

AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D. C. 20523
BIBLIOGRAPHIC INPUT SHEET

FOR AID USE ONLY

BATCH #16

1. SUBJECT CLASSIFICATION	A. PRIMARY Agriculture	AE10-0000-0000
	B. SECONDARY Agricultural economics	

2. TITLE AND SUBTITLE
The role of information in economic decision making

3. AUTHOR(S)
Grunig, J.E.

4. DOCUMENT DATE 1966	5. NUMBER OF PAGES 91p.	6. ARC NUMBER ARC 301.35.G891
--------------------------	----------------------------	----------------------------------

7. REFERENCE ORGANIZATION NAME AND ADDRESS
Wis.

8. SUPPLEMENTARY NOTES (Sponsoring Organization, Publishers, Availability)
(In Land Tenure Center paper no.20)

9. ABSTRACT

10. CONTROL NUMBER PN-RAA-847	11. PRICE OF DOCUMENT
12. DESCRIPTORS Decision making Information theory	13. PROJECT NUMBER
	14. CONTRACT NUMBER Repas-3 Res.
	15. TYPE OF DOCUMENT

July 1966

LTC No. 20

THE LAND TENURE CENTER
310 King Hall
University of Wisconsin
Madison, Wisconsin 53706

THE ROLE OF INFORMATION IN
ECONOMIC DECISION MAKING

BY

JAMES E. GRUNIG

This paper is for internal circulation only. Please do not quote from it in its present form.

All views, interpretations, recommendations and conclusions expressed in this paper are those of the author and not necessarily those of the supporting or cooperating organizations.

THE ROLE OF INFORMATION IN ECONOMIC DECISION MAKING

by James E. Grunig*

The process of decision making is a central feature of most economic analyses. Assumptions about the way in which economic actors make basic decisions underly theories of the firm, consumer demand, welfare economics, market structure, location and other basic economic theories.

The role of information in the decision process is implicit in much of this economic analysis, but, in general, information is a variable which most economists either assume is present in their ceteris paribus formulation of theory or try to overcome in theory when insufficient amounts of it are present. Communications specialists, on the other hand, stress the importance of disseminating information to decision makers, but ignore the function of this information in the decision making process and know little about the type of information which would be most useful to the decision maker.

*James E. Grunig is a doctoral candidate in mass communications at the University of Wisconsin and editorial assistant of the Land Tenure Center, a cooperative program of the American Nations, the Agency for International Development and the University of Wisconsin.

The author would like to express appreciation to the following people for helpful comments and suggestions on this paper: Bruce H. Westley, for whose course in the theory of mass communications this paper was originally submitted; Bryant E. Kearl, Peter Dorner and William C. Thiesenhusen. The author, however, takes all responsibility for any statements or conclusions in this paper.

Both economists and communicators have failed to systematically treat the role of information in decision making and the effect information has on the "rationality" of decisions. The intent of this paper, then, is to examine the literature on the decision making process--including work done by psychologists and sociologists as well as economists--and from these writings to construct a theory on the role of information in the decision process. Such a theory should be able to: 1) show economists why information is frequently a limiting variable in decision making and the effect adequate information has on the quality of decisions, and 2) show communications specialists the type of information needed by decision makers so that a more effective communications strategy might be planned.

A theoretical role for information in decision making would be an addition to both economic and communication theory. The understanding gained would also have considerable heuristic value for communications workers. For example, communicators working in information services, public relations and advertising provide information for decision makers, although in the latter two cases the information is not intended to be as objective as in the former. Information services such as the information divisions in government agencies or the Cooperative Extension Service in colleges of agriculture exist primarily to provide relevant technical information.

Public relations practitioners provide information to executives about effects of their decisions on the public and provide stockholders, employees and others relevant

(hopefully) information needed to make decisions about the company. Advertising workers provide consumers information needed to make decisions about purchases of the advertised products. Instrumental economic information is also provided by more strictly journalistic information sources such as trade publications as well as by the general news

But perhaps the greatest need for a theory of the role of information in decision making is in the field of economic development. Both economists and communications researchers are becoming increasingly aware that communications can play a substantial role in the development process. Economists are now asking communications workers for help in studying the effects of communications on development.

Communications researchers, however, have not sufficiently determined the kinds of information decision makers^{1/} in developing areas need to improve their economic position and then have not looked for the most efficient means of communicating this information. Instead they have

^{1/}The decision makers referred to here are primarily subsistence farmers and workers in rural areas since they are most in need of information in order to improve their income and welfare status. However, the analysis which follows could apply equally to managers and businessmen in emerging industries, to urban laborers, or to government planners.

assumed that all economic development requires is an advanced media system similar to that now existing in highly developed countries. They have then proceeded to describe the communications system in developing countries, judging its effectiveness by the yardstick of the media system in the United States. Not surprisingly they have found that an advanced media system accompanies economic development and that an advanced communications network promotes the social and political characteristics of an advanced economy.^{2/}

But for communications to play its maximum role in development more research is needed on the types of information needed in early stages of development before a country can afford an advanced media system and then on the most efficient system for communicating this information-- even though this system might require experimental communications techniques.

The Importance of Decision Making in Economic Theory

As noted above, decision making is the cornerstone upon which most economic theory is based. And in traditional theory the economic man has nearly always been assumed to make rational decisions. The theory of consumer demand

^{2/}Characteristics such as empathy, innovativeness, political awareness, achievement motivation, and educational and occupational aspirations have often been found (c.f., Rogers, 1965).

rests on the assumption that the consumer chooses between alternative commodities by assigning a measure of utility or satisfaction to the consumption of each commodity. His total amount of utility (U) then is a function of all of the commodities (c_i) which he consumes, or:

$$U = f(c_1, c_2, \dots, c_n) \quad (1)$$

The utility the consumer gets from additional quantities of the same commodity is assumed to increase but at a decreasing rate--i.e., he gets less satisfaction out of each additional unit of the commodity which he consumes.^{3/}

If the consumer had unlimited income he would continue to purchase each commodity until its marginal utility (MU) became zero. But each consumer has only limited income and thus is subject to a budget constraint--his total expenditures cannot exceed his income, or:

$$Y = P_1 c_1 + P_2 c_2 + \dots + P_n c_n \quad (2)$$

where Y = total income

c_i = the i^{th} commodity

p_i = the price of the i^{th} commodity

^{3/} In mathematical terms the marginal utility or the first derivative of the utility function with respect to each c_i is positive but declines with additions of c_i (the second derivative is negative).

It can be shown mathematically^{4/} that total utility is at a maximum when:

$$\frac{MU_1}{P_1} = \frac{MU_2}{P_2} = \dots = \frac{MU_n}{P_n} \quad (3)$$

This simply means that the consumer will be able to obtain maximum utility if he buys the amounts of each commodity where the marginal utility per dollar's worth of each purchase is equal.

From equation (3), it can be seen that if the price of one commodity rises, the consumer will then be out of equilibrium. To restore equilibrium he will then increase his purchases of the other commodities and decrease his purchases of the commodity with the increased price until equilibrium is restored. Thus the theory of consumer behavior is the basis of the downward sloping demand curve in which the quantity demanded decreases as the price of the commodity increases.

Utility theory has been criticized on many grounds, as will be seen later. However, the immediate difficulty

^{4/}If equation (2) is solved for c_2 and the solution inserted in equation (1), the first derivative of equation (1), with respect to one commodity, when set equal to zero (maximization criterium) results in the following equation:

$$\frac{\partial U / \partial c_1}{P_1} = \frac{\partial U / \partial c_2}{P_2} = \dots = \frac{\partial U / \partial c_n}{P_n}$$

is the measurement of utility. One result of this difficulty has been indifference curve analysis which incorporates all of the above equations in the indifference curves^{5/} but skirts the problem of measuring utility by assuming that a consumer can choose between bundles of two commodities without measuring utility and that at some point he will be indifferent between certain amounts of each of the two commodities. Nevertheless, even this modification of the theory of consumer demand leaves the principle of rational decision making intact.

The theory of the firm parallels closely the theory of consumer behavior, the principal difference being that the entrepreneur maximizes profit in making decisions while the consumer maximizes utility. The firm has a production function which specifies the amount of total output (TP) obtained from various quantities of inputs (q_i):

$$TP = f(q_1, q_2, \dots, q_n)^{6/} \quad (4)$$

^{5/}A more complete explanation of the nature of indifference curves can be found in any standard textbook on price theory (c.f., Liebhafsky, 1963).

^{6/}The partial derivative of this function with respect to each q_i is the marginal product for an infinitesimally small addition of each input.

The total revenue (TR) obtained by the firm is the market price (P) multiplied times the total product. The marginal revenue (MR) is the additional revenue resulting from the sale of an additional unit of total product. If the firm is small enough to be able to sell all of its output without affecting the market price, the marginal revenue equals the price paid for the additional unit of output. If the firm controls a large portion of the market and its actions affect price, then price declines as total output: increases and marginal revenue is less than price.

The firm also has a cost function (TC) which when subtracted from its total revenue function gives the profit level. If the entrepreneur can sell all of his output at a constant price, the profit maximization point is where price of the last unit of output equal its marginal cost (here price equals marginal revenue). If price is a function of output, the profit maximization point is where marginal cost of the last unit of output equals its marginal revenue.^{1/}

^{1/}If $TR = P \times TP$ and $TC = h(TP) + C$, where $h(TP)$ = variable cost and C = fixed cost, subtracting the two equations gives the firm's profit (Pr) function:

$$Pr = TR - TC = P \times TP - h(TP) + C$$

To maximize profit, the first derivative of this function is set equal to zero. The result, if price is a constant, is:

This profit maximization assumption ($MC = MR$) holds in all four of the principal market situations--perfect competition, monopoly, oligopoly, and monopolistic competition. In perfect competition the market consists of a large number of sellers, each with a very small share of the market. Each sells undifferentiated products. These firms can sell any amount of product at a constant price.^{8/} Thus to maximize profit they produce as long as price ($P = MR$) exceeds marginal cost. In a monopoly situation where one firm controls the entire market, price is not constant ($P \neq MR$), and the firm then produces additional output as long as marginal revenue exceeds marginal cost.

In oligopoly (a small number of very large firms constitute the market) and monopolistic competition (a large number of small firms selling slightly differentiated products constitute the market), marginal revenue and marginal cost are also equated to maximize profit. In the monopolistic competition model, the market has some characteristics of perfect competition, but the market

$$\underline{7/} \text{ (Continued). } P = \frac{d(TC)}{d(TP)} \text{ or } P = MC$$

If price is a function of output the resulting equation is:

$$\frac{d(TR)}{d(TP)} = \frac{d(TC)}{d(TP)} \text{ or } MR = MC$$

^{8/} They face an infinitely elastic demand curve.

price for an individual firm is not constant⁹--thus the equilibrium position of a firm is an intermediate solution between the perfect competition and the monopoly model. An oligopoly situation approaches a monopoly situation except that the two or more very large firms are uncertain of the decisions their competitors will make. This uncertainty makes it difficult for most of the present theories of oligopoly to specify an equilibrium position for the firm.

