

^aSource: Harris Directory, 1983.

(f) transportation equipment (SIC 37).

These manufacturing groups were chosen because a large number of Michigan companies are concentrated in each area. These six areas represent 85% of the manufacturing establishments in Michigan and employ 92% of the people working in manufacturing (Harris Directory, 1983).

The distribution of the respondents across the six manufacturing groups is shown in Table 3. The table also shows the distribution across these manufacturing areas for Michigan as a whole, for companies within the sample that made location/expansion decisions and for the objective information sample.

As can be seen in Table 3, the number of fabricated metals companies tends to be over-represented in this sample relative to the state of Michigan as a whole, and the number of machinery manufacturers is under-represented. However, more important for the present study is the fact that the decision makers and the objective information sample were not appreciably different from the total sample. In addition, analyses of variance for all the items used to measure stress and vigilance showed no significant differences across SIC groups.

Because we were interested in companies that were large enough to have made location decisions but small enough to have decision making concentrated in a single person or a single level of the organizational hierarchy, questionnaires were only sent to companies which were identified by Chamber

Table 4

Number and Percentage of Companies in Each Size Range in the
Total Sample and in Subsamples

Number of employees	Total respondents	Decision makers	Objective info. sample
< 100	163 (37.2%)	75 (28.5%)	34 (26.1%)
100 to 300	163 (37.2%)	110 (41.8%)	55 (42.3%)
300 to 500	49 (11.2%)	32 (12.1%)	19 (14.6%)
500 to 1000	32 (7.3%)	22 (8.4%)	9 (6.9%)
> 1000	29 (6.6%)	22 (8.4%)	12 (9.2%)
Not classified	2 (0.5%)	2 (0.8%)	1 (0.8%)
Total	438 (100%)	263 (100%)	130 (100%)

of Commerce records as employing between 50 and 2000 people. The distribution of respondents across size categories is shown in Table 4.

Respondents were asked to indicate the county in Michigan in which their companies were located. Questionnaires were returned from 51 of Michigan's 83 counties. Approximately 42% of the sample came from four counties: Oakland, Kent, Wayne, and Macomb. Statewide, these counties account for 57% of Michigan's manufacturing establishments (Harris Directory, 1983).

The questionnaires were addressed to the people on the mailing lists of the Michigan Chamber of Commerce. Usually these were company presidents. The person receiving the questionnaire was asked to complete it if he or she was directly involved in location decision making. If the addressee was not involved in such decisions, he or she was asked to direct the survey to someone in the company who was.

Almost all of the respondents were top executives; approximately 50% were presidents or chief executive officers. Table 5 shows respondents' positions.

In sum, the returned questionnaires appear to have captured the desired sample of central decision makers in small to medium-sized manufacturing companies across the state of Michigan. The size and geographic distribution of companies in the sample is representative of Michigan manufacturing as a whole. Except for an over-representation

Table 5

Number and Percentage of Companies with Respondents in Each
Organizational Position in the Total Sample and in Subsamples

Position	Total respondents	Decision makers	Objective info. sample
President, CEO	209 (47.7%)	137 (52.1%)	69 (53.1%)
V.P.	78 (17.8%)	47 (17.9%)	22 (16.9%)
Plant manager	46 (10.5%)	25 (9.5%)	13 (10.0%)
Treasurer	46 (10.5%)	23 (8.7%)	10 (7.7%)
Chairman	10 (2.3%)	7 (2.7%)	4 (3.1%)
Other executive	36 (8.2)	18 (6.8%)	11 (8.5%)
Clerical	1 (0.2%)	0 (0.0)	0 (0.0)
Other	7 (1.6%)	4 (1.5%)	0 (0.0)
Not specified	5 (1.1%)	2 (0.8%)	1 (0.8%)
Total	438 (100%)	263 (100%)	130 (100%)

of fabricated metal producers and an under-representation of machinery manufacturers, the sample corresponds fairly well to the types of manufacturing enterprises which exist in Michigan.

The decision makers do not appear to be appreciably different from the total sample in terms of size, product group, geographic location or position of respondent. The objective information sample also appears to be fairly similar to the total sample and to the decision making sample.

Procedure

Questionnaires and return envelopes were mailed to executives of manufacturing companies that were members of the Michigan Chamber of Commerce and fell within the size range and manufacturing categories previously discussed.

The surveys were mailed in September 1984. They were coded with subject numbers, but the subjects were told that they could remove the numbers if they were concerned about anonymity. In October 1984, copies of the questionnaires were mailed to subjects who had not responded to the first mailing.

The cover letters and complete questionnaire are contained in Appendix C.

Questionnaire

The questions that measured the variables used in the tests of the hypotheses are listed in Appendix A.

Demographic Information

Four background questions were asked to determine (a) the manufacturing group, (b) company size, (c) county location in Michigan, and (d) organizational position of the respondent.

Location/Expansion Decisions

The executives were asked (a) if they had opened any new facilities in the last five years, (b) if they had physically expanded an existing facility within the last five years, and (c) if they planned to open or expand a facility in the next two years. If a location/expansion decision had been made, additional information was requested concerning (a) the location (city or county and state) of the facility, (b) the month and year in which the decision was made, (c) the month and year in which the facility was opened or the expansion completed, and (d) the number of employees at the new facility or expansion.

Stress

Five questions were written to measure the level of stress associated with the decision process. These items were derived from Janis and Mann's definition of stress. These five items involved the following perceptions: stress, time pressure, lack of confidence that an optimal solution can be found, risks involved, and importance of the decision.

Vigilant Information Processing

Janis and Mann identify seven procedural criteria that form a scale of vigilant information processing (see pp. 23-24 of this paper). In attempting to measure vigilance, I omitted the last procedure because it is related to implementing a decision. Although this is undeniably important, it is beyond the scope of what is traditionally considered part of the decision making process. The remaining procedural criteria were assessed with four questions dealing with: (a) the number of alternatives considered, (b) the number of attributes researched, (c) the estimation of the risks and costs of negative consequences, and (d) the reexamination of alternatives.

Importance and Subjective Comparisons of Attributes

Subjects were presented with 34 items that were believed to make business conditions more or less favorable. For each item, subjects were asked to rate its importance to their companies in decisions to relocate or expand. They were also asked to compare Michigan with another state on each factor. More specifically, each subject was asked to compare the location in Michigan where his or her company or physical facility was located with the specific location within another state to which one or more plants had been moved. They were asked to compare how the two locations had ranked at the time the location decision had been made. If the subject's company had not moved any plants outside of Michigan, the subject was asked to compare the Michigan

location with the out-of-state location that he or she considered to be the next best place to locate a plant. Subjects were asked to indicate the two locations that they were comparing.

Other Variables

Satisfaction with the decision was measured by two questions. The first question simply asked about satisfaction with the decision, and the second asked subjects to assess the probability that they would locate a facility in Michigan in the next five years. This item was reverse scored for subjects who had located or expanded outside of Michigan, resulting in a question that assessed the predisposition to make the same decision in the future for the whole sample.

The evaluation of Michigan's business climate was assessed by a single 5-point question.

Objective Information

Objective information was collected for 130 of the decision makers. No information was collected for decision makers who (a) did not give a specific location (city or county) in Michigan and in another state, (b) did not specify the year in which the decision was made, (c) located or expanded in Michigan and indicated that no other state was seriously considered, (d) located or expanded outside of the United States, or (e) left many items blank.

Some subjects made more than one location/expansion decision. When this was the case, the most recent decision

was the one for which information was gathered because subjects had been told to refer to the most recent decision when answering the questionnaire. The city or county which the most recent expansion or location decision had selected was called the preferred location. The city or county that the subject had cited as using as a comparison was called the comparison location. If no comparison location was listed and the preferred location was outside of Michigan, it was assumed that the comparison location was the Michigan county in which the company was located.

Each subject made 34 subjective evaluations of characteristics of locations that might influence business location decisions. Of these, two were judgments that could not be objectified: personal preferences of company executives, and style of living for employees. Four items were objectifiable but only through contact with the companies--distance to customers, distance to materials, distance to services, and distance to other facilities of the company. One item--the size of the city or town--was easily quantifiable, but the favorability of a larger or smaller city was a matter of personal preference, and so the item could not be used to determine if a subject was being accurate in stating that the Michigan location was better than the other-state location, or vice versa. Some items were vague and difficult to define with a single piece of objective information (for instance, marketing facilities or business climate). For others, no adequate source of

objective data was found.

Information was obtained on 14 items. The sources of the data and the means and standard deviations are listed in Appendix B.

All of the information was collected at a Federal Depository Library, one of nearly 1400 located across the country, and so would have been available to all decision makers. Federal Depository Libraries contain all documents published and circulated by the United States government.

Information was collected from the most up-to-date and specific sources available at the time that the most recent decision was made. For each subject, every attempt was made to locate information for specific SIC groups and specific cities, counties, or Standard Metropolitan Statistical Areas (SMSAs). Often this was not obtainable. When a choice had to be made between information that was aggregated by SIC groups or by locality, the latter was chosen. However, some information was available only at a state level.

RESULTS

Properties of Scale Items

Stress Scale

Five questions were written to measure stress as Janis and Mann (1977) defined it. These items assessed perceptions of stress, time pressure, lack of confidence, risks, and decision importance. The items are shown in Appendix A. The means, standard deviations and intercorrelations of these items for the 263 subjects who made location decisions are shown in Table 6.

It is apparent that the item assessing the initial lack of confidence that an optimal solution could be found was not highly correlated with the other items. The reliability (coefficient alpha) of the scale constructed from these five items was .58. When the confidence item was removed, alpha rose to .74.

A factor analysis of the stress items was conducted to examine the dimensionality of the hypothesized scale. The method used was principal factors with varimax rotation. Two factors with eigenvalues greater than one were extracted. The factor loadings are shown in Table 7. It is clear that the lack of confidence item does not load on the first factor. Therefore, it seemed reasonable to drop the confidence item from the stress scale. The remaining four

Table 6

Means, Standard Deviations, and Intercorrelations of Stress
Scale Variables

Item	Mean	SD	Intercorrelations			
			1	2	3	4
1. Stress	2.47	0.98				
2. Time pressure	2.57	0.90	.66			
3. Lack of confidence ^a	2.31	1.04	.01	-.03		
4. Riskiness	2.83	0.92	.35	.43	.01	
5. Importance	4.25	0.68	.37	.31	-.10	.29

^aItem deleted from stress scale.

Table 7

Principal Factors Matrix for Stress Items

Item	Factors	
	1 ^a	2 ^b
Stress	.74	.15
Time Pressure	.91	-.17
Lack of confidence	.00	-.12
Riskiness	.47	.18
Importance	.37	.70

Note: N = 208

^aEigenvalue = 2.26; % of variance = 45.2.

^bEigenvalue = 1.03; % of variance = 20.5.

Table 8

Distribution of Score on the Stress Scale

Score	Number of Subjects	%
5	1	0.4
6	0	0.0
7	3	1.1
8	5	1.9
9	18	6.8
10	37	14.1
11	35	13.3
12	34	12.9
13	21	8.0
14	19	7.2
15	17	6.5
16	7	2.7
17	12	4.6
18	5	1.9
19	2	0.8
20	0	0.0
Blank	47	17.9

Note. $\bar{M}$ = 12.17, $\bar{SD}$ = 2.63, median = 11.76, kurtosis = -.179, skewness = 0.448, $\bar{N}$ = 263.

items were summed to form a scale that was used to measure stress in the tests of the hypotheses.

The stress scale ranges from 4 to 20 points. The scores of the decision makers in this study ranged from 5 to 19. The mean for the scale was 12.17, and the median was 11.76. The distribution of scores (Table 8) shows a fairly normal distribution. Approximately 60% of the subjects had stress scores in the middle third of the scale. The scale is slightly skewed toward the low stress end of the scale, but the high end of the scale is represented in the sample, too.