The marginal productivity theory of wages can also be derived from the total product function. The marginal product of a worker is the additional output produced by that worker. The marginal product of each additional laborer times the marginal revenue which his output brings in the market is the marginal revenue product (MRP) of the last worker hired. According to the theory, the entrepreneur pays all workers the MRP of the last worker hired, or if wages are artificially fixed (e.g., by a union) he hires workers as long as their MRP exceeds their wages.

The theory of consumer demand, the theory of the firm, and the four market situations are the basic theories of micro-economics. However, many other theories are based upon them. Welfare economics, for example, stems from utility theory. In early welfare economics, a welfare policy was assumed to be good if it added to the total

utility of some persons and did not take utility away from others (Pareto optimum). Later this theory was revised to say that a policy is good if it adds more utility to some persons than it takes away from others. In other words, a measure is good if its marginal social benefits exceeds its marginal social costs.

Location theory is based on the principle that prices of products and/or costs of production of firms in different locations differ by the amount of transportation costs between the two areas--a type of perfect competition solution. Most market structure research is conducted by comparing the observed industrial or market structure with the theoretical perfect competition model and making judgments about the number of firms, size of firms, ease of entry, and price discrimination on the basis of this model.

This section has briefly outlined some basic aspects of micro-economic theory in order to underscore the importance of decision making in economic theory. As this outline shows, the economic actor in standard economic theory is always assumed to make decisions in a rational manner. What effect information has on these economic decisions and whether these decisions are always made in a rational manner now must be examined.

Decision Making Theories in the Literature

A search of the literature revealed three general types of decision making theories. The first is the conventional rational man model with later refinements to account for imperfect knowledge--a model resulting principally from the work of economists. The second type of theory consists of reactions to the rational model, by economists and psychologists observing economic behavior and attempting to devise a theory that recognizes that the real world is not made up of economic men who react in this rational manner. A related type of theory has evolved from socio-psychological research on decision processes independent of their economic implications. The third type of theory has resulted from the long tradition of research by sociologists and rural sociologists on the diffusion of innovations and on the effect of a social system on decisions.

These theories will be summarized and the role of information abstracted from them. Finally, an attempt will be made to synthesize these divergent theories into a general theory on the role of information in decision making.

The Rational Man Model

The model of the rational economic man which was discussed in detail earlier has had a long tradition in the history of economic thought. The theory was implicit in the work of Adam Smith, David Ricardo and the other classical

writers and was introduced directly by Jeremy Bentham in his concept of utility. Bentham believed decisions were made on the basis of a hedonistic calculus by which pleasures and pains of various actions were measured and balanced.

The theory became the dominant mode of economic thought in the marginalism revolution in economic theory led by William Stanley Jevons, Carl Menger and Leon Walras in the late 1800's. However, the rationalism concept remaining today probably can be traced to the writings of Alfred Marshall in 1890 when he synthesized and expanded the relevant aspects of production theory from classical work and relevant aspects of utility theory from the marginalists.

The chief characteristic of the rational man is that he is a maximizing animal. The consumer maximizes utility and the businessman maximizes profit. The model assumes that the economic man studies all alternative solutions to a problem, has complete knowledge about each alternative, and then chooses the alternative most rational in terms of his goal of maximizing utility or profit.

Marshall (1895) and the neo-classical economists believed this type of decision making was the dominant method existing in the real world. Although they recognized that individual decision makers often make

irrational or "whimsical" decisions, they felt that the law of large numbers would operate to cancel out these irrational decisions.

Information had no role in this theory but was merely part of an assumption. Knowledge was assumed to be perfect, and all relevant information was assumed to be available to the decision maker. However, it can easily be seen that it was precisely because knowledge was perfect that the economic man in traditional theory was able to make rational decisions. Because the economic man knows and understands all possible consequences of his alternative decisions, it is a simple matter for him to make the rational choice, and few deliberations other than maximizing ones are necessary.

Knight, in his classic book (1921), was probably one of the first theorists to call attention to the implications of the lack of complete knowledge. He states that for perfect competition to exist, "There must be perfect, continuous costless intercommunication between all individual members of the society. Every potential buyer of a good constantly knows and chooses among the offers of all potential sellers, and conversely." (p. 78). He then shows that lack of knowledge leads to risk and uncertainty.

Risk is an uncertain situation where the probability of outcome of given alternatives is known. Insurance schemes can thus be devised to handle risk. Uncertainty,

on the other hand, occurs when probability expectations cannot be assigned to outcomes of alternative solutions in question.

At about the same time, J. M. Clark pointed out (1923, p. 417) that prices are not always determined by perfectly competitive rational means. Rather, because of a lack of information one firm often becomes a price leader, and the others follow suit.

Contemporary writers have also pointed out the importance of imperfect knowledge. Simon, (1948, p. 68) writing on knowledge and behavior, says:

The function of knowledge in the decision-making process is to determine which consequences follow upon which of the alternative strategies. It is the task of knowledge to select from the whole class of possible consequences a more limited subclass, or even (ideally) a single set of consequences correlated with each strategy. The behaving subject cannot, of course, know directly the consequences that will follow upon his behavior. If he could, a sort of reverse causality would be operating here--future consequences would be determinants of present behavior. What he does is to form expectations of future consequences, these expectations being based upon known empirical relationships, and upon information about the existing situation.

Johnson and Haver (1953, p. 12), agricultural economists, similarly point out that problems which confront farm decision makers can be classified as:
1) changes in prices or lack of information concerning prices, 2) lack of information concerning existing

production methods, 3) changes in production methods, 4) changes in personalities and lack of information concerning personalities, and 5) changes in economic, political and social institutions and lack of information concerning the existing institutions.

Johnson and others (1961) who took part in a study of the managerial processes of farmers in seven Midwestern states expanded Knight's concepts of risk and uncertainty to five "knowledge situations." These situations are: 1) subjective certainty--where the manager has adequate knowledge to make a positive or negative decision, 2) risk action--where enough knowledge is available to make a decision on probability knowledge and the cost of additional knowledge is exactly equal to its value, 3) learning--where the manager's knowledge is inadequate to make a decision, but the cost of obtaining further information is less than its expected value, 4) inaction--where knowledge is inadequate, but the cost of gathering further information exceeds its value, and 5) forced action--a situation where knowledge is inadequate but where the decision maker is forced to make a positive or negative decision.

Essentially, however, these categories can be reduced to "subjective certainty" and "learning." A decision maker nearly always makes a decision with some risk attached or defers the decision until he has more information.

Clodius and Mueller (1961), writing on market structure research, recognized that lack of information may be one of the factors causing product differentiation, the extent to which products (though similar) are viewed as different by buyers.

All of these writings point up the fact that when incomplete knowledge is admitted into the model of economic man, uncertainty arises, and the decision maker is forced to make decisions that may turn out to be irrational post hoc. The lack of complete knowledge, in essence, is what makes a decision necessary. If complete knowledge is possible, the decision maker automatically chooses the alternative which maximizes his goal--profit or any other goal--without the deliberation that accompanies the making of a decision.

However, in searching for the role of information in decision making, it must be recognized that complete knowledge entails more than complete information. Complete knowledge also includes the capacity to comprehend, organize and analyze all relevant information. The decision maker may have complete information available to him, but if he lacks the capacity to process all of this information, then perfect knowledge still cannot exist. Similarly, the difficulty of the decision task and the number of factors which must be taken into consideration affect the degree of

knowledge possible. Here, within these limits, appears the function of information. Earlier in this paper complete knowledge was said to be what makes a rational decision possible. Now with the addition of the terms "risk and uncertainty" and "knowledge situations," we see that knowledge (including information) functions to reduce risk and uncertainty. And within the constraints of the decision maker's mental capacity and the complexity of the situation, information also basically functions to reduce risk and uncertainty. In this context also, Knight's distinguishment between risk and uncertainty shows that information can form the basis of probability knowledge in uncertain situations and thus convert uncertainty into risk.

Once the importance of incomplete knowledge and the lack of information was recognized, decision making researchers moved in two directions. Those interested in describing the process as it exists in the real world turned to "descriptive" studies. Those who cling to the old pure maximization model have become "normative" theorists-- studying how decisions ought to be made to be rational. (c. f., Headley and Carlson, 1963)

As pointed out by Simon in the above quotation, the relevant variable which descriptive theories must account for is expectations--expectations being knowledge short of perfect knowledge. Since the decision maker has less than

perfect knowledge he necessarily makes decisions on the basis of what he expects to occur in the future, and these expectations must be accounted for to preserve the rational model.

One of the first attempts to theoretically overcome imperfect knowledge was the model of monopolistic competition developed in the 1930's by E. H. Chamberlain and Joan Robinson (See Liebhafsky, 1963, pp: 269-302). This model took the conditions of perfect competition--a large number of small firms with minute shares of the market--and tried to explain why prices often differ for seemingly identical products, other factors being equal. They showed that because of locational advantages, advertising, reputation, good will, etc. firms face a demand curve that is less than infinitely elastic. Thus the model showed that the demand curve for a firm slopes downward, although it is still highly elastic, and that within a certain range a firm could charge a higher price than the perfect competition equilibrium.

A second major theoretical attempt to overcome uncertainty was Von Neumann and Morgenstern's theory of games and economic behavior. This theory showed that because of uncertainty about the future decision makers use a probability strategy similar to one used by a gambler. They theorized that the decision maker uses probabilities about the outcome of relevant events and that

the consumer thus maximizes expected utility, the entrepreneur expected profit.

The theory has been applied to oligopoly situations where each firm faces a great deal of uncertainty about the actions of competing firms. The oligopolistic firm then uses a strategy to determine its behavior on the assumption that the other firms will respond with actions that will maximize their own expected profit.

Friedman and Savage (1952) have used game theory applied to utility analysis to devise a total utility curve which explains why decision makers purchase insurance or lottery tickets when the cost of the insurance or lottery ticket exceeds the expected payoff.

Arrow (1963, p. 710) discusses the contribution of strategies to rational theory, stating:

... the theory of expectations has been treated as something to be added to a utility theory involving choice over time. However, some methods of forming expectations seem more rational than others and, at least formally, one can treat the learning process itself as a process of successive choices by the individual. His domain of choice is now a strategy--that is, in each stage he finds his next step as a function of all information available to him up to the present time.