If the sample were to be divided into three parts by dividing the scale into three equal parts, the low and high stress groups would contain very small samples. It was decided instead to divide the sample into three equal parts. Subjects with scale scores of 5 through 10 were labeled low stress, 11 through 13 moderate stress, and 14 through 20 high stress.

Vigilance Items

Four items were written to assess vigilant information processing (see Appendix A). The means, standard deviations and intercorrelations of these items are shown in Table 9. The correlations between these items were low, ranging from .08 to .24. The standardized item alpha for the scale of these items was only .43. When three outliers were removed, the standardized alpha rose to .49, still unacceptably low. A principal factoring with iteration factor analysis yielded

Table 9

Means, Standard Deviations, and Intercorrelations of Vigilance Items

Item	Mean	SD	<u>Intercorrelations</u>		
			1	2	3
1. Number of alternatives	3.76	4.36			
2. Number of attributes	11.19	9.82	.14		
3. Risks estimated	3.81	1.16	.08	.16	
4. Alternatives re-examined	2.85	1.29	.11	.22	.24

Note. N = 181.

Table 10

Principal Factors Matrix for Vigilance Items

Items	Factor ^a
Number of alternatives	.26
Number of attributes	.46
Risks estimated	.41
Alternatives reexamined	.55

Note: N = 191.

^aEigenvalue = 1.53; % of variance = 38.4.

only one factor with an eigenvalue greater than one. Although all the variables loaded on this factor (see Table 10), it only accounted for 38% of the variance.

The hypothesized scale of vigilant information processing does not appear to be a unitary concept, as measured by these items. Nevertheless, the items were constructed to measure the first six procedural criteria of Janis and Mann's concept of vigilant decision making. Therefore, I decided to retain each of the items for the purpose of testing the conflict model of decision making. The items were used individually as multiple dependent variables. Multivariate statistical procedures were used to control for the intercorrelations of the items.

Three subjects were eliminated from the sample because their extreme scores on the number-of-alternatives variable suggested that they were outliers. This variable was an open-ended question with a mean of 3.8 and a median of 2.7. These subjects stated that they had considered 25, 30 or 40 alternative sites. These values were considerably higher than those of the rest of the subjects (approximately 5, 6, and 8 standard deviations from the mean), so the outliers were eliminated.

Satisfaction Scale

Two items were written to assess satisfaction with the decision (see Appendix A). The first question assessed satisfaction directly. The second question concerned the predisposition to make the same decision in the future. The

means for these two items were 3.57 and 2.75, with standard deviations of 0.662 and 0.975, respectively. The two items were correlated .17. Because the items were not highly correlated they were used separately as dependent variables, with the small intercorrelation controlled by multivariate techniques.

Tests of the Hypotheses

Hypothesis 1

The first hypothesis proposed that vigilant information processing will be higher under conditions of moderate stress than under conditions of either high or low stress. To test this hypothesis, the stress scale was used as an independent variable, and each of the four vigilance items were used as dependent variables.

One way to test if the relationship between two variables is curvilinear is to determine if the addition of the squared independent variable to the regression equation significantly increases the size of $\underline{R}^2$.

In this case, the simple multivariate linear equation was tested using the stress scale as the predictor and the four vigilance items as the criteria. Multivariate Multiple Regression (MMR) is a multiple regression procedure which allows multiple dependent variables. The Statistical Package for the Social Sciences' (SPSS) (Hull & Nie, 1981) MANOVA procedure can calculate MMR if no categorical variables are specified and the continuous variables which serve as predictors are included in the equation as

"covariates". In this case, stress was the single predictor in the linear equation.

Wilks' lambda (1932) was used to test the significance of the multivariate equation. Lambda is a multivariate extension of the F -ratio test (Tatsuoka, 1971) and is transformed in the SPSS computer package using Rao's formula (Rao, 1973) into an F statistic. According to the Wilk's lambda multivariate test of significance, the linear equation was significant at the .005 level ($F = 4.518$; $df = 4, 173$).

The univariate tests of significance produced the statistics shown in Table 11. The linear regression equations were significant for the variable measuring the estimation of risks ($p < .01$) and the variable concerned with the reexamination of alternatives ($p < .005$).

The test of the polynomial regression was made with the stress scale and the square of the stress scale used as independent variables and the four vigilance items again used as dependent variables. The multivariate significance level for the polynomial equation was the same as that for the linear equation ($F = 3.128$; $df = 8, 346$; $p < .005$). The polynomial term did not appear to add to the significance of the simple multivariate regression equation.

In order to explore the planned comparisons and the mean differences between low, moderate, and high stress, the first hypothesis was also tested by multivariate analysis of variance (MANOVA). The stress scale was trichotomized

Table 11

Stress as a Predictor of Vigilance Items: Multivariate and Univariate Regressions of the Linear and Polynomial Equations

Criteria	Equation				ΔR^2	Sig.
	Linear R ²	Linear Sig.	Polynomial R ²	Polynomial Sig.		
Multivariate	-	.002	-	.002	-	ns
Univariate						
Number of alternatives	.0088	ns ^a	.0089	ns	.0001	ns
Number of attributes	.0005	ns	.0140	ns	.0135	ns
Risks estimated	.0342	.013	.0423	.023	.0081	ns
Alternatives re-examined	.0546	.002	.0639	.003	.0093	ns

Note. N = 178.

^ans = not significant at the p = .05 level.

Table 12

Means and Standard Deviations of Vigilance Items for Low, Moderate, and High Levels of Stress

Vigilance items	Stress		
	Low	Moderate	High
Number of alternatives			
M	3.17	3.67	2.92
SD	2.24	2.27	2.41
Number of attributes			
M	10.83	12.33	9.76
SD	10.30	9.94	9.57
Risks estimated			
M	3.49	3.81	4.10
SD	1.18	1.15	1.11
Alternatives re-examined			
M	2.60	2.69	3.34
SD	1.21	1.22	1.32

Note. N = 175.

and used as an independent variable with three levels: high, moderate and low stress. The four vigilance items were used as dependent variables.

The means and standard deviations for each of the vigilance items at each of the three levels of stress are presented in Table 12. The mean number of alternatives examined was higher for the moderate stress group than for the low and high stress groups. Likewise, the number of attributes researched was higher when stress was moderate than when high or low. The other two vigilance items demonstrated the highest mean levels of vigilance when stress was highest.

The Wilks' lambda multivariate test of significance found a statistically significant F value (3.0949; $df = 8, 338$; $p < .005$). The univariate F tests demonstrated that most of the difference between cells could be attributed to the variables measuring estimation of risks and reexamination of alternatives (see Table 13).

Hypothesis 1 would predict that there is relatively little difference between the level of vigilance demonstrated in the low and high stress groups because both are making poor quality decisions. Individuals who experience moderate levels of stress should engage in decision processes that are more vigilant than are those of both low and high stress groups. To test this, a planned comparison was made between moderate stress and the combination of high and low stress (the curvilinear

Table 13

Stress as a Predictor of Vigilance Items: Multivariate and Univariate Analysis of Variance Tests of Main Effect and Curvilinear and Linear Comparisons

Dependent variable	Main effect		Curvilinear comparison		Linear comparison	
	F	Sig.	F	Sig.	F	Sig.
Multivariate	3.0949 ^a	.002	2.2222 ^c	.069	3.9954 ^c	.004
Univariate						
Number of alternatives	1.7422 ^b	.178	3.1569 ^d	.077	0.2868 ^d	.593
Number of attributes	1.0649 ^b	.347	1.8187 ^d	.179	0.2808 ^d	.597
Risks estimated	3.4323 ^b	.034	0.0056 ^d	.941	6.8642 ^d	.010
Alternatives re-evaluated	5.4669 ^b	.005	2.1128 ^d	.148	8.6398 ^d	.004

^a $\underline{df} = 8, 338.$ ^b $\underline{df} = 2, 172.$ ^c $\underline{df} = 4, 169.$ ^d $\underline{df} = 1, 172.$

relationship). The multivariate F was 2.222 ($df = 4, 169$). This was marginally significant ($p < .10$), but, because this probability level exceeds the normal .05 cutoff, it is more appropriate to speak of this as a possible curvilinear tendency rather than as a truly significant relationship.

An examination of the univariate F tests (see Table 13) revealed that moderate stress was associated with a higher level of vigilant information processing only in the case of the number of alternatives examined. And even this relationship was very weak, with a significance level of .08. There was no statistically significant relationship between the number of attributes researched and stress. Although the responses did follow the predicted curvilinear direction, with moderately stressed decision makers researching an average of 1.5 more attributes than low stress respondents and 2.5 more than high stress subjects, the variance within the groups was high enough to wash out statistically significant differences between groups.

The strength of the linear relationship, on the other hand, is more impressive. A multivariate comparison of the low and high stress groups was significant ($F = 3.9954$; $p < .005$). The univariate tests indicated that the high stress group demonstrated more vigilant information processing than the low stress group in the cases of the variables measuring risk estimation and reevaluation of alternatives.

In summary, the relationship between stress and vigilant information processing appears to be more strongly

linear than curvilinear. For two of the vigilance items--risk estimation and reevaluation of alternatives--the higher the level of stress the better the information processing. For a third variable--number of alternatives--there is a tendency toward a weak curvilinear relationship; more alternatives are considered when the level of stress is moderate than when stress is high or low. There appeared to be no relationship between stress and the number of attributes researched. However, because of several fundamental limitations of the study, which will be enumerated in the discussion section of this paper, these conclusions should not be accepted without reservation.

Hypothesis 2a

This hypothesis predicted that satisfaction with the decision would be higher for individuals who had employed more vigilant decision procedures than for those who had been less vigilant. This was not supported.

The hypothesis was tested using Multivariate Multiple Regression (MMR), i.e., a multiple regression with multiple dependent variables, as described in the preceding section. Satisfaction with the decision and predisposition to make the same decision in the future were the criteria and the four vigilance items were the predictors. The Wilks' lambda multivariate significance test indicated that the relationship was not statistically significant ($F = 1.4318$; $df = 8, 278$; $p > .10$). Neither univariate F was statistically significant. The F value for satisfaction was

0.9556 ($df = 4, 140$; $p > .10$). For the variable concerned with the likelihood of making the same decision in the future, F was 1.7216 ($df = 4, 140$; $p > .10$).

Hypothesis 2b

This hypothesis was related to the previous one and predicted that satisfaction with the decision would be associated with stress in a curvilinear fashion; that is, people who had perceived moderate stress when making a decision would be more satisfied with their decisions than would people who had experienced high or low levels of stress. This hypothesis was not supported.

The means and standard deviations for each level of stress are shown in Table 14. The Wilk's lambda multivariate F was marginally significant ($F = 1.947$; $df = 4, 352$; $p = .10$). The univariate significance tests (Table 15) demonstrated that the relationship was significant only for the variable measuring the expressed probability of making the same decision in the future and not for satisfaction with the decision. The planned comparisons revealed that the form of the relationship was not curvilinear. The comparison of the moderate stress group with the combined low and high stress groups produced F values that were not significant for the multivariate or the univariate models.

Contrary to expectation, the relationship between stress and post-decision satisfaction tended to be a negative linear one. The multivariate planned comparison

Table 14

Means and Standard Deviations of Decision Satisfaction Items for Low, Moderate, and High Stress

Satisfaction items	Stress		
	Low	Moderate	High
Satisfaction with decision			
M	3.67	3.56	3.54
<u>SD</u>	0.58	0.71	0.66
Same decision in future			
M	3.02	2.99	2.65
<u>SD</u>	0.83	0.79	0.82

Note. N = 180.