Dillon and Heady (1960) tested a number of game theoretic strategies with Iowa farmers to determine if their decisions were determined by a strategy. One such type of strategy is the maximin. With this strategy the decision maker assumes

nature will do its worst and chooses the alternative with the largest minimum payoff. Another example of a strategy is Savage's concept of minimizing the maximum regret. Here the decision maker determines the highest and lowest payoff from each alternative, subtracts them, and chooses the alternative with the smallest difference. In essence, these models seek alternatives with little uncertainty.

A third strategy tested was the Hurwicz criterion or the pessimism-optimism index. If β ($\beta = 0-1$) represents the decision maker's level of pessimism and $(1-\beta)$ his level of optimism he then maximizes the function:

$$\beta \min_j a_{ij} + (1-\beta) \max_j a_{ij} \quad (5)$$

If the decision maker is unwilling to take risk, $\beta = 1$, and the decision is made according to the maximin criterion.

The final strategy was the Laplace criterion or the simple maximization of expected payoff. Here the probability of payoff is multiplied times the possible payoff and the highest expected payoff is chosen.

Dillon and Heady found that in a hypothetical situation only the maximin and Laplace strategies had significant descriptive value. The maximin strategy was used by farmers with low capital investment (indicating conservatism) who were older and who had less than average formal education. The Laplace strategy was used by younger, better educated farmers with a high capital

investment. When applied to a real-world situation, however, the strategies had little descriptive value. But Dillon and Heady found that if the farmers had used any of the strategies as a management guide (i.e., in a normative sense) they would have increased the resulting profit of their decisions.

Some theorists are now formulating game theoretic models using a subjective probability rather than an objective probability (c.f., Savage, 1954). The theory then would state that a decision maker maximizes what he believes will be his utility or profit in the future--i.e., he makes his decisions on the basis of personal expectations about the future. This modification of the original game theory seems to have psychological content, as will be seen in the next section.

A significant feature of these game theory strategies, as far as the role of information is concerned, is that they are all concerned with overcoming the lack of sufficient information. Thus the role of information in reducing uncertainty can again be seen in that the less information a decision maker has, the less accurate his expectations will be and the less chance his decisions will have of being rational. Complete information would eliminate the need for strategies, but uncertainty of the kind which communicated information cannot eliminate is implicit in

nature. Information cannot eliminate all uncertainty, but can reduce it and improve the expectations on which decision strategies must be based.

A similar type of descriptive work was done by the farm management economists taking part in the interstate managerial survey. Accepting the view of Oppenheim (1953) that a decision is rational if it is directed logically by any goal--not necessarily profit--the economists found the following steps in decision making: 1) problem definition, 2) observation (including information seeking), 3) analysis, 4) decision, 5) action, and 6) responsibility bearing.

All of this descriptive work has been aimed at preserving the model of rational man while accounting for its deficiencies. Other economists and many psychologists point out the deficiencies still remaining (as will be seen in the next section), but many economists point to the fact that the rational man model still predicts decision behavior better than any alternative model. Friedman (1953) has suggested that the theory is valuable because the only test of a theory is its predictive power and not the realism of its assumptions. Nagel and Samuelson, among others, dispute this position. Nagel (1963) says an economic theory is designed to explain as well as predict and that the theory must describe the real

world as well as predict the outcome of a large class of economic phenomena. Samuelson (1963) disputes Friedman's viewpoint saying, "Abstract models are like scaffolding used to build a structure; the structure must stand by itself. If the abstract models contain empirical falsities, we must jettison the models, not gloss over their inadequacies."

On the other hand, normative theorists acknowledge the failings of the rational model but maintain that it is a valuable tool in management science. This normative theory has developed mainly in the work on decision making in the field of economic statistics.

Normative theorists have developed high powered mathematical techniques to solve decision problems under many types of conditions. The most widely used technique at present is linear programming, which uses a linear mathematical model to maximize profit subject to given restraints. Henderson and Quandt (1958, p. 76) provide the following example of a linear programming problem:

Consider the problem of an entrepreneur who possesses fixed quantities of the m inputs which he desires to allocate among the n activities in such a way as to maximize his revenue. An example might be provided by a farmer who possesses fixed quantities of land, managerial labor, and tractor hours and desires to determine optimal plantings of a number of alternative crops. The entrepreneur's revenue (R) is a linear function of the activity (output) levels:

$$R = p_1q_1 + p_2q_2 + \dots + p_nq_n$$

where P_j is the fixed price that he receives for a unit of q_j . The entrepreneur will select particular activity levels such that R is as large as possible. He is not entirely free in his selection of activity levels. The sum of the amounts of the i^{th} input that he uses to support the n activities cannot exceed his fixed endowment (x_i^0):

$$\begin{aligned} a_{11}q_1 + a_{12}q_2 + \dots + a_{1n}q_n &= x_1^0 \\ a_{21}q_1 + a_{22}q_2 + \dots + a_{2n}q_n &= x_2^0 \\ \cdot &\cdot &\cdot &\cdot &\cdot &\cdot &\cdot &\cdot &\cdot &\cdot \\ a_{m1}q_1 + a_{m2}q_2 + \dots + a_{mn}q_n &= x_m^0 \end{aligned}$$

Linear programming is but one technique used in the burgeoning field of operations research--which can be described as mathematical models and computer programs to help businessmen make the most rational decisions possible (c.f., Manne, Miller and Starr. These mathematical techniques are essentially information processing methods. They improve the decision maker's ability to comprehend, organize and analyze relevant information--the constraint on perfect knowledge discussed earlier.

But these precise computational techniques are only as good as the information which they are asked to analyze. Recognizing this, normative theorists have also devised theories for the optimum level of search for information. Shannon and Weaver's (1949) information theory provides a precise measure of the amount of

information needed to eliminate uncertainty. This measure, known as entropy, consists of binary digits (bits), or the logarithm to the base 2 of all possible alternative solutions to a problem. In other words, entropy (E) is the number of times the complete listing of alternatives (N) must be halved before all uncertainty is erased:

$$E = \log_2 N \quad (6)$$

However, the number of possible alternatives in this theory may be infinite or at least very large, and obtaining complete certainty may often be uneconomical. A straight marginal interpretation of the optimum level of search for information would be that information should be sought as long as its marginal value exceeds the marginal cost of search. Several normative theorists have specified mathematically this optimum level of search.

Charnes and Cooper (1958), for example, combined search theory and linear programming in a mathematical model useful for giving the optimum level of search in operations research problems. Marshak (1954, 1959) has formulated complicated mathematical models for the value of information, as distinguished from Shannon and Weaver's amount of information. His model predicts payoff from new information and takes into account supply and demand price of information, the usefulness of information, the probability of faulty information, etc.

However, the most interesting theoretical discussion of the optimal level of search for information is that of Stigler (1961). His theory can be used normatively, but it also has many descriptive implications. Stigler limits his discussion to one problem of information, that of ascertainment of market price. In this regard, Stigler says "Price dispersion is a manifestation--and, indeed, it is the measure of ignorance in the market. . . For any buyer the expected savings from an additional unit of search will be approximately the quantity (q) he wishes to purchase times the expected reduction in price or:

$$q \left| \frac{P_{\min}}{n} \right| \quad (7)$$

The expected saving will be greater, the greater the dispersion of prices. The saving will also be greater, the greater the expenditure on the commodity. . . The cost of search, for a consumer, may be taken as approximately proportional to the number of sellers approached, for the chief cost is time. . ."

Stigler also theorizes that sellers search for potential buyers as long as their expected increase in receipts exceeds the cost of search. Prices, however, often vary in the market because the cost of searching for additional buyers or additional sellers often exceeds the possible increase in receipts or decrease in price.

He then says information--in this case advertising-- functions to reduce the cost of search. He gives the example of classified advertisements as an extremely efficient way of identifying potential buyers and sellers. "Advertising is, among other things, a method of providing potential buyers with knowledge of the identity of sellers. It is an immensely powerful instrument for the elimination of ignorance. . . comparable in force to the use of the book instead of the oral discourse to communicate knowledge."

If m = the number of sellers, λ = the probability any one buyer will inform other buyers of the information, and ΔC_m = the expected cost reduction from the information, the value of information to buyers is approximately:

$$\sum_{M=1}^r \frac{r!}{m!(r-m)!} \lambda^m (1-\lambda)^{r-m} \Delta C_m \quad (8)$$

Finally, Stigler says that the cost of search is greater in larger markets and for this reason specialized firms are formed to disperse information. Such firms might be trade journals or specialized brokers.

Agricultural economists often use a normative model to teach management procedures to farmers taking part in Extension Service programs. Rieck and Pulver studied the effectiveness of one of these programs. They formulated a normative, rational decision model consisting of the steps of orientation, observation, analysis and evaluation, and

implementation. They then empirically measured the decisions of farmers. Farmers who had been taught decision making through the Extension program made more rational decisions (as defined by the model) than those farmers not taking part in the program--showing that rational decision making can be taught.

In summary, this survey of the rational economic theories and their modifications leaves a clearcut theoretical role for information in decision making. The basic role of information is to reduce uncertainty. If the decision maker has perfect knowledge (including all relevant information and the mental capacity to process it), his decisions theoretically will always be simple maximizing ones. But when faced with uncertainty, the decision maker must form expectations and use strategies to rationally overcome the uncertain situation. In this case, he uses information as the basis of his expectations or limited knowledge. The more information he has available and which he can process, the more accurate his expectations, and the more rational his decisions.

According to economic theory, the decision maker seeks out additional information to reduce uncertainty as long as its expected payoff exceeds the cost of seeking out the information. Information communicated to him through indirect methods, such as through the mass media,

reduces his cost of search--since the principal cost of search is time. Thus, in short, the more relevant, easily available information the decision maker has and can utilize, the lower will be his cost of search, the more accurate his expectations, and the more rational his decisions.

The theory thus stated has many implications for communications work. But before this theoretical role can be accepted without reservations, two other lines of research and theory must be discussed.

Reactions to the Rational Man Theory

Some of the reactions to the rational decision model have come from economists. Shubik (1961), for instance, says, "It may be argued that this model is adequate to describe the behavior of small individually owned enterprises, with low capitalization, no (or few and unimportant) market imperfections, no influence in the market and no problems caused by lack of perception, incomplete information or uncertainty."

He feels an adequate theory of the firm must reflect: 1) the goals of the individual as a decision maker, 2) the firm as a formal organization and economic unit, and 3) the interactions of firms in the socio-economic and politico-economic environment.