Table 15

Stress as a Predictor of Satisfaction with the Decision: Multivariate and Univariate Analysis of Variance Tests of Main Effect and Curvilinear and Linear Comparisons

Dependent variable	Main effect		Curvilinear comparison		Linear Comparison	
	<u>F</u>	Sig.	<u>F</u>	Sig.	<u>F</u>	Sig.
Multivariate	1.9470 ^a	.10	1.0096 ^c	.37	2.9102 ^c	.06
Univariate						
Satisfaction with decision	0.6445 ^b	.53	0.2653 ^d	.61	1.0237 ^d	.31
Same decision in future	3.4901 ^b	.03	1.4509 ^d	.22	5.5293 ^d	.02

^adf = 4, 352. ^bdf = 2, 177. ^cdf = 2, 176. ^ddf = 1, 177.

between the high and low stress groups yielded an F value which had a significance level of .06 ($F = 2.9102$; $df = 2, 176$). This comparison was significant only for the variable measuring the predisposition to make the same decision ($F = 3.6364$; $df = 1, 177$; $p < .05$), and not for the satisfaction with the decision.

Neither Hypothesis 2a nor 2b was supported.

Decision-making vigilance was not related to satisfaction with the decision or to the feeling that the same decision would be made in the future. Instead of the expected curvilinear relationship between stress and satisfaction, a negative linear relationship was found. The lower the level of stress, the more likely subjects were to state that they would make the same decisions in the future.

Hypotheses 3a to 3d

These hypotheses concerned decision rationality and assessment rationality. Rationality is the ability of a decision maker to arrive at an evaluation or decision that is consistent with and could be predicted by the decision maker's evaluations of smaller components or attributes of the decision domain.

In order to test these hypotheses, the survey respondents were asked to read 34 factors that might affect business location decisions and to compare a location in Michigan with a location in another state on these factors (see Appendix A). In addition, respondents were asked to rate the importance of each of the factors for their

Table 16

Varimax Rotated Factor Matrix of Ratings of Importance of Attributes

Item number ^a	Factor							
	Taxes	Natural resources	Labor	Lifestyle	Skilled workers	Financing	Transportation	Distance
IMP6	-.04	.07	-.11	.01	-.07	.10	-.07	.43*
IMP7	-.01	.21	.10	.01	.05	-.05	.32	.59*
IMP8	-.01	.09	.12	.11	.26	.04	.11	.40*
IMP9	-.13	.01	.07	.22	.21	-.01	-.12	.18
IMP10	.01	.09	.29	.03	.14	.04	-.00	.22
IMP11	.02	-.01	.11	.05	.79*	.05	.08	.40*
IMP12	.06	.03	.10	.20	.79*	-.02	.15	.06
IMP13	.21	.08	.58*	.06	.30	.00	.05	-.01
IMP14	.17	.04	.73*	.05	.02	.07	.10	-.00
IMP15	.23	.15	.78*	.14	.12	.08	.07	.06
IMP16	.17	.01	.70*	.13	.00	.04	.04	-.14
IMP17	-.01	.16	.17	.10	.03	.05	.65*	-.05
IMP18	.05	.13	.04	.24	.27	.09	.55*	-.04
IMP19	.12	.22	-.14	.26	.12	.08	.20	-.02
IMP20	-.06	.41	.04	.23	-.01	.22	.08	.06
IMP21	.17	.50	.11	.07	-.03	.26	.10	.47
IMP22	.18	.68*	-.00	.14	.11	.04	-.06	.01
IMP23	.23	.72*	.09	-.01	.10	.09	.06	.33
IMP24	.18	.68*	.05	.10	-.08	.03	.25	.07
IMP25	.44*	.33	.26	.03	-.08	.15	.08	.06
IMP26	.13	.55*	.12	.17	-.04	-.02	.12	-.05
IMP27	.87*	.12	.12	.11	.01	.09	.10	-.12
IMP28	.79*	.17	.06	.08	.03	.04	.08	-.09
IMP29	.64*	.12	.15	.26	.06	.11	-.01	.17
IMP30	.80*	.16	.34	.08	-.00	.05	-.06	.03
IMP31	.04	.00	.12	.40*	.10	.20	-.00	.04
IMP32	.43	.19	-.01	.45	.07	.12	.10	.16
IMP33	.19	.11	.05	.37	.09	.73*	.12	.01
IMP34	.30	.20	.18	.23	-.03	.64*	.06	.08
IMP35	.71*	.22	.26	.02	-.01	.14	-.07	.03
IMP36	.27	.20	.15	.64*	.13	.13	.12	-.03
IMP37	.44	.14	.24	.55	.05	.06	.09	.00
IMP38	.33	.18	.09	.43*	.13	-.12	.12	.14
IMP39	.01	.03	.04	.44*	.02	.12	.10	-.06
								-.01
								-.08

Note. Starred items were used to form factors: loading $\geq .40$ on one and only one factor.

^a Item numbers correspond to those of the importance items listed in Appendix A.

Table 17

Intercorrelations of Importance Scales; Reliabilities in the Diagonal

Scale	1	2	3	4	5	6	7	8
1. Taxes	(.90)							
2. Natural Resources	.44	(.81)						
3. Labor	.46	.25	(.84)					
4. Lifestyle	.37	.32	.30	(.62)				
5. Skilled Workers	.10	.09	.24	.26	(.81)			
6. Financing	.42	.37	.28	.45	.14	(.80)		
7. Distance	.00	.25	.08	.12	.14	.15	(.49)	
8. Transportation	.14	.29	.24	.31	.27	.25	.20	(.61)

companies' decisions to relocate or expand.

In order to reduce the number of variables, the importance ratings were factor analyzed using a principal factoring solution with iteration. Factors which had eigenvalues greater than one were rotated using the varimax method. The resulting factor matrix is shown in Table 16. Items that had loadings of at least .40 on one and only factor were used to form scales. The items comprising the scales were examined and the scales were labeled: Taxes, Natural Resources, Labor, Lifestyle, Skilled Workers, Financing, Distance and Transportation.

The reliabilities of the scales were calculated using coefficient alpha and are shown along with the scale intercorrelations in Table 17. One scale, Distance, had a particularly low reliability and therefore was not included in any of the hypothesis tests.

The remaining items were weighted by multiplying the importance rating by the comparison rating for each item. Weighted attribute comparison factors were formed by summing the weighted items that made up each factor. The reliabilities and intercorrelations of the weighted scales are shown in Table 18.

Hypothesis 3a

This hypothesis dealt with decision rationality, which is the consistency of a final decision with the assessments of the attributes of the alternatives. Janis and Mann imply that an additive decision strategy such as this is most

Table 18

Intercorrelations of Weighted Attribute Comparison Factors;
Reliabilities in the Diagonal

Scale	1	2	3	4	5	6	7	8
1. Taxes	(.90)							
2. Natural Resources	.50	(.73)						
3. Labor	.50	.33	(.47)					
4. Lifestyle	.24	.40	.24	(.83)				
5. Skilled Workers	.10	.16	.12	.15	(.79)			
6. Financing	.47	.43	.32	.19	.13	(.67)		
7. Distance	.06	.13	.02	.01	.31	.08	(.45)	
8. Transportation	.06	.09	-.04	-.02	.34	.03	.39	(.41)

likely to be employed when vigilant decision procedures are used.

By asking each decision maker to compare his or her top Michigan alternative with his or her top out-of-state alternative, the rationality of the decision to locate in or outside of Michigan can be assessed. The most recent location choice was coded as Michigan or elsewhere, and this was used as the criterion of decision rationality. The larger the multiple correlation produced by regressing the weighted attribute comparison factors against the new location, the more rational or consistent the decision. The multiple correlation for the total sample of decision makers was .32, which was statistically significant ($p < .05$).

Hypothesis 3a predicted that $\underline{R}$ would be greater for the groups which had higher scores on the vigilance items than for the groups with lower scores. This was tested by dividing the subjects on each vigilance item into two groups—high and low vigilance—with as equal a number in each group as possible. The significance of the difference in the $\underline{R}$ s for the high and low vigilance groups was tested for each of the vigilance items using the following formula:

$$z = \frac{(R_1 - R_2)}{\sqrt{\left(\frac{1}{n_1 - 1} + \frac{1}{n_2 - 1}\right)}}$$

This is only a weak measure of rationality, because it is assessed at the group rather than at the individual level, which is the appropriate level of analysis.

Table 19

Decision Rationality: Mean Correlations between Weighted Attribute Factors and Final Decisions for Low and High Vigilance Groups and Significance Tests of the Difference in Correlations

Vigilance Item	Vigilance						Difference	
	Low			High			<u>z</u>	Sig.
	<u>n</u>	<u>R</u>	Sig.	<u>n</u>	<u>R</u>	Sig.		
Number of alternatives	75	.31	.40	67	.38	.19	0.41	.68
Number of attributes	63	.38	.24	82	.46	.01	0.47	.64
Risks estimated	100	.31	.22	46	.39	.43	0.44	.66
Alternatives re-examined	56	.52	.02	54	.37	.40	0.78	.44

The results are shown in Table 19. In only two cases were there significant correlations between the business climate attributions for Michigan and another state and decisions to locate in Michigan or out-of-state. The significant correlations were for the group that reexamined alternatives to a less extent and for the group that gathered information about more of the attributes. However, for none of the vigilance indicators, did we find that the more vigilant subjects had significantly higher correlations between their weighted assessments of business climate factors and their final location decisions than did less vigilant subjects.

One problem with the preceding analysis is that dichotomization of the sample dramatically reduces power and increases the likelihood of failing to reject the null hypothesis when it is, in fact, false. In the case of this hypothesis, power ranged from a little over .06 to nearly .10. One way to avoid diluting power, is to forego splitting the sample and instead employ moderated multiple regression (Cohen & Cohen, 1975).

The seven weighted attribute factors and the vigilance item were regressed against the location decision. Then the interaction terms (vigilance x each weighted attribute factor) were added as a block to the regression equation. Vigilance is a moderator of decision rationality if the addition of the interaction terms significantly increases the size of R^2 .

In no instance was the change in R^2 significant. For the vigilance item measuring the number of alternatives considered, the addition of the interaction terms increased R^2 by only .02 ($p = .96$, $N = 100$). In the case of the number of attributes researched variable, R^2 increased .07 ($p = .28$, $N = 114$). The estimation of risks variable was not significant as a moderator (change in $R^2 = .03$, $p = .85$, $N = 99$), nor was the reexamination of alternatives variable (change in $R^2 = .04$, $p = .79$, $N = 88$). Clearly, the degree of vigilance of the decision making process appeared to play no role in predicting the extent to which a final decision was consistent with component assessments.

Hypothesis 3b

Hypothesis 3b predicted that individuals who had experienced moderate stress would be more rational in their decision making and information processing than would individuals who had experienced either high or low levels of stress. This was tested by splitting the sample into two groups--moderate stress and combined low and high stress--and testing the significance of the R differences when the weighted attribute factors were regressed against Michigan or another state as the choice for the most recent location.

The hypothesis was not supported. The results are shown in Table 20. There was no difference between the R_s for the moderate and the nonmoderate stress groups.

Although obviously pointless in this case, moderated

Table 20

Decision Rationality and Assessment Rationality: Mean Correlations between Weighted Attribute Factors and (I) Final Location Decisions and (II) Overall Assessment of Business Climate for Low Plus High Stress and Moderate Stress Groups and Significance Tests of the Differences in Correlations

Criterion	Stress						Difference $\frac{Z}{Sig.}$	
	Low & High			Moderate				
	$\underline{n}$	$\underline{R}$	Sig.	$\underline{n}$	$\underline{R}$	Sig.	$\underline{Z}$	Sig.
(I) Final location decision	74	.36	.20	47	.36	.55	0.00	1.00
(II) Assessment of business climate	75	.47	.01	55	.62	.00	0.84	.40

multiple regression was employed in order to increase power. If stress had moderated the relationship in a curvilinear fashion, there would have been a significant change in R^2 when the curvilinear interaction terms (stress squared x each of the weighted attribute factors) were added to the equation which already included stress, stress squared, and stress times each of the weighted attribute factors. The addition of the polynomial interaction terms increased R^2 by .09, which was not significant ($p = .18$, $N = 96$). Therefore, stress does not appear to moderate decision rationality in a curvilinear manner.

Hypothesis 3c

This hypothesis concerned the rationality of a summary assessment and predicted that the correlation between the weighted attribute comparison factors and an overall assessment of Michigan's business climate would be higher for the high vigilance group than for the low vigilance group. It was predicted that, while decisions about locations might be constrained by factors beyond the decision maker's control, overall assessments about a state's business climate should be less dependent on unmeasured factors. In other words, the effects of vigilance and stress on decision rationality may be obscured but may be detectable in the case of assessment rationality.

The multiple correlation for the entire sample was .47 ($p < .05$). This was a higher correlation than for decision rationality, but the hypothesized impact of vigilance on the

Table 21

Assessment Rationality: Mean Correlations between Weighted Attribute Factors and Overall Assessment of Business Climate for Low and High Vigilance Groups and Significance Tests of the Differences in Correlations

Vigilance item	Vigilance						Difference	
	Low			High			<u>z</u>	Sig.
	<u>n</u>	<u>R</u>	Sig.	<u>n</u>	<u>R</u>	Sig.		
Number of alternatives	75	.64	.00	74	.43	.05	1.27	.20
Number of attributes	63	.39	.20	88	.61	.00	1.32	.18
Risks estimated	100	.43	.01	51	.66	.00	1.33	.18
Alternatives re-examined	56	.50	.03	64	.47	.04	0.16	.87

magnitude of the correlations was not found. There were no statistically significant differences in the sizes of the R_s obtained from the low vigilance groups and those computed for the high vigilance groups (see Table 21).

As can be seen in Table 21, in three out of four of the cases, the magnitudes of the differences between the low and high vigilance groups are fairly large--over .20. Yet, because of the small sample sizes, even in the best case, power is less than .20. At the .05 alpha level, approximately 250 subjects would be necessary to increase the power to .80. Using moderated multiple regression, instead of dichotomizing the sample, power increased somewhat but not enough to reject the null hypothesis.

The number of alternatives considered was not a moderator; its interaction terms increased R^2 by only .05 ($p = .29$, $N = 119$). There was a slight moderator effect for the number of attributes researched variable (change in $R^2 = .07$, $p = .08$, $N = 133$) and for the estimation of risks variable (change in $R^2 = .07$, $p = .09$, $N = 119$). But neither of these effects reached the .05 probability level. And finally, there was no evidence that the reexamination of alternatives moderates assessment rationality (change in $R^2 = .03$, $p = .77$, $N = 107$).

Hypothesis 3d

It was predicted that assessment rationality would be higher for the moderate stress group than for the high or low stress groups. As with the other three rationality

hypotheses, this hypothesis was not supported (see Table 20). The level of stress was not significantly related to the degree to which assessments of components of a decision predict an overall assessment.

The moderated multiple regression was conducted in the same manner as for Hypothesis 3b, except that the dependent variable was the summary assessment of business climate. Stress did not moderate assessment rationality in a curvilinear fashion. The addition of the polynomial interaction terms increased R^2 by .07, but this was not statistically significant ($p = .18$, $N = 117$).

Hypothesis 4a

This hypothesis predicted that unbiased information processing would be higher for moderate stress groups than for high or low stress groups. No evidence was found to support this hypothesis.

To test the hypothesis, the objective information was first converted to a comparison value by subtracting the figure for Michigan from the figure for the other state when a lower number signified a favorable business condition (such as wage rates) and vice versa when a high value is preferable (such as worker productivity). Each of these differences was then standardized using the means and standard deviations of the difference scores.

For each subject, an individual correlation was calculated by correlating the 14 subjective comparisons with the 14 standardized objective comparisons. The mean

Table 22

Comparisons of Mean $\bar{z}$ Values of Correlations (Unweighted and Weighted by Importance) between Objective and Subjective Comparisons for Low, Moderate, and High Levels of Stress

$\bar{z}$ transformed correlations	$\bar{z}$		Significant difference		
	$\bar{M}$	$\bar{SD}$	$\bar{n}$	$\bar{F}$	$\bar{df}$ Sig.
Unweighted					
Stress level					
Low	.065	.275	32		
Moderate	.028	.388	49		
High	.106	.374	37		
Between groups				.514	2,115 .60
Weighted					
Stress level					
Low	.053	.455	32		
Moderate	.063	.419	48		
High	.092	.501	36		
Between groups				.068	2,113 .93

correlation for the 130 subjects was only .052.

Because subjects might have been more accurate in their evaluations of items that were more important to their companies, a weighted correlation was also computed. For each of the 14 items, the subjective comparison rating was multiplied by the corresponding importance rating. These weighted subjective comparisons were then correlated with the standardized objective information. The average weighted correlation was .068.

Both the weighted and unweighted correlations were converted to z scores using the Fisher r to z transformation formula.

Two analyses of variance were used to test if the sizes of the correlations were related to stress levels. The F values were not statistically significant for either the weighted or the unweighted correlations (see Table 22).

Hypothesis 4b

The final hypothesis predicted that the cognitive distortion of information about alternatives should be higher when information processing vigilance is low. This was supported for only one of the four vigilance items--the number of attributes researched.

As with the test of the previous hypothesis, individual correlations were computed between the subjective evaluations and the standardized objective information. The weighted and unweighted correlations were converted to z scores.

Table 23

Correlations between Z Values of Correlations (Unweighted and Weighted by Importance) and Vigilance Items

Vigilance items	R	
	Unweighted	Weighted
Number of alternatives	.13	.10
Number of attributes	.20	.12
Risks estimated	.04	-.04
Alternatives re-examined	.17	.12

The correlations between the z scores and the vigilance items are presented in Table 23. The correlations are fairly low. When the four vigilance items were regressed against the unweighted z score, using stepwise entry, only the number of attributes researched was a significant predictor of the correlation between subjective and objective comparisons ($F = 5.124$; $df = 1, 108$; $p < .05$). When the weighted correlation was used as the criterion, none of the vigilance items was correlated highly enough with the criterion to surpass the level of significance ($p = .05$) necessary to enter the regression.

SUMMARY AND CONCLUSIONS

Results of Hypothesis Tests

Nine hypotheses were formulated and tested in this study of Janis and Mann's (1977) conflict model of decision making. In only two instances was the theory supported. There was a weak curvilinear relationship between stress and the number of alternatives considered, and there was a higher degree of accuracy in attributions when the number of attributes researched was higher. In three cases, there were statistically significant relationships contrary to those predicted by the theory. There were positive linear relationships between stress and the reexamination of alternatives and the estimation of risks and costs. There was a negative linear relationship between stress and the expressed likelihood of making the same decision in the future. All of the remaining tests were not statistically significant in either direction.

Although there were nine hypotheses, because vigilance was measured with four separate items, there were in all 24 significance tests. By reporting as weakly significant the results of significance tests at the .10 probability level, I have ipso facto permitted a Type I error rate of 10%. One would expect two or three statistically significant results by chance. Therefore, one can have little confidence in the

validity of the five statistically significant relationships found.

But for the sake of discussion, I will for the moment assume that the findings are not random and will discuss the results of the hypothesis tests in more detail. Then I will consider more general problems with the study and the theory. Finally, I will discuss the practical and theoretical value of the study, and suggestions for future research.

Vigilance and Stress

The first hypothesis encompasses the fundamental premise of the theory--that information processing is more vigilant when stress is moderate than when stress is high or low. This relationship was found to exist only for one of the four measures of vigilance: the number of alternatives considered. When all four vigilance items were considered together, the relationship was primarily a positive linear one. This was true for the vigilance items concerning the estimation of risks and costs and the reexamination of alternatives. Finally, the search for information about the attributes of the alternatives evidenced no significant relationship with stress.

Let us imagine what might be happening here. When perceived stress is low, the decision maker sees the decision as relatively unimportant and nonrisky and does not feel a great deal of time pressure. The conflict model proposes that when this is the case, the decision maker will

continue with the status quo or will choose the first alternative that presents itself, without a great deal of consideration. He or she will not spend time identifying alternatives, reexamining alternatives or estimating risks. When the amount of stress associated with a decision is somewhat higher, however, the decision maker becomes more concerned about making a wrong decision and will attempt to identify more alternatives, will reevaluate the alternatives more consistently and will be more concerned about estimating the costs and risks of making a wrong decision. Both Aldag (1980) and Janis and Mann (1977) would agree up to this point, and this was what was found in this study.

The impact of high stress conditions, however, is a matter of contention. Janis and Mann propose that decision making becomes impaired as decision makers panic. Aldag argues that the highest stress that organizational decision making can generate is not sufficient to cause a breakdown in the decision making process.

The present study found some support for both views. The number of alternatives considered was lower for the decision makers reporting high stress than for those reporting moderate stress. So for this component of vigilance a curvilinear relationship with stress was confirmed. However, highly-stressed decision makers were more likely to reexamine the alternatives and to estimate the risks and costs of negative consequences than were moderately stressed subjects.

It appears, then, that stress affects different aspects of decision making in different ways. Up to a point, stress encourages a thorough canvassing of alternatives. When stress becomes too intense, however, the number of alternatives examined is abbreviated. This may occur because time constraints preclude a more extensive search. On the other hand, the number of alternatives may be limited not by the decision maker but by the problem, and this, in fact, may be a source of stress. In other words, high levels of stress may not be the cause of a curtailed search for alternatives; the paucity of feasible alternatives may be the cause of extreme stress.

Two other aspects of decision making vigilance appear to profit from high stress. Janis and Mann believe that two criteria of good decision making are the reexamination of alternatives and the estimation of costs and risks associated with the alternatives. The results of this study show that, as far as these two criteria are concerned, the more stress the better. I am not convinced, however, that this compels us to conclude that information processing improves under conditions of ever increasing stress. Although Janis and Mann declare that these criteria are necessary components of vigilant decision making, one can imagine that, as with stress, more might not be better. The decision maker who feels a great amount of stress may be compulsively reexamining all of the alternatives, including those that are clearly without merit, and may be brooding

about the risks and costs of making a wrong choice. After a point, these processes cease to facilitate the decision and serve only to delay it. This is a possibility that Janis and Mann have not considered.

Finally, the fourth component of vigilant decision making--the search for information about the attributes of the alternatives--appears to be unrelated to stress. The mean number of attributes researched is higher for the moderate stress group than for the high or low stress groups but not significantly so. The reason for the lack of association is not clear but may be due to an interaction between the number of alternatives examined and the number of attributes researched. The decision maker may compensate for time limitations under highly stressful conditions by limiting the number of alternatives but not the amount of information gathered about the alternatives. The total amount of time spent gathering information would thus be less in the low and high stress conditions than in the moderate stress conditions. Perhaps decision makers in organizations must defend their choices to other members and so feel compelled to gather information even when decisions are relatively unimportant or routine, on the one hand, or when time is limited, on the other. Of course, in this study we have no information about the depth of the information search. Respondents were asked simply to indicate the attributes about which they gathered information. It is entirely possible that, although the

number of attributes was similar for the three groups, the research was more cursory in the low and high stress groups than in the moderate group, but this is merely speculation.

Decision Quality

The first hypothesis encompasses Janis and Mann's basic theory. The remaining hypotheses are corollaries of the first. The central hypothesis was only partly supported. Had the hypothesis been clearly upheld, confirmation of the other hypotheses would have strengthened our faith in the model. However, since the central hypothesis was not supported corroboration of ancillary predictions should not be expected and would not be sufficient, in any case, to verify the model.