Shubik agrees with the major point of the present paper when he points out that an important variable left out of economic theory is information and its cost. He says economic man could not comprehend all relevant information even if it were available. Economic man, he adds, necessarily operates under conditions of low information. He cites an experimental oligopoly situation where the players in the experiment reached a non-cooperative equilibrium when they had limited information. But with complete information they moved toward a point on the Pareto optimal surface, where, according to the rational theory, neither could gain by cooperating further with the other.^{10/}

Shackle (1958) says the old economic man was thrown out by the Keynesian revolution. Economists learned then that "men's fantasies and figments of the mind affect decisions." He asks psychologists to equip the economic man with an expectation forming capacity. "What we seem to need is some means of describing the mental set-up

^{10/}In this regard, it can be seen that an important part of public policy in relation to oligopolistic firms is to prevent the free flow of information between the firms in order to prevent collusion, market sharing, profit fixing, etc.

on which news and fresh impressions impinge; some means of classifying different types of this pattern; and some means of visualizing how they affect expectations, making them different than before."

Tobin and Trener Dolbear (1963, p. 681) conclude:

But in the last analysis, rationality cannot apply to conditions of uncertainty. It may be that, instead of seeking a quasi rationality which can be applied to those situations, we should, as descriptive scientists rather than advisers, look more directly for the manners in which individuals and groups simplify and structure complicated situations in which they must make decisions whose outcomes they cannot control or predict.

They add that although the real world does not seem to fit the rational model, the normative scientists using mathematical models and computers to make maximization feasible are well on their way to making the business world over to fit the model.

Weiskopf, in his book The Psychology of Economics (1955), says the rational decision model was never realistic. Rather, the theory emerged from the dominant value pattern of the 19th century Victorian period. Marshall, he says, saw the world through the eyes of a Victorian moralist and consequently imposed his values on what he thought was reality.

These reacting economists criticize the rational model but offer no constructive replacement. A "school" of economists of a somewhat earlier period, however,

challenged the rational decision theory primarily on methodological grounds and offered a complementary theory. The school, known as the American institutionalists, was made up primarily of Thorstein Veblin, Wesley Clair Mitchell and John R. Commons.

The institutionalists believed social, economic, legal and political institutions--habitual forms of structure, organization and behavior--regulate the conduct of individuals. They objected to the deductive method of the rational theories on the grounds that the method might be adequate within one particular institutional structure but that it does not account for changes in institutions which change the nature of economic behavior. They stressed the study of institutions through the inductive method and collection of data about actual day-to-day economic performance in order to explain economic phenomena.

Veblin (1909), for instance, in criticizing marginal utility theory stated:

The limitations of the marginal-utility economics are sharp and clear. . . marginal-utility theory is of a wholly statical character. It offers no theory of a movement of any kind, being occupied with the adjustment of values to a given situation. . . It is characteristic of the school that whenever an element of the cultural fabric, an institution or any institutional phenomenon, is involved in the facts with which the theory is occupied, such institutional facts are taken for granted, denied, or explained away.

Commons (1934, p. 697) similarly states:

When a new worker goes into a factory or on a farm, or when a beginner starts in a profession or a business, everything may be novel and unexpected because not previously met in his experience. Gradually he learns the ways of doing things that are expected from him. They become familiar. He forgets that they were novel when he began. He is unable even to explain them to outsiders. They have become routine, taken for granted. His mind is no longer called upon to think about them. . . . We speak of such minds as institutionalized. But all minds are institutionalized by whatever habitual assumptions they have acquired and they take for granted, so that they pay no attention to them except when some limiting factor emerges and goes contrary to what they were habitually expecting.

Two writers who have made proposals for alternative models based on empirical evidence are the economic psychologists Herbert Simon and George Katona.

Simon (1959, 1963) reviews the developments in economic theory mentioned in the previous section which he feels have been important modifications in the concept of economic man. The he adds (1953, p. 710):

But extending the classical theory to these new areas requires more than broadening the definition of rationality. In addition, it requires a distinction between the objective environment in which the economic actor "really" lives and the subjective environment that he perceives and to which he responds. When the distinction is made, we can no longer predict his behavior-- even if he behaves rationally--from the characteristics of the objective environment; we also need to know something about his perceptual and cognitive processes.

Simon suggests that man is more of a satisficing animal than a maximizing one. Rather than examining all possible alternatives and seeking all relevant information, man chooses the first alternative which satisfies his personal level of aspiration. He says this satisficing model is richer than a maximizing model because it treats not only equilibrium but also the method of reaching equilibrium.

Citing studies on aspirations by Kurt Lewin (See below), he points out that:

Psychological studies of the formation and change of aspiration levels support propositions of the following kinds. (a) When performance falls short of the level of aspiration, search behavior (particularly search for new alternatives of action) is induced. (b) At the same time, the level of aspiration begins to adjust itself downward until goals reach levels that are practically attainable. (c) If the two mechanisms just listed operate too slowly to adapt aspirations to performance, emotional behavior--apathy or regression, for example--will replace rational adaptive behavior. (1959, p. 263)

Simon concludes that the rational maximizing model is adequate for simple, slow-moving situations where the decision maker has a single operational goal. But, "As the complexity of the environment increases, or its speed of change, we need to know more and more about the mechanisms and process that economic man uses to relate himself to that environment and achieve his goals" (1959, p. 279).

Katona bases his work on surveys of economic behavior conducted at the University of Michigan Survey Research Center. Throughout his writings, Katona stresses the effect of habit on economic behavior. He says consumers and businessmen often find that repeating past action is the easiest and the least risky decision because the outcome of the present situation usually approximates closely the outcome of similar situations in the past.

Katona (1953, p. 309) distinguishes between habitual behavior and genuine decision making. He says psychological research has demonstrated how habits are formed through experiments on learning nonsense syllables, lists of words, mazes and conditioned responses. These habits, once formed, are to some extent automatic and inflexible. Genuine problem solving behavior, on the other hand, occurs when a problem or question has been aroused. Habitual behavior is the most common type of behavior, and problem-solving behavior is a deviation from habit.

And, Katona adds, "Strong motivational forces-- stronger than those which elicit habitual behavior-- must be present to call forth problem-solving behavior. Being in a 'crossroad situation,' facing 'choice points' or perceiving that something new has occurred are typical instances in which we are motivated to deliberate and choose" (1953, p. 310).

Consumers, he has found, use habitual behavior in making most purchases except when they make expenditures on large, expensive items which they purchase infrequently. Even for these large expenditures, habit, when it has had a chance to be formed and to persist, often overrules genuine weighing of alternatives and seeking of information.

Business decisions, he says, generally are assumed to be more genuine than habitual. But this assumption too has many exceptions. He points out (1951, pp. 231-238) that firms rely on many habitual practices or standardized rules in making pricing and other decisions. Only when strong pressures from competitors or from fear of large losses occur does careful deliberation and weighing of alternatives take place.

Katona's contribution is well illustrated in the following passage

There can be no doubt that habits are powerful among businessmen and consumers. Following established procedures or rules of thumb or acting in a routine way have often been described in studies of business behavior. If businessmen were to consider every item of information they receive--every piece of news, each letter or telephone call--as giving rise to a problem which needs to be studied and analyzed, they would have no time to conduct their business. In larger firms, delegation of authority is necessary; employees with lower status usually are given instructions and rules to follow rather than permission to make independent decisions. Many well-established business procedures find their

origin in conventions that prevail in the entire trade or industry; others have been used for long periods in the firm; others develop over relatively short spans of time. Similarly, consumers often adopt ways of spending and saving that prevail in their country, their family, or social group, or ways acquired through their own experience.

Cyert and March (1963), colleagues of Simon, formulated a "behavioral theory of the firm" with similar results as Katona and Simon. Businessmen, they found, generally make decisions on the basis of established rules. The level of search for new alternatives is intensified only when existing solutions are perceived as inadequate. "This means that decision making is likely to reflect a response to local problems of apparent pressing need as much as it will reflect continuing planning on the part of the organization" (p. 79).

Cyert and March admit that the firm does have substantial ability to solve problems and make decisions. But they add that the firm is limited by the uncertainty of its environment, the problems of maintaining a viable organization and the limitations on its capacity to assemble, store and utilize information. As such, they theorize that the firm is an adaptively rational system rather than an omnisciently rational system. The firm rationally adapts its decisions to the knowledge it has and to the limitations of its environment and

organizational structure. But it is not rational in the perfect knowledge sense envisioned by most economic theorists. They say (p. 99) that the firm as an adaptive institution has the following characteristics:

1. There exist a number of states of the system. At any point in time, the system in some sense "prefers" some of these states to others.
2. There exists an external source of disturbance or shock to the system. These shocks cannot be controlled.
3. There exist a number of decision variables internal to the system. These variables are manipulated according to some decision rules.
4. Each combination of external shocks and decision variables in the system changes the state of the system. Thus, given an existing state, an external shock, and a decision, the next state is determined.
5. Any decision rule that leads to a preferred state at one point is more likely to be used in the future than it was in the past; any decision rule that leads to a nonpreferred state at one point is less likely to be used in the future than it was in the past.

They say that a firm in making a decision selects one alternative but that alternatives which are chosen are usually similar to those used in the past. If alternatives are generated one at a time, the firm simply chooses the first alternative that satisfies its objective. If more than one alternative is generated at a time, a choice process takes place and maximization rules may be applied to select an alternative.

In regard to information seeking, they found that firms often make a definite commitment to action before the search for information has proceeded very far. However, the search becomes more intensive as the decision approaches implementation. Communication within the firm, Cyert and March have found, has an important effect on decision making. Communication in the system is affected by the situation and goals of the individuals who transmit the information through the channels of the firm. This biasing and counterbiasing has an important effect on a firm's expectations and subsequent decisions, and an improved communication system within the firm can do much to eliminate these biases.

Duncan, writing on the contributions psychology could make to economics, rules out theories of abnormal behavior, instinct theory, or structuralist explanations. What is needed, he concludes, "is a general theory of the normal behavior of the normal individual, and moreover, a theory of dynamic equilibrium." This limitation, he adds, narrows the field to theories descended from functionalism and behaviorism. What Duncan calls for seems to be what Simon, Katona and Cyert and March have contributed.

Shackle (1952) has formulated a theory of decision making based on potential "surprise." He feels a decision maker decides between alternatives on the basis of the

degree of belief he has in each possible outcome. This degree of belief corresponds to the surprise he would feel if the outcome should occur, the less the potential surprise the stronger the belief. The decision maker has a "focus gain" for each alternative, an expected gain which is a function of both the possible size of gain and the degree of belief that that gain will occur. He also has a "focus loss," which is a function of the possible loss from the alternative and the degree of belief. The ratio of focus gain to focus loss is then used by the decision maker to compare alternatives. This notion seems to approximate closely the concept of subjective probability.

Stigler (1961), in his article already cited, speculates on why decision makers often make decisions on the basis of habit and custom. He says that the first time a consumer purchases an item he searches thoroughly for the best price. But successive asking prices are generally positively correlated, so an experienced buyer needs to search less to find the minimum price. Similarly, consumers often rely on the reputation of a store or product because such a reputation usually guarantees that goods are of a certain quality. These goods then are habitually purchased because they economize on the cost of search.

Also, more search is undertaken for large, seldomly purchased items such as a house or car because they have a higher price and the possible payoff from additional search is much higher (See equation 8).

One other approach to understanding decision making is the computer simulation technique. Newell, Shaw and Simon (1958), provide an example of this technique. They see decision making as an information processing mechanism and attempt to simulate that mechanism. This processing system is governed by a set of rules which if discovered could be simulated and decisions thus predicted. They now have devised a computer program which can solve logic problems in much the same manner as a human doing the same problem. Their work, however, again assumes all relevant information is available and thus fails to treat the information seeking aspects of decision making.

Aside from the studies summarized above, a great deal of work on decision making has been done in psychology, but on decisions which are not necessarily economic ones.

Lanzetta and Kanareff (1962) hypothesized that the expected value maximization theory is equivalent to an instrumental conditioning model. They theorized that when a decision maker makes a decision which is rewarded with a high payoff, the payoff will reinforce him, and he will be inclined to make that decision again. Through

successive trials and errors he would asymptotically approach the maximum payoff, gradually getting closer to it but never fully reaching it.

They tested this hypothesis in an experimental situation under various conditions of information cost and level of aspiration, but found no support for the hypothesis. They added, however, that the results may have been negative because the reinforcement factor is uncertainty reduction rather than payoff, and their experimental situation resulted in a low level of uncertainty reduction when correct decisions were made. They also found that low information seekers spent more time processing data and making a decision. They were careful and deliberate and made maximum use of the information they had before seeking more. High information seekers were more interested in a superficial exposure to a great deal of information and thus spent less time processing data and made quicker decisions.

Feather (1959) reviewed five independent lines of research in decision making which he said utilized essentially the same concepts and predictive equations. In each theory, a resultant force--a kind of action--was related to a maximized combination of valence or subjective probability factors. All of these, he

points out, can be reduced to the game theoretic hypothesis of maximization of subjective expected utility.

The theories to which Feather refers are: a) Lewin, Dembo, Festinger and Sears' (1944) analysis of level of aspiration behavior, b) Tolmann's (1955) discussion of the principles of performance, c) Rotter's (1954) basic equation in his social learning theory, d) Edwards (1954, 1955) discussion of the SEU (Subjective Expected Utility) from decision theory, and e) Atkinson's (1957) risk-taking model.

Lewin, Dembo, Festinger and Sears (1944) studied aspiration at what they termed a choice situation, a psychological situation where a person must decide whether he will choose a more difficult, an equally difficult or an easier level of action. The individual makes his choice on the basis of two factors--valence, or the attractiveness of an outcome or the feeling of success it brings, and the probability of success as seen by him.

Lewin et al. summarize their theory as follows (p. 376):

Most of the qualitative and quantitative results related to the level of aspiration can be linked with three factors, namely, the seeking of success, the avoiding of failure, and the cognitive factor of a probability judgment. The strength of these forces and the values corresponding to the subjective probability depend on many aspects of the life space of the

individual at that time, particularly on the way he sees his past experience and on the scales of reference which are characteristic for his culture and his personality.

Valence (Va) of each level (n) of activity ($Va(A^n)$) includes negative valence that future failure has on the level of activity ($Va(Fai^{A^n})$) and positive valence of success ($Va(Suc^{A^n})$):

$$Va(A^n) = Va(Suc^{A^n}) + Va(Fai^{A^n}) \quad (9)$$

Positive valence increases with the difficulty of the goal, reaching a maximum at the capacity level of a person's ability. Negative valence increases in the opposite manner in that negative valence is greater for easy tasks and lowest for difficult tasks.

The weighted valence of success ${}^oVa(Suc^{A^n})$ is the product of the valence and the subjective probability of success:

$${}^oVa(Suc^{A^n}) = Va(Suc^{A^n}) \cdot P(Suc^{A^n}) \quad (10)$$

The corresponding formula for failure is:

$${}^oVa(Fai^{A^n}) = Va(Fai^{A^n}) \cdot P(Fai^{A^n}) \quad (11)$$

These weighted valences of success and failure in a given choice situation make up the decision maker's level of aspiration which subsequently influence his decision. Lewin et al. say that the probability scale is influenced by past experience (both amount of experience and amount of success), goal structure of the activity (whether the

goal has an upper and lower limit), and wishes, fears and expectations. The valence scale is influenced by group standards as well as difficulty of the task.

Tolman (1955) discusses decision making from the context of "performance," by which he means a generalized way of behaving which can be discovered in two or more test situations. As an example he cites the experimental situation where a rat in a Skinner box must decide whether to turn right or left. Performance, Tolman says, is determined by three factors, need-push, valences and expectancies. Need-push is "that portion of a drive which, under the concrete stimulus conditions of the moment, gets into the behavior space." Examples for experimental rats are food deprivation, sex deprivation or water deprivation. Valences are "conceived as bearing nearly the same relation to incentive-values that need-pushes bear to drives." Examples, again for a rat, are foods, sex objects or liquids.

A "belief expectancy" is an "acquired expectancy of greater or less certainty and permanence, which will tend to lead to an activated expectation whenever an instance of the given sign stimulus-unit is presented."

Tolman states the entire theory as follows:

My final argument is that as a result of (i) the need-push for food, (ii) the positive valence of the expected food, (iii) the need-push against

work, and (iv) the negative valence of the expected work, there results the performance vector Pv.

This performance vector specifies the direction and magnitude of performance according to the following equation:

$$Pv = f_x (n_f, v_f, exp_f) - f_y (n_w, v_w, exp_w) \quad (12)$$

where n_f = positive need-push
 n_w = negative need-push
exp = expectation
 v_f = positive valence
 v_w = negative valence

Tolman does not specify the actual form of the equation, but states that the function may be multiplicative.

Rotter (1954) theorizes that behavior potential is a function of expectancy and reinforcement value. Behavior potential is the "potentiality of any behavior's occurring in any given situation or situations as calculated in relation to any single reinforcement or set of reinforcements. Expectancy is the "probability held by the individual that a particular reinforcement will occur as a function of a specific behavior on his part in a specific situation or situations. Expectancy is independent of the value or importance of the reinforcement." Reinforcement value "may be ideally defined as the degree of preference for any reinforcement to occur if the possibilities of their occurring were all equal."

Rotter's basic equation is thus:

$$B.P.x, s_1, R_a = f(E_{x, R_a, s_1} \text{ \& } R.V.a) \quad (13)$$

This equation reads that the potential for behavior x to occur in situation 1 in relation to reinforcement a is a function of the expectancy of the occurrence of reinforcement a following behavior x in situation 1 and the value of reinforcement a.

Reinforcement value, in turn, is determined by reinforcements it has been associated with, has led to, or has been perceived to lead to in past experience:

$$R.V.a_1, s_1 = f(E_{R_a \rightarrow R(b-n)} \text{ \& } R.V.(b-n), s_1) \quad (14)$$

In other words, the value of reinforcement a in situation 1 is a function of the expectancies that this reinforcement will lead to the other reinforcements b to n in situation 1 and the values of these other reinforcements b to n in situation 1.

Rotter's expectancy is not an actuarial probability but a probability calculated from past histories of reinforcement and a generalization of expectancies from related behavior-reinforcement sequences. But the more experience an individual has in a given situation, the less he will rely on generalization from similar experiences. The equation for expectancy is:

$$E_{s_1} = f\left(E'_{s_1} + \frac{GE}{N_{s_1}}\right) \quad (15)$$

i.e., an expectancy (E_{S_1}) is a function of the expectancy for a given reinforcement to occur as a result of previous experience in the same situation ($E_{S_1}^1$) and expectancies generalized from other situations (GE) divided by some function of the number of experiences in the specific situation (N_{S_1}).

Edwards (1954) discusses a number of economic and psychological decision theories and stresses the importance of subjective probabilities in game theory. Edwards (1955) then tested experimentally the expected utility (EU) game theory model and his subjective expected utility (SEU) model. The subjective expected utility model predicted experimental decision behavior fairly well, but the expected utility model did not.

In his work on risk taking behavior, Atkinson (1957) states that, "The strength of motivation to perform some act is assumed to be a multiplicative function of the strength of the motive, the expectancy (subjective probability) that the act will have as a consequence the attainment of an incentive, and the value of the incentive: $Motivation = f(Motive \times Expectancy \times Incentive)$." A motive, according to Atkinson is "conceived of as a disposition to strive for a certain kind of satisfaction, as a capacity for satisfaction in the attainment of a certain class of incentives." He points

out that there are two dominant motives--the motive to achieve and the motive to avoid failure. An incentive is the relative attractiveness or unattractiveness of a goal in a specific situation. Expectancy is subjective probability or "cognitive anticipation."

His experiments were designed to determine the effects of the above two motives when performance is measured against some standard of performance. The major implications of his findings are: a) performance level should be greatest when there is greatest uncertainty about the outcome regardless of which motive is strongest, and b) persons in whom the achievement motive is stronger prefer intermediate risk, while persons with the dominant motive of avoiding failure prefer either very easy and safe undertakings or extremely difficult and speculative undertakings.

Feather summarizes the results of these five lines of research in the following table:

<u>Theorist</u>	<u>Concept</u>	<u>Resultant</u>
Lewin, et al.	subjective prob. x valence	force (weighted valence)
Tolman	expectation, need-push, valence	performance vector
Rotter	expectancy + reinforcement value	behavior potential
Edwards	sub. prob. x utility	SEU
Atkinson	expectancy (motive x incentive value)	resultant motivation

Feather feels, however, that none of these theories adequately show the effect which different levels of subjective probability have on decision making. In his experimental work he found: a) As the goal object becomes less likely in the eyes of the subject he wishes to obtain it more. The increased attractiveness is more apparent in ego-related than in chance-related situations and more in achievement-oriented than in relaxed situations. b) As the goal object becomes less likely for a subject, there is less tendency for him to choose it even though it has achievement value. This is less apparent, however, in ego-related and achievement-oriented conditions.