The remaining hypotheses were concerned with the value of vigilant information processing. The basic hypothesis of the model is that vigilance and stress are related in a curvilinear fashion. This relationship is not of much importance unless it can be demonstrated that decisions made in a vigilant manner are of a higher quality than those made less vigilantly. The objective assessment of the quality of a decision is difficult because many of the outcomes of a decision can only be assessed by the subjective valuations of the decision maker. The quality of the decision was therefore measured indirectly in a number of ways: (a) the satisfaction of the decision maker with the decision, (b) the expressed probability of making the same decision in the future, (c) the rationality with which information was

organized to make an overall judgment and a final decision, and (e) the accuracy of subjective judgments.

If vigilant information processing contributes to higher quality decisions, then we should find that the more vigilant decision makers have higher scores on the above indices of decision quality. More indirectly, if we believe that moderate stress leads to higher vigilance, we should expect that individuals reporting moderate levels of stress will also be rated higher on the measures of decision quality than will individuals experiencing high or low stress. Because the impact of stress is hypothesized to be an indirect cause of decision quality, the relationship between stress and quality should be weaker than that between vigilance and quality, unless, of course, vigilance is not being measured correctly, or stress is related directly to decision quality in unforeseen ways.

Satisfaction with the Decision

A carefully made decision will not always lead to satisfactory results because the future is unpredictable. All things being equal, though, the assumption is that decisions which are made in a more vigilant manner will lead to outcomes that are more pleasing to the decision maker. And when decision makers are happy with the results, they should indicate that they would probably make the same decisions again.

In this study, we found no relationship between vigilance and satisfaction with the decision. Perhaps

insufficient time had elapsed since the decisions had been made for the outcomes to have been affected. The opening or expansion of a plant involves costs that may take years to recoup in higher profits. The executives may also have overestimated the importance of location to their business objectives. Other factors beyond the control of the decision makers, such as the state of the national economy or foreign competition, may have far more impact on the success of an enterprise than does the State in which it is located.

The other index--probability of making the same decision in the future--is an accurate measure of satisfaction with the decision only if subjects believe that conditions are stable. If respondents believe that business climate factors have changed since they made their decisions, then they should not be expected to make the same decisions in the future. Over 66% of the executives surveyed, including those who had made no location decisions, indicated that if they had to make a location decision in the next five years they probably or definitely would not locate in Michigan. This suggests that many of these Michigan manufacturers view Michigan's business climate as worsening.

In addition, there are instances in which it does not make good business sense to locate two plants in the same state. In order to expand distribution or marketing networks, for instance, a new plant may be located in a

different geographical territory even though an existing facility has proved highly satisfactory in a particular location.

Although there was no relationship between vigilance and either satisfaction measure, stress was associated with the predisposition to make the same decision in the future, but not in the predicted manner. The individuals most likely to make the same decision were those who had experienced low stress not moderate stress. In one sense, this is consistent with Janis and Mann's assertion that under conditions of low stress decision makers are likely to maintain the status quo. On the other hand, this appears to conflict with their causal model which proposes that moderate stress promotes vigilance which leads to a higher probability of making the same decision in the future. In this instance, Janis and Mann have made two contradictory predictions, but we can conclude at least that decision makers experiencing high stress should be least predisposed to making the same decisions. And this was confirmed.

Rationality

None of the hypotheses concerning decision rationality or assessment rationality were supported. Neither vigilance nor stress appears to have much impact on rationality.

These hypothesis tests suffered from low power. Although moderated multiple regression increased the power to the point where two of the vigilance items--the number of attributes researched and the estimation of risks--showed a

slight tendency to act as moderators of assessment rationality, the relationships were not statistically significant at the 95% probability level.

One reason why the relationship may have been obscured is that rationality is more appropriately assessed at the individual rather than at the group level. This is usually done by having each individual make multiple decisions and then computing individual correlations. This was not possible in this study. If vigilance or stress had influenced individual rationality, then, theoretically, this should also have been observable at the group level. However, the chances of detecting this are not propitious.

Perhaps it is unrealistic to expect vigilance to be related to the rational combination of information. After all, none of the four vigilance items have anything to do with how information is put together to arrive at a decision. In addition, Janis and Mann propose that bolstering is one way that decision makers cope with high stress. A decision maker bolsters a chosen alternative by exaggerating its favorableness over rejected alternatives. If bolstering is occurring, then vigilant decision makers will not appear more rational than nonvigilant decision makers.

Although the vigilance criteria do not deal with the combination of information to arrive at a decision, one can imagine circumstances in which low or high stress might impair rationality. For example, when stress is very high

the decision maker may be in such a panic that he or she cannot calculate a sum of the subjectively weighted attributes. But even if this sort of hysteria occurs, it would not be apparent in the results of this study because most of the subjects were not surveyed in the midst of a stressful decision. In the absense of present stress, there is no reason why they could not be highly rational, at least in their summary assessments.

Accuracy of subjective assessments

The preceding hypotheses were concerned with the consistency of subjective assessments and final decisions. Another measure of the quality of the decision processes involves the correspondence of subjective assessments with reality. Only one of the vigilance criteria was associated with higher correlations between subjective assessments and objective information, and that was the number of attributes about which information was gathered. This makes sense because information search about the attributes is the only vigilance item that is directly concerned with gathering data. Although estimating risks and costs might be presumed to be associated in some way with increasing the accuracy of assessments, there is probably no reason to expect that the number of alternatives examined or reexamined should be related to accuracy.

Stress was not related to accuracy. This is not altogether surprising, since only the number of attributes item was related to accuracy, and this vigilance criterion

was not significantly associated with stress.

There are a number of problems with the so-called objective data. The information may have been more vague and inaccurate than that used by some of the companies in making their subjective assessments. Frequently, published information was only available at a state level. A company working with local groups may have had access to much more precise local information concerning their specific kind of manufacturing. The objective information used here to assess the accuracy of the subjective assessments presumably reflects reality to some degree, but it is probably more akin to a sketch than to a photograph. This interferes with a true test of this hypothesis.

Summary

Only very limited support was found for Janis and Mann's conflict model of decision making. Moderate stress was found to be related to the examination of a greater number of alternatives. On the other hand, high stress apparently promotes the reexamination of alternatives and the estimation of risks and costs, although, as mentioned earlier, the contribution to decision quality of ever increasing levels of these criteria may be limited.

In fact, none of the vigilance criteria that were related to stress were also related to any of the measures of decision quality. Only the number of attributes researched was related to the accuracy of subjective assessments, and this criterion was not affected by stress.

Stress only seems to be related to one aspect of decision quality, and this is a subjective measure. The higher the level of stress, the less likely decision makers were to report that, if they had to make a location decision in the future, they would make the same decision. This relationship was not curvilinear, however, and may simply reflect the fact that decision makers find stress unpleasant and recall decisions made under high stress in an unfavorable light. Because they felt a lot of stress, they would like to do things differently in the future, regardless of the actual outcomes of their decisions.

We can conclude from this study that stress affects different aspects of the decision process differently. Aldag's (1980) contention that organizational stress does not become high enough to impair decisions was challenged, at least in the case of the number of alternatives examined. In addition, high stress subjects were least likely to state that they would make the same decisions in the future. On the other hand, the highest levels of stress perceived by executives making complex location decisions seemed only to promote the careful reexamination of alternatives and the estimation of risks and costs. For these aspects of decision making, increased stress appeared to be nothing but beneficial.

Problems with the Study

There are a number of problems with this study which make the above conclusions suspect. These problems are

primarily concerned with the reliability and validity of the measures of stress and vigilance.

First of all, vigilance was measured by four single items. So the reliabilities of these important components of the model are unknown. We have no evidence of the quality of the vigilance items and can only guess at their meanings.

In addition, the stress scale is not a true ratio scale with a real zero point. Therefore, the true range of the scale is unknown. The responses were categorized as low, medium or high stress, but they actually may encompass only a small range of stress somewhere in the middle of the construct. The frame of reference of the respondents was probably that of business decisions. And while location and expansion decisions may be more stressful than other more routine business decisions, had the subjects responded in terms of a range of stress that extended from what to eat for breakfast to escaping from a burning building, the range of responses measured here might have been considerably more compressed. The problem is that we do not know what frames of reference the respondents were using. If this study did just measure the middle range of an inverted-U relationship between stress and vigilance, that may explain the differing results. The curve would have been slight and difficult to distinguish from the error variance. Perhaps this is why a curvilinear relationship with stress was found for one of the vigilance items, linear relationships for two others,

and no relationship for the fourth.

Another problem with the data is that the variables in the model were measured with self-reports. The respondents may have exaggerated the vigilance of their information processing, and we have no way to check this except by noting that there was a significant relationship between the number of attributes researched and the accuracy of assessments when compared to published information.

Moreover, both vigilance and stress were measured retrospectively--up to five years after the decisions were made. The executives may not have remembered the details of the decision process and may have had even more difficulty recalling their emotional states. The outcomes of the decisions may have influenced their memories. If the decisions produced negative consequences, the decision makers may recall more stress than was actually perceived at the time.

In addition, asking people about stress and vigilance in the same questionnaire may encourage them to present themselves in ways that are consistent with personal theories about decision making and stress. If a decision maker believes, for instance, that careless decisions are made when stress is extreme, he or she may balk at reporting that his or her information processing was not very vigilant even though the level of stress was low.

Two problems previously mentioned are the inappropriate group level of analysis used in testing the rationality

hypotheses and the dubious validity of the objective information used in measuring cognitive distortion.

Another problem with the study is related to organizational decision making. In organizations, decisions frequently involve more than a single individual, particularly in the collection of information. In this study only one decision maker from each organization was surveyed. The level of stress perceived by one individual may not be a determinant of the level of vigilance if responsibility for the decision is shared by a number of people in the organization.

Problems with the Theory

The issue of the generalizability of the model to group decision making is just one problem with the theory. A more fundamental problem is that the theory may be untestable. Table 2 presents Janis and Mann's attempt to relate the vigilance criteria to the five coping patterns. It is very difficult to differentiate the four nonvigilant coping patterns. Unconflicted adherence differs from unconflicted change and defensive avoidance on only one criterion. On three of the criteria, hypervigilant decision makers' performance fluctuates, and so in some cases, hypervigilance is indistinguishable from defensive avoidance and only differs on one criterion from unconflicted adherence and unconflicted change. I dealt with these problems by simplifying the model for the purpose of testing its general propositions. The criteria were simply interpreted as more

or less vigilant, and stress was divided into three rather than five levels. Such simplification may be inappropriate, but it is difficult to imagine how one could test the model as presented in Table 2.

Experimental research is ruled out because the model is supposed to be applicable only to consequential decisions. Any experimental condition that generated real levels of extreme stress would undoubtedly be unethical.

Because the theory involves nonrational behavior, distortion and self-justification, self-report data would probably be viewed with scepticism by Janis and Mann. This leaves only case studies, with all the concomitant problems of researcher bias, and the even more dubious post-hoc analysis of anecdotal evidence.

Although the model entails a level of complexity that sometimes is difficult to test, in many ways it probably oversimplifies the decision process. Questions that are not dealt with include: How are the vigilance criteria related to one another? Given a fixed amount of time and resources, what are the tradeoffs made between the criteria? At what point does the exercise of a criterion become detrimental to the decision process?

In addition, there is the problem of the direction of causality. Janis and Mann propose that stress causes vigilance. The causality may sometimes be the other way around. In laboratory studies, when subjects are presented with more alternatives or more attributes, decision making

becomes impaired (Billings & Marcus, 1983; Lussier & Olshavsky, 1980; Olshavsky, 1979; Payne, 1976). In other words, the availability of alternatives or information about the attributes may be a source of stress because of information overload. Conversely, the scarcity of feasible alternatives or reliable information may be frustrating and stress-inducing.