Siegel (1957) also agrees that Lewin's work can be reduced to game theory terms. However, he expands the theory by showing in his experiments that level of aspiration is included in the subject's utility of his achievement goals. The decision model should recognize, he says, that utility has a model of its own whose main concepts are level of aspiration (LA) and reinforcement effects (R). His model of decision making is thus:

$$SEU = \sum_i p_i u_i$$

$$u_i = f(LA, R)$$

$$p_i = \text{probability}$$

$$u_i = \text{utility}$$

(16)

Cartwright and Festinger (1943) studied decision making from the standpoint of the interactions of decision time, decision confidence and decision difficulty. They say that an individual in a decision situation chooses the alternative toward which the stronger force is directed. If the two forces are equal, no choice can be made. Thus whenever a balance of forces is approached decision time will be lengthened. The strength of each of the forces depend on the amount of weight or potency each situation has for the subject. In the authors' words:

Stated formalistically, in overlapping situations, the strength of the effective force acting on a person ($O_{f,p,g}$) is equal to the strength which that force would have if there were only one situation, multiplied by the potency of the situation to which it belongs:

$$O_{f,p,g} = f_{p,g} \cdot P_o(S) \quad (17)$$

The potency of each overlapping situation is determined by the subject's feeling that his judgment is correct. Confidence which an individual has in his judgment is then the difference in potency between the two overlapping situations. If he has no confidence, the difference in potency is zero. Cartwright and Festinger then use this theory to predict the relative frequency of which each alternatives will be chosen and the time needed to make the decision. Festinger (1943, 1943) has tested the theory and found it to predict very accurately.

Block and Petersen (1955) cite Cartwright and Festinger's work and, adding to it, showed experimentally that personality characteristics affect decision time and decision confidence. Summarizing their results, Block and Petersen say:

Overly confident people tended to be rigid and dogmatic; overly cautious people tended toward introspection and self-abasement, and individuals with realistic confidence in their decision appeared to be self-reliant and socially perceptive. Fast deciders (in this particular situation) were passive, suggestible, and conforming, while slow deciders were ascendant, self-assured, and humorous.

Summarizing the work cited thus far in this section leads to three conclusions: 1) The work of Simon, Katona, and Cyert and March show that habitual or satisficing behavior is the predominant type of economic behavior but genuine decision making--weighing of alternatives, seeking of information, etc.--takes place when important, cross-roads decisions are made or in new situations where habits have not yet been formed. This importance of habit was also stressed by the institutional school of economists in their criticism of the theories of marginalism.

2) Psychological research has shown that when genuine decisions are made, they can be predicted with a subjective expected utility form of game theory model. This research also explains why habit is often used in place of genuine decision making. Shackle, Lanzetta and

Kanareff, Lewin et al., Tolman, Rotter, Atkinson, Edwards, and Feather all stress the importance of subjective probability in decision making (although each uses somewhat different terms). They found subjective probability to be formed through conditioning, past experience, the person's life space, and experience in related situations. In other words, in new situations, a person has little experience on which to base his expectancies (subjective probabilities), and he uses genuine decision making to improve these expectancies. Once expectancies become fixed in the decision maker's mind, habit sets it; and habit may then be the most economical form of decision making. Stigler pointed this out when he said that habit in a market situation often reduces the cost of search because successive asking prices are positively correlated. Also, when the decision maker faces important--and infrequent--decisions, a great deal of time has usually passed since he has made a similar decision. Thus he engages in genuine decision making because his subjective probabilities have become outdated.

3) Personality variables, aspiration levels, confidence, motivations, different valences or utilities, and other human characteristics influence the speed and manner in which decisions are made.

The third conclusion does little harm to the rational economic model and its implications for information, but shows that individual differences can prevent decisions from being made in the predictable manner. These are probably the differences Marshall felt would be balanced out in the aggregate by the law of large numbers, but differences which become important in individual cases.

The first two conclusions, however, both support and challenge the rational model. They show that the purely rational model works only part of the time--that part being when major decisions and/or new decisions are made. The role of information for these decisions remains unchanged--reducing uncertainty, improving expectations, and cutting the cost of search, all within the constraints of the difficulty of the situation and the mental capacity of the decision maker.

However, the prominence of habitual decision making makes it necessary to modify the rational theory. In decision situations where the decision maker has previous experience, or perceives that he has had previous experience, habit substitutes for the decision process and information then is not sought or used. This suggests two possible additions to a theory on the role of information in the decision process. Information

could be the force which causes the decision maker to realize he is at a crossroads and which jolts him from his habitual behavior into his decision making behavior. It can also be the base upon which the decision maker, intentionally or unwittingly, shapes the pattern for future habitual behavior as a substitute for genuine decision making.

Two theories from the field of mass communications can be used to explain these modifications of the rational model. The first is Festinger's (1957) theory of cognitive dissonance. This theory states that the individual constantly seeks a state of cognitive balance in which cognitions about himself--knowledge, belief and opinions--are consistent with cognitions about the environment. Dissonance arises when these cognitions differ.

When dissonance is present, an individual seeks out information to reduce the dissonance. In doing so, he usually seeks information consistent with his attitudes and beliefs and avoids inconsistent information. Festinger supports the implications of this theory with results from an experimental gambling situation in which dissonance was artificially produced.

Cohen, Brehm and Latané (1959) repeated the experiment with the same results. However, they also found that dissonance-produced information seeking was stronger when the subject's position was made public.

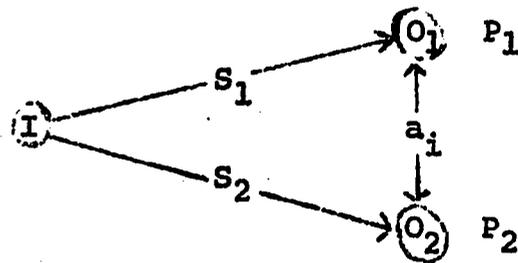
This theory explains why decision makers seek information for important decisions but rely on habit for small decisions. A perception of possible failure in the important decision would create a higher state of dissonance than in the minor decision and thus more time would be spent in seeking information on alternatives. However, the selective exposure and avoidance implications of this theory do not seem to hold up under the empirical evidence that genuine decisions are made on the basis of a game theory model--unless the view is taken that selective exposure and avoidance influence subjective probability.

Freedman and Sears (1965) reviewed the literature on selective exposure and concluded that the available evidence does not support the hypothesis. They suggest that utility of the information and previous exposure to the information may determine exposure. This finding supports the conclusion stated above, namely that in new situations and in crossroads decisions information is sought and genuine decisions are made whereas in most other situations habitual behavior rules.

In the new situation the decision maker has little previous exposure to relevant information and thus seeks out information on both sides of the issue. In crossroads decisions, information has more utility and

more is sought out. Perhaps, then, in habitual behavior situations, the selective exposure and avoidance implications of Festinger's theory would hold. And it is possible that the reason Festinger's hypothesis has not always been found to be true in experimental situations is that habitual situations have been confused with genuine decision situations.

Another explanation of the differences in decision behavior and information seeking can be given using the orientation paradigm developed by Carter. The paradigm is as follows:



(Figure 1)

I is the individual in the orientation situation.
 O_1 and O_2 are two objects from the environment which are situationally relevant.

a_i is the pertinence relation, based on an attribute which both O_1 and O_2 possess to some extent.

P_1 and P_2 represent the extent to which O_1 and O_2 possess the attribute a_i .

S_1 and S_2 are the salience relations between I and the two objects.

The essential features of this paradigm are the individual, two objects relevant to the environmental situation, and attributes held jointly by the objects. The individual has both a salience and a pertinence relationship with these objects.

Salience is a psychological closeness to the objects developed by personal experience. In Carter's words, "The salience relation indicates the 'psychological distance' between the individual and a given object. It is a function of the previous reinforcement history for that object as a consequence of directed behaviors following previous orientations. This value tends to be relatively independent of the attribute or attributes by which the object may be or have previously been seen as pertinent to another object."

In other words, salience seems to be habitual values for an object which have developed out of "previous orientations" or situations where the individual was forced to make a new decision and the choice which he put into action then became psychologically close to him. A salient value, once formed, tends to hold across situations and is not specific to one situation.

The pertinence relationships are the degree to which each object possesses a relevant attribute (a_i). These relationships are independent of the psychological

closeness to the individual. Pertinence relationships, according to Carter, are "contingent on the given situation and the fact that some attribute makes the juxtaposition of the two objects relevant."

An example of a salience relationship in economics would be the statement: "I don't know why but I just like cattle." A statement of a pertinence relationship would be: "I am going to raise cattle this year rather than hogs because with the expected market prices they will be more profitable per dollar of investment."

Salience relationships seldom change once they are formed, and exposure to new information, persuasive messages, etc. have little effect on them. Pertinence relationships, however, are completely objective and are subject to change when new information is acquired.

Carter points out that when an individual is oriented to only one object--when he is in the "goal-seeking mode"--the only influence is the salience relationship. The only discrimination then used by the individual is recognition. But when the individual is oriented toward two objects--"the evaluative mode"--pertinence relationships become important, and the primary discriminations used are inclusion and exclusion.

In a statement which shows the relevance of these two modes of behavior to decision making, Carter says:

In problem solving activities it is essential for the individual to be in the evaluative mode if he is to process information and make discriminations other than recognition. Thus, some "insight" phenomena may derive their appearance of suddenness from the switch in mode by the individual from goal seeking to evaluation.

The person in the goal-seeking mode needs only to find his goal, so to speak. He is looking for a referent as a locator. This person is particularly susceptible to a phenomenon of selective perception --i.e., of non-recognition, from the observer's point of view.

This theory, then, seems to explain well the findings of Simon, Katona, and others. When the individual makes decisions habitually, he is in the one-object, "goal-seeking mode." Salience relationships (his personal feelings about the object) then are the only important relationships, and his only discrimination or decision that needs to be made is recognition. But "when the given situation makes two objects relevant"--the crossroads decision--or in a new situation where saliences have not yet been formed evaluation of the alternative objects takes place on the basis of pertinences. Here information is important, and information is sought. Information functions to make the attributes of each object clear and to reduce uncertainty in the decision.

Social Effects on Decision Making

A great deal of research on decision processes has also been carried out in the field of sociology, most of this work being done in connection with the diffusion of innovations. Principal studies have centered around the adoption of new farm practices, diffusion of new practices among doctors, and others. This work corresponds closely with the work of economists, as the acceptance or rejection of an innovation is simply the making of a decision.

A prominent sociological theory is that the diffusion process takes place in stages. Wilkening (1953, p. 9) probably was one of the first to recognize these stages when he stated:

An understanding of why farmers do or don't accept improved practices requires that one recognize acceptance as a process composed of learning, deciding and acting over a period of time. The adoption of a specific practice is not the result of a single decision to act but of a series of actions and thought processes.

Rogers (1962, pp. 76-86) reviews over 500 studies of the diffusion of innovations and lists the following five stages found in most of the studies.

1. Awareness---The individual is exposed to the innovation but lacks complete information about it.
2. Interest----The individual becomes interested in the new idea and seeks additional information about it.

3. Evaluation--The individual mentally applies the innovation to his present and anticipated future situation and then decides whether or not to try it.
4. Trial-----The individual uses the innovation on a small scale in order to determine its utility in his own situation.
5. Adoption----The individual decides to continue the full use of the innovation.

This model is very similar to the economic decision model of Johnson, et al. and Rieck and Pulver. The difference is that economists view the initial stage in the process as purposive--i.e., the individual recognizes that a problem exists and then purposely seeks a solution to the problem. Sociological researchers, on the other hand, generally view the awareness stage as random or non-purposive.

Economists, in other words, look at rationality from the standpoint of an individual decision maker who faces a problem situation and wishes to choose the one alternative among many which will best solve his problem. If this choice involves adopting a new idea or practice, the economist does not care whether the idea or practice is rational for all decision makers in the social system, but only that it be rational for the specific individual involved.

Sociologists, however, in studying adoption of new techniques choose a technique which they feel every rational decision maker in the social system should adopt. They do

not look at each individual's specific situation to ascertain whether the practice in question may or may not be useful for him. Rather they watch the stages which the individual goes through in adopting the practice and also the influence of the social system in the processing and diffusion of information about the practice and the part the individual's role in the social system plays in the adoption of the innovation.

Rogers points out, however, that one sociologist-- Hassinger--argues that awareness must be initiated by the individual. He may be exposed to the innovation but will not be aware of it, Hassinger argues, until he has a problem or need that the innovation promises to solve. Hassinger's viewpoint is similar to what John Dewey calls an indeterminant situation (c.f., Logic: The Theory of Inquiry). Dewey argues that a person participates in ongoing activities solely on the basis of habit, without even needing to think about the activity, until he faces an uncertain, indeterminant, or problematic situation. Then the person thinks and choose a course of action which will best alleviate the indeterminant situation.

Rogers (p. 82), in viewing the conflict states: "Perhaps one is faced with a chicken-and-egg type of question. Does a need precede awareness of an innovation or does awareness of a new idea create a need for that innovation. The available research studies do not yet provide a clear answer to this question, but tentative evidence suggests the latter is more common."

Perhaps, in view of this methodological difference between economists and sociologists, it may be questionable whether the two points of view can be integrated in a theory of decision making. The diffusion model which has evolved from sociological work can be criticized on several grounds (these will be discussed later), but it does have one valuable contribution to an economic theory of decision making. That is, the diffusion model illustrates the effect which a social system has on decisions made by economic actors--a factor which economists often overlook. This is especially important for a theory concerned with the role of information in the decision process because the social system itself is an important communications channel or information processing mechanism.

In most studies of the diffusion process, different sources of information have been found to be most important in each of the stages. In this regard, Rogers points out that a generalization supported by many studies is that impersonal information sources are most important at the awareness stage and personal sources at the evaluation stage. Impersonal sources are generally the mass media which do not involve face-to-face communication. Personal sources, however, involve face-to-face contact. Examples for a farm situation in

the United States are other farmers, extension agents, or salesmen.

Because of their mass nature, Rogers says (pp. 98-102), the media ordinarily have not been beamed at a specialized or local audience and thus are most effective in calling attention to a new idea. However, at the evaluation stage mental judgment of the idea is necessary and personal communications become more important because they allow an important two-way exchange of ideas.

Lionberger (1960, pp. 5-6) lists what in the past have been the most important sources of information at each stage of the adoption process for agricultural innovations. At the awareness stage mass media are most generally used. At the interest stage, the farmer needs more information about the innovation. The mass media are still important here but other farmers and agricultural agencies increase in importance. At the evaluation stage, a decision is required, and fellow farmers with the requisite experience and respected opinions are most often sought as information sources. Agricultural agencies rank second at this stage. At the trial stage, information on application of the new idea or practice is needed, and friends and neighbors as well as agricultural agencies are consulted. At the adoption stage performance and demonstrated merit of the practice are necessary. The most

important information sources are the farmer's own experience and the experiences of other farmers. Mass media and agricultural agencies may reinforce the decision by providing information on successful performance.

A second generalization advanced by Rogers (pp. 102-104) is that cosmopolite information sources are most important at the awareness stage and localite information sources at the evaluation stage. Cosmopolite sources are sources outside the social system such as mass media and outside agricultural agencies. Localite sources are sources inside the system such as fellow farmers.

Another categorization arising out of diffusion research is that of different types of adopters. These categories are differentiated according to the time taken to adopt a new practice. The adopter categories derived by Rogers (pp. 169-172) are as follows:

1. Innovators ---- The innovator is the first to adopt a new practice. He is venturesome and willing to take the risks associated with being the first to adopt a practice.
2. Early Adopters--Early adopters are less venturesome than innovators. They have more respect than innovators in the community. They are localites while innovators are cosmopolites. Hence they are the most effective opinion leaders.
3. Early Majority--The early majority are more deliberate; they accept new practices just before the average

member of the social system. They participate in community activities but rarely hold leadership positions.

4. Late Majority---The late majority are cautious and skeptical. They adopt innovations just after the average member of the community. Adoption in this case may often be an economic necessity or a response to social pressures.
5. Laggards ----- Laggards are the traditionalists of a social system. They are near-isolates in the community, have almost no opinion leadership and are the last to adopt an innovation.

Members of these adopter categories also differ in their information seeking behavior. Rogers (pp. 178-182) lists the following generalizations.

1. Impersonal sources of information are more important than personal sources for relatively early adopters than for later adopters.
2. Cosmopolite sources of information are more important than localite sources for relatively early adopters.
3. Early adopters utilize information sources that are in closer contact with the origin of new ideas than later adopters.
4. Earlier adopters utilize a greater number of different information sources than do later adopters.

A concept coming out of adoption and other diffusion studies related to the five adopter categories is that of opinion leaders. Opinion leaders are the individuals to which most other individuals look for advice and support.

Opinion leaders are generally found in the early adopter category, but because of their cosmopolite tendencies innovators are seldom opinion leaders. However, Lionberger (p. 59) points out that "in areas where alertness to new developments in farming and quick acceptance are status factors, innovators and persons sought as information sources are likely to be one and the same. Where local norms dictate caution with respect to change, they are likely not to be."

With regard to information sources, Rogers (pp. 238-239) points out that opinion leaders use more impersonal, technically accurate and cosmopolite sources of information than do their followers.

The rational decision model was related to the adoption process in a study by Dean and his colleagues (1958). They found a direct relationship between rationality and adoption of recommended corn practices. They suggest that rationality is an intervening variable between the antecedents of adoption and adoption itself. In their study these antecedents were contact with the Extension Service, degree of mechanication, size of farm, age of operator (an inverse relationship), level of living, participation in formal organizations, and education.

This diffusion model, as mentioned previously, can be criticized on several grounds. One criticism is that it reflects the manner in which the diffusion process has been developed and encouraged in the United States--an atypical society. For example, mass media are probably most important at the awareness stage because they contain mostly "news"--information on new ideas, practices and techniques--and seldom attempt to re-examine the older methods. In other words, the model is a description of what has occurred in one type of economic organization in the United States. That organization has ordinarily been a family farm agricultural system since most adoption studies have been conducted by rural sociologists. Because the media in the past have been used in the way the model describes, however, does not mean their function will inevitably be the same in the future. Even within agriculture, communication patterns may change in the future, as, for instance, they would change if a vertically integrated farming system would become dominant.

The model also fails to distinguish between positive and negative incentives for adoption. For example, all present studies seem to concern situations where adoption will lead to a positive reward--higher profit, less labor time, better living conditions, etc. The model does not treat a coercive type of adoption

situation. Examples might be filing income tax returns, obeying traffic laws, registering with the selective Service System, etc. Here non-adoption carries the almost certain penalty of a fine, jail or some other negative incentive. In this situation the decision maker conceivably would pass directly from the awareness to the adoption stage without going through the intermediate stages. Similarly the concept of different adopter categories would also immediately disappear in a coercive situation. In many cases, a modified form of this coercive system may be the most effective way of bringing about adoption of new practices, both in the United States and especially in developing countries.

Therefore, the diffusion model presented above cannot be accepted as being the only process which must inevitably take place in a social system. But this area of research is important because it illustrates the effects of social influences and social roles on decision making. Two other social-psychological studies have measured this social influence directly.

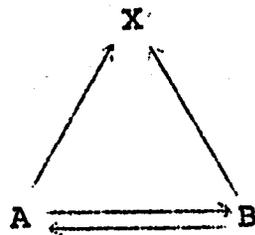
Asch (1951) asked experimental groups of eight individuals to compare the length of three clearly unequal lines. All but one of the eight were stooges who had been instructed to make the wrong choice. Only one was left to make what he considered to be the correct

choice, although he thought the others were doing the same. One third of the individuals making decisions followed the majority in making the wrong decision, while no one made the wrong decision in a control group. This effect diminished, however, when there was less than a unanimous majority against the critical member. Asch found wide and striking differences among individuals in the same experimental situation, and hypothesized that these differences were caused by character traits, particularly those pertaining to the person's social relations.

Deutsch and Gerard (1955), however, point out that Asch and others who have studied group influence have carelessly used the term "group influence." They found that group influence contains aspects of both a) normative social influence and b) informational social influence. Normative influence results when individuals are expected to conform with the expectations of others in the group. Informational influence results when individuals accept information from others in the group as evidence about reality. An example of such an influence is the decision maker who accepts poor or irrational information from an influential member of the community and puts it to use without checking other sources for the accuracy of the information.

The literature cited in this section leads to the conclusion that the individual in making a decision is influenced by the social system(s) of which he is a part and by his role in this(these) system(s). The implications of this conclusion for information are that the individual in a social system often relies on others in the system as sources of information needed to make decisions. Information comes to him through the information processing mechanisms of the system and often may include biases of individuals transmitting the information. The decision maker also may often receive information non-purposely, although he may not use the information until he recognizes a problem situation in his environment.

Again these conclusions can be explained in terms of models of communication behavior. Newcomb's (1953) consensus model shows how two individuals in a social system reach a consensus about an item of common interest through communication--thus explaining the social influence on decision making. This model is represented below, where A and B are the individuals in the social system and X is the object of common interest:



(Figure 2)

Explaining the social influence in this orientation situation, Newcomb says:

Under the conditions of continued association which we are assuming, A and B as they communicate about X are dependent upon each other, not only because the other's eyes and ears provide an additional source of information about X, but also because the other's judgment provides a testing ground for social reality. And to be dependent upon the other, in so far as such dependence influences behavior, is to be oriented toward him.

Carter's model (Figure 1), when expanded to a co-orientation situation, also explains the social influence on decisions. In this situation Figure 1 is expanded to add a second individual who has salience and pertinence relations with the two relevant objects O_1 and O_2 . Consensus is reached when the two individuals agree on common values for the two objects in the situation. The two individuals can reach an understanding about the attributes held by the two objects and the pertinences of the two objects (the degree to which the objects possess the attributes). But the saliences toward the objects held by each individual prohibit a perfect consensus unless the salience relationships were initially identical.