Value of the Study

Criticisms aside, this study is of value as a first test of a contingency model of decision making which proposes that stress influences the vigilance of information processing.

The major theoretical contribution of the study is the finding that vigilance is not a unitary concept. The vigilance criteria do not form a single dimension. Furthermore, stress affects different aspects of vigilance in different ways.

The study also has some practical implications for business decision making. For instance, low levels of stress seem to be associated with the lowest degrees of vigilance. For the most part, this has not been a matter of great concern because, by definition, these decisions are viewed as relatively unimportant or easily reversible. However, because stress is a perceptual variable, some organizational decision makers may be interpreting decisions as unstressful, when in fact the decisions involve important outcomes for the organization. For example, employees who

have experienced burnout are responding to constant stress by becoming unresponsive to stress. These individuals may become particularly careless in their decision making, even though the decisions demand high vigilance. At the other extreme are individuals who perceive decisions as stressful when in fact they are not of much importance. As a result, more time is spent on decisions than is warranted. In some cases, the decision maker may even become paralyzed by stress even though the decision may not be of life and death importance to the organization.

One thing organizations can do to minimize these problems is to communicate to the decision makers the level of importance of the decisions. If high-pressure organizations represent all decisions as being of major importance, decision makers may have trouble prioritizing the decisions and will probably spend too much of their time making minor decisions. This will only increase the time pressure, further elevating stress levels.

Organizational decision makers should also be aware of the problems that arise when stress becomes very high. When a decision will produce very important consequences, it may be advisable to assign an extra person to the decision making team to identify additional alternatives.

Aside from these two recommendations, however, organizations probably do not have to be very concerned about the impact of stress on decision making. High stress is detrimental to only one out of four of the decision

making vigilance criteria and is related to the quality of decisions only in terms of predispositions to make the same decisions in the future. Stress may be an important organizational problem because of its relationship to the morale, turnover, and the physical and mental health of employees (Cooper & Marshall, 1976; McGrath, 1976; McLean, 1979). However, its impact on decision making quality should probably not be a worrisome issue for most organizations.

Suggestions for Future Research

In future research, reliable scales of the vigilance criteria should be developed and tested. In addition, other kinds of organizational decisions should be examined to determine if the same patterns observed here are found in other decision situations.

A research project might be designed to minimize the problems of self-report data by following people through decisions and employing objective measures of some or all of the variables. Stress might be measured through health records or physiological data such as heart rate or galvanic skin response. Some sort of objective measure of the quality of the decision might also be devised. For business decisions, some indicators of successful outcomes of decisions are return on investment, turnover, grievances, scrap, etc. Of course, any outcome measure should be matched to the objectives of the particular decision.

Another issue that might be of interest to researchers is how individuals differ in their perceptions of stress and

what organizations can do to modify these perceptions in ways which promote the best use of time and resources in decision making.

Finally, any future model of stress and decision making should incorporate the results found here and in other research. For example, research is needed to determine how the vigilance criteria interact and how they promote good decisions. Other criteria should also probably be examined and tested. Most importantly, models should be developed relating stress to a wide range of decision strategies, not just the satisficing-type and optimizing-type that Janis and Mann used. A great of research has been conducted on contingency models of decision making since Janis and Mann wrote their book. Future research on decision making must not ignore the complex range of decision strategies which have been identified. Conversely, contingency models of decision making should not neglect the role of stress and other emotional factors in information processing.

APPENDICES

APPENDIX A

Questionnaire Items Used to Measure the Constructs

APPENDIX A

Questionnaire Items Used to Measure the Constructs

Stress Scale

1. Decision making can be stressful. How much stress did you feel when you were involved in the decision to relocate or expand? (R = reflected scoring)

 - ☐ An exhaustive amount
 - ☐ An extreme amount
 - ☐ Quite a bit
 - ☐ Some
 - ☐ None

2. When you were involved in the decision process, how much time pressure did you feel? (R)

 - ☐ An exhaustive amount
 - ☐ An extreme amount
 - ☐ Quite a bit
 - ☐ Some
 - ☐ None

3. When you first started thinking about expansion or relocation, how confident were you that an optimal solution could be found? (Item dropped from the scale.)

 - ☐ Completely confident
 - ☐ Extremely confident
 - ☐ Quite confident
 - ☐ Moderately confident
 - ☐ Not at all confident

4. How would you assess the risks of expanding or relocating a company? (R)

 - ☐ The most risky decision a company can make
 - ☐ Extremely risky
 - ☐ Quite risky
 - ☐ Moderately risky
 - ☐ Not at all risky

5. How important do you think a decision about the location or expansion of a facility is? (R)

☐ One of the most important decisions that our company has made
☐ Very important
☐ Somewhat important
☐ Somewhat unimportant
☐ Very unimportant

Vigilant Information Processing

Number of alternatives:

1. How many alternative sites did you consider?
 _____ alternative sites

Number of attributes:

2. Please look at the preceding list of business location factors (see under Importance and Subjective Comparisons of Attributes) and circle the number of each factor about which you collected information when you were making the decision about where or whether to relocate or expand you company's facilities. (Coded as the number of items circled.)

Risks estimated:

3. When you were considering alternatives, did you try to estimate the costs and risks of the negative consequences of each of the alternatives? (R)

☐ Always
☐ Very often
☐ Fairly many times
☐ Occaisionally
☐ Never

Alternatives reexamined:

4. Before you made a final choice, how many of the known alternatives, including those that were originally regarded as unacceptable, did you reexamine? (R)

- ☐ All of the known alternative
☐ A large number of the alternatives
☐ Quite a number of the alternatives
☐ Some of the alternatives
☐ None of the alternatives

Importance and Subjective Comparisons of Attributes

Questions 6 through 40 is a list of factors that may affect business-location decisions. Beside each factor are two blank spaces. In the first blank indicate how important each factor is for your company in decisions to relocate or expand. Use the following scale:

- 6 = The most important factor
 5 = One of the most important factors
 4 = A very important factor
 3 = A somewhat important factor
 2 = A slightly important factor
 1 = A factor of no importance at all

In the second blank, please compare Michigan with another state on these same factors. Be very specific and compare the location within the state of Michigan where your company or physical facility is located with the specific location within another state to which you have moved one or more plants. Please compare how the two locations ranked at the time you made the decision to move. If you have not moved any plants outside of Michigan please compare your location in Michigan to another location in a state other than Michigan that you think would be the next best place to locate your plant. Use the following scale to make your comparisons:

- 7 = Michigan location is very much better
 6 = Michigan location is somewhat better
 5 = Michigan location is a little better
 4 = No difference
 3 = Out-of-state location is a little better
 2 = Out-of-state location is somewhat better
 1 = Out-of-state location is very much better
 0 = Do not know

In this comparison, what is the location of the Michigan facility? _____

What is the location of the out-of-state facility? _____

Make your responses for each factor in the appropriate blank space immediately to the left of each item.

Importance Rating (1-6)	Comparison Rating (0-7)	
_____	_____	6. Distance to customers
_____	_____	7. Distance to materials
_____	_____	8. Distance to services
_____	_____	9. Distance to other facilities of the company
_____	_____	10. Availability of unskilled or semiskilled workers
_____	_____	11. Availability of skilled workers
_____	_____	12. Availability of technical or professional workers
_____	_____	13. Productivity of workers
_____	_____	14. Wage rates
_____	_____	15. Labor relations
_____	_____	16. Extent of worker unionization
_____	_____	17. Transportation facilities for materials and products
_____	_____	18. Transportation facilities for people
_____	_____	19. Marketing facilities
_____	_____	20. Ample area for future expansion
_____	_____	21. Costs of property and construction
_____	_____	22. Water supply and costs
_____	_____	23. Availability and cost of energy
_____	_____	24. Zoning and other regulations
_____	_____	25. Business climate; attitudes toward industry
_____	_____	26. Environmental protection requirements
_____	_____	27. State taxes on business
_____	_____	28. Local taxes on business
_____	_____	29. State and local taxes on individuals
_____	_____	30. Costs of workers' compensation costs
_____	_____	31. Size of city or town
_____	_____	32. Fiscal health of state
_____	_____	33. Local sources of financing
_____	_____	34. State and/or local financial inducements to new businesses
_____	_____	35. Costs of unemployment compensation

- | | | |
|-------|-------|---|
| _____ | _____ | 36. Style of living for employees |
| _____ | _____ | 37. Cost of living |
| _____ | _____ | 38. Crime rate |
| _____ | _____ | 39. Personal preferences of
company executives |
| _____ | _____ | 40. Other (specify) _____ |
-

Satisfaction with the Decision

1. How satisfied are you with the decision that was made? (R)

☐ Very satisfied
☐ Somewhat satisfied
☐ Somewhat dissatisfied
☐ Very dissatisfied

2. If you were locating a new facility within the next five years, do you think that you would locate in Michigan? (Reverse scored for subjects whose last location was outside of Michigan.)

☐ Definitely would not
☐ Probably would not
☐ Probably would
☐ Definitely would

Business Climate

1. How would you compare the overall business climate of Michigan to that of other states? Michigan's business climate is:

☐ A great deal better
☐ Moderately better
☐ About the same
☐ Moderately worse
☐ A great deal worse

Location/Expansion Decisions

1. In the past five years, has your company opened any new facilities? Yes ___ No ___

a. If yes, where is the newest facility located?
 City or County _____ State _____

- b. When was the decision concerning the location of this new facility actually made? Month _____ Year _____
 - c. When was the new facility opened? Month _____ Year _____
 - d. About how many full-time employees does this new facility employ? _____ full-time employees
 - e. Was this new facility the relocation of an existing facility, that was then closed? Yes ___ No ___
 - f. If this was a relocation, where was the previous facility located? City or County _____ State _____
2. In the past five years, has your company physically expanded an existing facility? Yes ___ No ___
- a. If yes, where is the most recently expanded facility? City or County _____ State _____
 - b. When did you make the decision to expand this facility? Month _____ Year _____
 - c. When was the expansion completed? Month _____ Year _____
 - d. If this expansion required a change in the number of employees at this facility, about how many full-time employees were added? _____ employees
3. In the next two years, does your company plan to open a new facility? Yes ___ No ___
- a. If yes, where will it be located? City or County _____ State _____ Have not decided _____
 - b. When will the facility open? Month _____ Year _____ Not yet determined _____

- c. How many full-time employees do you think will employed at this new facility? _____ full-time employees

Demographic Information

1. In which type of manufacturing is your company primarily engaged?

☐ processing of food or kindred products
☐ lumber and wood products, furniture, or paper and allied products
☐ chemicals, petroleum refining, rubber, plastics, stone, clay, glass, concrete, or primary metals
☐ fabricated metal products
☐ machinery
☐ transportation equipment

2. About how many people does your company now employ?

☐ fewer than 50	☐ 50 to 100
☐ 100 to 200	☐ 200 to 300
☐ 300 to 400	☐ 400 to 500
☐ 500 to 1000	☐ 1000 to 1500
☐ 1500 to 2000	☐ over 2000

3. In which Michigan county is your company located?

4. What is your position (title) in the company?

APPENDIX B

Objective Data on Attributes:

Sources of Information and Descriptive Statistics

APPENDIX B

Objective Data on Attributes:

Sources of Information and Descriptive Statistics

Information was collected about the location alternatives of the 130 companies in the objective information sample. All of the information was collected at a Federal Depository Library.

Availability of Unskilled or Semiskilled Workers

This was estimated by the percentage of the labor force unemployed in each Standard Metropolitan Statistical Area (SMSA), if available. Otherwise, the percentage for the State was used.

Source. United States Department of Labor. (May, annual). Employment and earnings. Washington, DC: U.S. Dept. of Labor, Bureau of Labor Statistics.

Statistics for Michigan. Mean = 12.65. SD = 3.36.

Statistics for other States. Mean = 8.90. SD = 2.94.

Availability of Skilled Workers

This was estimated by the persons working full-time divided by the total persons in the following occupations: machine operators in manufacturing, fabricators, assemblers and hand working occupations (includes welders and cutters, production inspectors, testers, samplers, and weighers). The information was gathered for SMSAs, if available, for States, if not.

Source. United States Department of Commerce. (1973 &

1983). 1970 (1980) Census of the population:
Characteristics of the population (Vol. 1); Detailed
population characteristics (Chapter D). Washington, DC:
 U.S. Dept. of Commerce, Bureau of the Census.

Statistics for Michigan. Mean = 4.06. SD = .86.

Statistics for other States. Mean = 1.76. SD = .84.

Availability of technical or professional workers

This was measured as the persons working full-time divided by the total persons in the following occupations: salaried managers and administrators in manufacturing, engineers, mathematical and computer scientists. Data was collected for SMSAs, if available, for States, if not.

Source: United States Department of Commerce. (1973 or 1983). 1970 (or 1980) Census of the population:
Characteristics of the population (Vol. 1); Detailed
population characteristics (Chapter D). Washington, DC:
 U.S. Dept. of Commerce, Bureau of the Census.

Statistics for Michigan. Mean = .43. SD = .10.

Statistics for other States. Mean = .36. SD = .10.

Productivity of Workers

This was estimated by the value added by manufacture divided by all manufacturing employees. The value added by manufacture is the "conversion of the value of shipments (including resales and miscellaneous receipts) to value of production by adding the ending inventory of finished goods and work in process inventories and subtracting the beginning inventory. The cost of materials (including

materials, supplies, fuel, electric energy, cost of resales, and cost of contract work) is then subtracted from this value of production to obtain value added" (1978-1979 Annual Survey of Manufactures, p. A-4). Data was collected for counties.

Source. United States Department of Census. (Biannual). Annual Survey of Manufactures. Washington, DC: U.S. Dept. of Commerce, Bureau of the Census.

Statistics for Michigan. Mean = 32,882. SD = 5313.

Statistics for other States. Mean = 28,663. SD = 6632.

Wage Rates

The average hourly earnings in dollars for manufacturing employees was calculated for SMSAs or for States, if local data were not available.

Source. United States Department of Labor. (Annual). Supplement to employment, hours, and earnings: States and areas. Washington, DC: U.S. Dept. of Labor, Bureau of Labor Statistics.

Statistics for Michigan. Mean = 10.59. SD = 1.51.

Statistics for other States. Mean = 8.34. SD = 1.84.

Labor Relations

This was estimated by the worker days idle during the year due to all work stoppages as a percent of estimated nonagricultural working time (excluding private household workers). The data were collected for the States.

Source. United States Department of Labor. (Annual).

Analysis of work stoppages. Washington, DC: U.S. Dept. of Labor, Bureau of Labor Statistics.

Statistics for Michigan. Mean = 0.22%. SD = 0.07.

Statistics for other States. Mean = 0.21%. SD = 0.15.

Extent of Worker Unionization

Labor organization membership as a percent of nonagricultural employment was gathered for the States.

Source. United States Department of Commerce. (Annual). State and metropolitan area data book: A statistical abstract supplement. Washington, DC: U.S. Dept. of Commerce, Bureau of the Census.

Statistics for Michigan. Mean = 36.71. SD = 1.54.

Statistics for other States. Mean = 22.67. SD = 9.11.

Availability and Cost of Energy

This was the total cost of purchased fuels and electrical energy used in heat and power divided by all employees. This was calculated for the manufacturing SIC groups by State.

Source. United States Department of Commerce. (Biannual). Annual survey of manufactures. Washington, DC: U.S. Dept. of Commerce, Bureau of the Census.

Statistics for Michigan. Mean = 2085.20. SD = 1595.40.

Statistics for other States. Mean = 2824.88. SD = 4140.19.

State Taxes on Businesses

This was estimated by the total State government

revenue from corporate net income taxes and corporate license taxes divided by nonagricultural employees.

Source: United States Department of Commerce. (Annual). State government finances in 19__ . Washington, DC: U.S. Dept. of Commerce, Bureau of the Census.

Statistics for Michigan. Mean = 276.98. SD = 23.11.

Statistics for other States. Mean = 104.74. SD = 45.00.

State and Local Taxes on Individuals

This was estimated by the total State revenues from taxes per \$1000 of personal income plus per capital county tax revenue (included property, general sales and gross receipts, selective sale and gross receipts [alcoholic beverages, motor fuels, public utilities, tobacco products, and others]). If the county was unavailable, the average of the counties listed for the State was used.

Sources. United States Department of Commerce. (Annual). State government finances in 19__ . Washington, DC: U.S. Dept. of Commerce, Bureau of the Census.

United States Department of Commerce. (Annual). County government finances in 19__ . Washington, DC: U.S. Dept. of Commerce. Bureau of the Census.

Statistics for Michigan. Mean = 117.01. SD = 6.86.

Statistics for other States. Mean = 153.78. SD = 70.41.

Costs of Workers' Compensation Costs

This was calculated from the contributions from

employers to State workers's compensation funds. Added to this were direct premiums written by property and casualty insurance companies for workers' compensation for each State.

Sources. United States Department of Commerce. (Annual). State government finances in 19 . Washington, DC: U.S. Dept. of Commerce, Bureau of the Census.

Insurance Information Institute. (Annual). Insurance facts: 19-- property, casualty fact book. New York: Insurance Information Institute.

Statistics for Michigan. Mean = 225.41. SD = 29.84.

Statistics for other States. Mean = 129.05. SD = 69.33.

Costs of Unemployment Compensation.

This was the average employer tax rate if applied to total wages, i.e., the employer contributions incurred during the year divided by the total wages paid in covered employment.

Source. United States Department of Labor. (Annual). Unemployment insurance financial data. Washington, DC: U.S. Dept. of Labor, Employment and Training Administration.

Statistics for Michigan. Mean = 3.90. SD = .11.

Statistics for other State. Mean = 2.00. SD = .74.

Local Sources of Financing

This was the total commercial and industrial loans from all banks in the State divided by nonagricultural employees.

Source. Federal Deposit Insurance Corporation.

(Annual). Federal Deposit Insurance Corporation bank operating statistics. Washington, DC: Division of Management Systems and Financial Statistics, Federal Deposit Insurance Corporation.

Statistics for Michigan. Mean = 2564.53. SD = 632.12.

Statistics for other States. Mean = 2307.83. SD = 1368.94.

Crime Rate

This is the crime index rate per 100,000 people (includes murder, non-negligent manslaughter, forcible rape, aggravated assault, burglary, larceny, theft, motor vehicle theft, and arson). Data were collected for SMSAs, if available. If this was not available, the crime rate in cities and towns with 10,000 and over in population was used. If this was not available, the crime rate for the State or for rural areas in the State was used.

Source. Federal Bureau of Investigation. (Annual). Uniform crime reports for the United States. Washington, DC: Federal Bureau of Investigation, U.S. Dept. of Justice.

Statistics for Michigan. Mean = 5816.79. SD = 2105.81.

Statistics for other States. Mean = 5088.21. SD = 1673.78.

APPENDIX C

Questionnaire and Cover Letters

Code Number: _____

INDUSTRIAL LOCATION SURVEY

1. In which type of manufacturing is your company primarily engaged?

- ☐ processing of food or kindred products
☐ lumber and wood products, furniture, or paper and allied products
☐ chemicals, petroleum refining, rubber, plastics, stone, clay, glass, concrete, or primary metals
☐ fabricated metal products
☐ machinery
☐ transportation equipment

2. About how many people does your company now employ?

- | | |
|--|---------------------------------------|
| ☐ fewer than 50 | ☐ 50 to 100 |
| ☐ 100 to 200 | ☐ 200 to 300 |
| ☐ 300 to 400 | ☐ 400 to 500 |
| ☐ 500 to 1000 | ☐ 1000 to 1500 |
| ☐ 1500 to 2000 | ☐ over 2000 |

3. In which Michigan county is your company located? _____

4. What is your position (title) in the company? _____

5. In the past five years, has your company opened any new facilities?

Yes ☐ No ☐ GO TO QUESTION 6

5a. If yes, where is the newest facility located?

City or County _____ State _____

5b. When was the decision concerning the location of this new facility actually made? Month _____ Year _____

5c. When was the new facility opened? Month _____ Year _____

5d. About how many full-time employees does this new facility employ? _____ full-time employees

5e. Was this new facility the relocation of an existing facility, that was then closed? Yes ☐ No ☐ GO TO QUESTION 6

5f. If this was a relocation, where was the previous facility located? City or County _____ State _____

23

2
3
4
5
6
7
8
9
10
11

Questions 6 through 40 is a list of factors that may affect business-location decisions. Beside each factor are two blank spaces. In the first blank indicate how important each factor is for your company in decisions to relocate or expand. Use the following scale:

- 6 = The most important factor
- 5 = One of the most important factors
- 4 = A very important important factor
- 3 = A somewhat important factor
- 2 = A slightly important factor
- 1 = A factor of no importance at all

In the second blank, please compare Michigan with another state on these same factors. Be very specific and compare the location within the state of Michigan where your company or physical facility is located with the specific location within another state to which you have moved one or more plants. Please compare how the two locations ranked at the time you made the decision to move. If you have not moved any plants outside of Michigan please compare your location in Michigan to another location in a state other than Michigan that you think would be the next best place to locate your plant. Use the following scale to make your comparisons:

- 7 = Michigan location is very much better
- 6 = Michigan location is somewhat better
- 5 = Michigan location is a little better
- 4 = no difference
- 3 = Out-of-state location is a little better
- 2 = Out-of-state location is somewhat better
- 1 = Out-of-state location is very much better
- 0 = Do not know

In this comparison, what is the location of the Michigan facility? _____
 What is the location of the out-of-state facility? _____
 Make your responses for each factor in the appropriate blank space immediately to the left of each item.

Importance Comparison

Rating (1-6)	Rating (0-7)	
_____	_____	6. Distance to customers
_____	_____	7. Distance to materials
_____	_____	8. Distance to services
_____	_____	9. Distance to other facilities of the company
_____	_____	10. Availability of unskilled or semiskilled workers
_____	_____	11. Availability of skilled workers
_____	_____	12. Availability of technical or professional workers
_____	_____	13. Productivity of workers
_____	_____	14. Wage rates
_____	_____	15. Labor relations
_____	_____	16. Extent of worker unionization
_____	_____	17. Transportation facilities for materials and products
_____	_____	18. Transportation facilities for people

Importance Comparison	
Rating	Rating
(1-6)	(0-7)

_____	_____	19. Marketing facilities
_____	_____	20. Ample area for future expansion
_____	_____	21. Costs of property and construction
_____	_____	22. Water supply and costs
_____	_____	23. Availability and cost of energy
_____	_____	24. Zoning and other regulations
_____	_____	25. Business climate; attitudes toward industry
_____	_____	26. Environmental protection requirements
_____	_____	27. State taxes on businesses
_____	_____	28. Local taxes on businesses
_____	_____	29. State and local taxes on individuals
_____	_____	30. Costs of workers' compensation costs
_____	_____	31. Size of city or town
_____	_____	32. Fiscal health of state
_____	_____	33. Local sources of financing
_____	_____	34. State and/or local financial inducements to new businesses
_____	_____	35. Costs of unemployment compensation
_____	_____	36. Style of living for employees
_____	_____	37. Cost of living
_____	_____	38. Crime rate
_____	_____	39. Personal preferences of company executives
_____	_____	40. Other (specify) _____

IF YOUR COMPANY HAS OPENED OR EXPANDED A FACILITY WITHIN THE LAST FIVE YEARS, OR IF YOUR COMPANY PLANS TO DO SO WITHIN THE NEXT TWO YEARS, PLEASE CONTINUE WITH QUESTION 41; IF NO FACILITY HAS BEEN OPENED OR EXPANDED, AND THERE ARE NO PLANS TO DO SO, PLEASE GO TO QUESTION 59 ON TOP OF PAGE 7.

41. Please look at the preceding list of business location factors (items 6 through 40) and circle the number of each factor about which you collected information when you were making the decision about where or whether to relocate or expand your company's facilities.
42. How many alternative sites did you consider? _____ alternative sites
43. One way to select an alternative is to establish a set of minimum criteria that the alternative must meet or exceed in order to be considered. (Examples might be the existence of adequate sewage-treatment facilities or a maximum cost per acre of land.) Did you do this when you were making your decision?

- ____ Yes, we did this to eliminate some alternatives and then looked at the remaining alternatives in more detail. (GO TO 43a)
- ____ Yes, we did this, and only one alternative that we looked at exceeded all the minimum criteria. (GO TO 43a)
- ____ Yes, we did this, but none of the alternatives that we looked at exceeded all the minimum criteria. (GO TO 43a)
- ____ No, we did not establish minimum criteria. (GO TO 44)

43a. If in the above question you indicated that you established minimum criteria, please look over the list of factors numbered 6 through 40, and write the numbers of those factors for which you established minimum criteria. _____

44. Compared to other decisions your company has made, how complex are the issues involved in making decisions about the relocation or expansion of company facilities?

- ☐ The most complex problem we have encountered
☐ Extremely complex
☐ Quite complex
☐ Moderately complex
☐ Not at all complex

45. When you were considering alternatives, did you try to estimate the costs and risks of the negative consequences of each of the alternatives?

- ☐ Always
☐ Very often
☐ Fairly many times
☐ Occasionally
☐ Never

46. One way to select from among several sites is to assign a numerical value to each important factor for each site and then add the numbers and choose the alternative that has the highest numerical value. Did you do this when you were making your decision about relocating or expanding?

- ☐ We did this for all of the sites or alternatives we considered.
☐ We did this for an extremely large number of the alternatives.
☐ We did this for quite a number of the alternatives.
☐ We did this for some of the alternatives.
☐ We did this for none of the alternatives.

47. If you have opened a new facility or expanded an existing facility in Michigan, did you seriously consider any other states for possible facility locations? Yes ☐ No ☐

48. What other state do you consider to be the next best choice after Michigan for locating your business? _____

49. What city or county in that state? _____

50. When you identified an alternative site did you evaluate it immediately or did you postpone evaluation until you had identified all the alternatives?

- ☐ We evaluated each alternative as soon as it was discovered.
☐ We evaluated some alternatives immediately and postponed evaluation on some others.
☐ We didn't evaluate the alternatives until we had identified them all.

51. Before you made a final choice, how many of the known alternatives, including those that were originally regarded as unacceptable, did you reexamine?

- ☐ All of the known alternatives
- ☐ A large number of the alternatives
- ☐ Quite a number of the alternatives
- ☐ Some of the alternatives
- ☐ None of the alternatives

52. Decision making can be stressful. How much stress did you feel when you were involved in the decision to relocate or expand?

- ☐ An exhaustive amount
- ☐ An extreme amount
- ☐ Quite a bit
- ☐ Some
- ☐ None

53. When you were involved in the decision process, how much time pressure did you feel?

- ☐ An exhaustive amount
- ☐ An extreme amount
- ☐ Quite a bit
- ☐ Some
- ☐ None

54. How important do you think a decision about the location or expansion of a facility is?

- ☐ One of the most important decisions that our company has made
- ☐ Very important
- ☐ Somewhat important
- ☐ Somewhat unimportant
- ☐ Very unimportant

55. How satisfied are you with the decision that was made?

- ☐ Very satisfied
- ☐ Somewhat satisfied
- ☐ Somewhat dissatisfied
- ☐ Very dissatisfied

56. In the past five years, has your company physically expanded an existing facility? Yes___ No___ GO TO QUESTION 57



- a. If yes, where is the most recently expanded facility?
City or County_____ State_____
- b. When did you make the decision to expand this facility?
Month_____ Year_____
- c. When was the expansion completed? Month_____ Year_____
- d. If this expansion required a change in the number of employees at this facility, about how many full-time employees were added? _____employees

57. In the next two years, does your company plan to open a new facility?
Yes___ No___ GO TO QUESTION 58



- a. If yes, where will it be located? City or County_____ State_____ Have not decided___
- b. When will the facility open? Month_____ Year_____ Not yet determined___
- c. How many full-time employees do you think will be employed at this new facility? _____full-time

58. When you first started thinking about expansion or relocation, how confident were you that an optimal solution could be found?

- ___ Completely confident
___ Extremely confident
___ Quite confident
___ Moderately confident
___ Not at all confident

59. In the past ten years, how often has your company built major expansions of current facilities or built or purchased new plants or offices?

☐ Constantly
☐ Very often
☐ Fairly many times
☐ Occasionally
☐ Never
☐ Do not know

60. In the past ten years, how often have you personally been involved in decisions to expand or locate business facilities? Include decisions made while you were employed with other companies, if you were involved.

☐ Constantly
☐ Very often
☐ Fairly many times
☐ Occasionally
☐ Never

61. Before you made a decision to expand or relocate, how satisfied were you with the overall level of achievement of your company? [If your company has not made a decision to expand or relocate, how satisfied have you been with the company's achievement over the last five years?]

☐ Very greatly satisfied
☐ Greatly satisfied
☐ Somewhat satisfied
☐ Slightly satisfied
☐ Not satisfied at all

62. Before you made a decision to relocate or expand, how satisfied were you with the location or production capacity of your company's facility? [If your company has not made a decision to relocate or expand, how satisfied have you been with the company's location and production capacity over the last five years?]

☐ Very greatly satisfied
☐ Greatly satisfied
☐ Somewhat satisfied
☐ Slightly satisfied
☐ Not satisfied at all

63. How would you assess the risks of expanding or relocating a company?

☐ The most risky decision a company can make
☐ Extremely risky
☐ Quite risky
☐ Moderately risky
☐ Not at all risky

64. If you were locating a new facility within the next five years, do you think that you would locate in Michigan?

☐ Definitely would
☐ Probably would
☐ Probably would not
☐ Definitely would not

65. Some states and areas offer incentives to attract business development. Which of the following incentives have been offered to your company as inducements to locate or expand facilities in Michigan or in another state? (CHECK IN EACH COLUMN THE INDUCEMENTS YOU HAVE BEEN OFFERED:)

	<u>Offered by:</u>	
	<u>Michigan</u>	<u>Other State</u>
Free land	☐	☐
Low-rent plant	☐	☐
Tax abatements	☐	☐
Low-cost financing	☐	☐
Locally financed training programs	☐	☐
Well-developed industrial parks	☐	☐

Other (PLEASE SPECIFY) _____

Please rate the importance of each of the incentives in questions 66-71 and use the five-point scale below:

- 4 = Very important
 3 = Somewhat important
 2 = Slightly important
 1 = Of no importance at all
 0 = Not applicable

66. ☐ Free land
 67. ☐ Low-rent plant
 68. ☐ Tax abatements
 69. ☐ Low-cost financing
 70. ☐ Locally-financed training programs
 71. ☐ Well-developed industrial parks

72. Which one incentive, from questions 66-71, was most important in influencing your choice of a location? WRITE IN NUMBER FROM ABOVE LIST
- _____

73. How would you compare the overall business climate of Michigan to that of other states? Michigan's business climate is:

☐ A great deal better
☐ Moderately better
☐ About the same
☐ Moderately worse
☐ A great deal worse

74. What do you think are some advantages of locating a business in Michigan as opposed to other states? _____

75. What do you think are some disadvantages of locating a business in Michigan? _____

Thank you for taking the time to respond to this questionnaire. We have tried to cover the most important issues concerning the business climate in Michigan. If there are important matters we have missed, we would very much appreciate your taking the time to write in your comments so that we might take them into consideration when we analyze the data. If you would like a summary of the results of this study, write your name and address below, or write us under separate cover.

Please use the enclosed self-addressed envelope to return this completed questionnaire to the Social Science Research Bureau, 206 Berkey Hall, Michigan State University, East Lansing, Michigan 48824-1111.

MICHIGAN STATE UNIVERSITY

SOCIAL SCIENCE RESEARCH BUREAU
BERKEY HALL

EAST LANSING • MICHIGAN • 48824-1111

September 10, 1984

Dear Ms. Hoffman:

Much has been written about the "business climate" in Michigan and other advanced industrialized states. Unfortunately, heresay and anecdotes have become part of the inputs of important economic and policy decisions in both the public and private sectors. Our study is designed to measure the business climate with systematic and scientific procedures that will help decision makers, such as yourself, understand many of the advantages and disadvantages of relocation and expansion in Michigan. The results of this study will be available to you and others in both the public and private sectors.

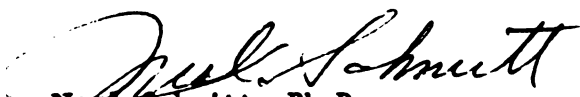
The enclosed instrument was designed by the Center for Redevelopment of Industrialized States at Michigan State University with the cooperation of the Michigan Chamber of Commerce. No person or firm will ever be identified in any report, and the answers to this questionnaire will be held in strict confidence; only members of the Michigan State University research team will have access to the data. The code number at the top of the page is merely to help us compare the responses on this survey with information about the industry that is available elsewhere. (If you have any doubts about this procedure, and the confidentiality of your replies, please feel free to remove the code number.)

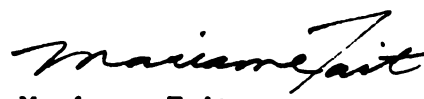
The questionnaire is designed to be answered by yourself, or the person most responsible for making decisions about expansion and/or the relocation of your firm. In some firms, decisions are made by more than one person, and we would appreciate your directing this questionnaire to the one person who would be most centrally involved in the decision.

We will be happy to send you a copy of the results of this study if you would just indicate this in the space provided at the end of the questionnaire. When you have completed this instrument, please return it in the self-addressed stamped envelope to Dr. Neal Schmitt at Michigan State University.

We all know of the economic and social problems we have faced in Michigan, and of the challenges and opportunities that lie in the future. If we are to have sensible and supportive policy making at all levels of government and in the business community, we need better information upon which to base our decisions. Only persons like yourselves, involved in the important day-to-day business decisions, can tell us what we need to know, and we hope you will take the few minutes necessary to complete the questionnaire. We know you will want to help us, and we thank you in advance for your cooperation.

Sincerely yours,


Neal Schmitt, Ph.D.
Professor
Telephone: 517-355-8305


Marianne Tait
Project Director
517-353-5324

MICHIGAN STATE UNIVERSITY

SOCIAL SCIENCE RESEARCH BUREAU
BERKEY HALL

EAST LANSING • MICHIGAN • 48824-1111

October 15, 1984

Dear Michigan Business Executive:

About three weeks ago we mailed you a survey concerning Michigan's "business climate." In that survey we asked you questions about plant relocation and expansion and how you and your staff go about making decisions concerning plant location or expansion.

As of October 12 we have not received your reply, and we are enclosing a second copy because we really need your views about the factors that influence business leaders. The survey, designed by the Center for Redevelopment of Industrialized States at Michigan State University with the cooperation of the Michigan Chamber of Commerce, addresses critically important issues for the State of Michigan and its future growth. Only people like yourself have the information we need to help guide policy makers on shaping our future. We will be happy to send you the results of this survey if you add your address at the end of the questionnaire.

Sincerely,



Neal Schmitt, Ph.D.

Professor

Telephone: 517-355-8305

P.S. If you have already returned our survey, please disregard this letter, and we thank you for your cooperation.

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