Carter's co-orientation paradigm and the importance of both saliences and pertinences then explains both the effect of the social system on individual decisions and also the fact that there are laggards in an adoption

process--i.e., why some members of the system fail to adopt a beneficial practice when their friends and neighbors are adopting the practice and are communicating about the practice.

Conclusions and Implications

The purpose of this paper has been to help explain the role of information in the decision making process in order to supplement economic and communication theories and to make these theories useful for communications workers. In order to recognize all the factors bearing on the decision maker, literature from the fields of psychology and sociology as well as economics, has been studied.

The study of this literature has led to one general observation on the entire decision making process. That is, men act like the rational economic men of orthodox economic theory only in rare instances. In most other cases, personal preferences which result in habit formation, psychological differences, and social roles and pressures alter the decision making process. Perhaps if a man's individual personality and his social roles could be removed, he would always make rational, maximizing decisions in which he carefully studies all alternatives, seeks all relevant information, etc. But then man would be more like a machine than a human being. In essence, he would have a computer for a mind.

With this conclusion in mind, the role of information in decision making can be stated as follows. Although most economic decisions are made on the basis of habit, genuine, rational decisions are made in new situations where the decision maker has little previous decision experience and in important, crossroads decisions. When rational decisions are made, the role of information is to reduce uncertainty. If the decision maker had access to all relevant information and had the mental capacity to analyze the information and relate it to his situation, he would have little reason not to make a rational decision. He could then easily choose the alternative which would maximize his goal or best solve his problem.

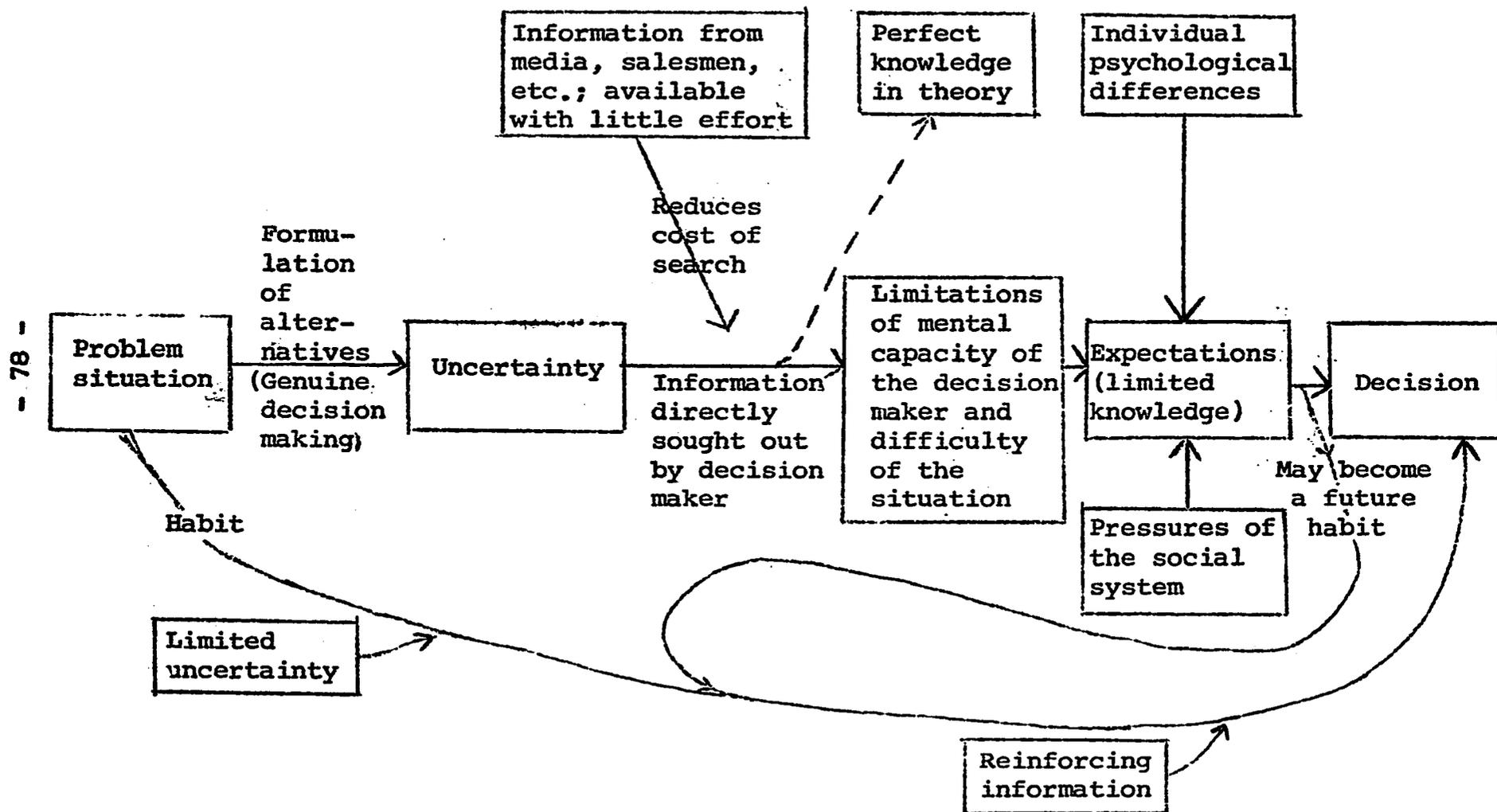
Communication, however, can never provide the decision maker with perfect knowledge. But information, even though it provides less than perfect knowledge, still functions to reduce uncertainty by improving the accuracy of the decision maker's expectations, the limited knowledge which he must use to make decisions. The decision maker cannot seek out all information because eventually the cost of search will exceed the expected payoff from the new information. Thus information furnished to him through little or no effort of his own--such as printed information, broadcast information, calls by salesmen or Extension agents--function to reduce his cost of search.

In short, communicated information reduces the decision maker's cost of search for information relevant to his situation. The more information he has available--again within the constraints of the difficulty of the situation and his mental capacity--the better will be his expectations, the less uncertainty there will be attached to his decision, and the more rational the final decision will be.

However, in situations where the decision maker has previous experience in making similar decisions or in relatively unimportant decisions, habit normally substitutes for genuine decision behavior. Information provided in a genuine decision situation was previously the basis for the formation of this habit, and accurate information is thus extremely important in the earlier situation if "good" habits are to be formed. Once habits have been formed, information may have little function except to reinforce habits--i.e., selective exposure and avoidance are the predominant type of information seeking.

Finally, the decision maker interprets information on the basis of his experience within an environmental situation, which includes experience with members of his social system. Also, information often comes to him through the information processing mechanisms of the social system and can be biased by the individuals

Figure 3. A schematic representation of the role of information in decision making.



transmitting the information. Both social influences may prevent the decision maker from using the information in a purely rational manner. The role of information is depicted in Figure 3.

This theory, then, has several implications for a communications strategy. The communicator whose role is to provide information to aid the decision maker can be most effective if he first learns what uncertainty the decision maker is facing, either in general or with reference to specific products, techniques or ideas. The most valuable information then would be that which will decrease this uncertainty through improving the decision maker's expectations about the outcomes of alternative solutions to the uncertain situation.

In situations where decisions are being made on the basis of habit, the communicator's strategy is more difficult. If he judges the habit to be "good"--i.e., that it is adequately providing solutions to problems faced by the decision maker--then the information should be designed to reinforce the habit. But if the habit is judged to be "bad"--e.g., in countries where traditional methods are used indiscriminantly--then information should be designed to jolt the decision maker out of his habitual behavior.

Carter's orientation paradigm shows how this can be done. The individual using habitual behavior is in a one-object, "goal-seeking" mode. His only discrimination is recognition and the only values brought to bear on the decision are saliences, which seldom change. However, if the individual can be jolted into the two-object, "evaluative" mode, pertinences, or the degree of possession of relevant attributes by the alternative objects, can be brought to bear on the decision. Information bringing awareness of an alternative to the habitual practice, and information which discusses relevant attributes of the two practices, could be this jolting force.

Finally, the communicator must be aware of individual psychological differences and social pressures which may cause his message to be ignored or misinterpreted. He should then try to eliminate these influences or, most often, try to circumvent them.

This strategy has immediate implications for a communicator whose primary activity is providing objective knowledge to decision makers. Such communicators are those working with trade publications, technical bulletins, market information, extension services, government agencies which provide technical information, etc. The strategy also has implications for public relations and advertising work. In these latter cases, what the communicator judges to be

"good" will usually be less objective than in the former cases. But even in these cases of presumed subjectivity, the communicator trying to promote a new product or trying to persuade an individual making an unfamiliar decision may find that the most persuasive message is one which provides objective facts about the relative attributes of the product or organization being promoted.

But as stated at the beginning of this paper, this communications strategy is especially important for work in a developing country. In these countries, decision makers may often act primarily on the basis of tradition and habit, and the task of a communicator is to set up relevant, "pertinent" alternatives to these traditions. In many cases, the most relevant attribute of alternative decisions is the amount of risk and uncertainty attached to the decision. Since the basic role of information in decision making is to reduce uncertainty, information can obviously play a key role in development.

In the United States and other developed countries, information is usually abundant, and risk and uncertainty carry only the possibility of bankruptcy. But Myren (1964) points out information is scarce in an underdeveloped country, and risk and uncertainty are prevalent. In such cases, reducing risk and uncertainty is vitally

important for economic progress because decisions about unknown or uncertain alternatives may carry the threat of starvation.

Díaz Bordenave (1966) found that farmers in Brazil with the highest intensity of search for instrumental information were those with the widest "range of decision making." The farmer had a wide possible range of decision making when he had a large farm, a large amount of cash on hand, and supervised a large number of workers--all of which reduce the harshness of uncertainty facing the decision maker. The farmers facing the most severe consequences of risk and uncertainty and those who most need information were the ones who sought information less. This finding underscores the fact that some way must be found to communicate with backward and low-income decision makers if they are to receive the information they need to reduce risk and uncertainty and subsequently to make the type of decisions necessary for economic and social progress.

Erasmus (1961) found that decisions in rural Mexico usually cannot be rational (to the outside observer) because of a lack of information. He says (p. 31):

Cognition derives its dynamic quality from frequency interpretation--the potentiality to synthesize experiences into predictive generalizations. At the pre-industrial, non-specialized level, frequency interpretation is based entirely upon casual observation, and spectacularity is important for acceptance of innovations.

Thus the role of the communications researcher in a developing country should not be simply to study the media system of the country and correlate the advance of a media system with innovativeness, entropy, political awareness, achievement motivation and other symptoms of a social system which is approaching an advanced stage of development. Rather the communications worker should study the uncertainties facing economic decision makers and try to find ways of communicating the information needed to overcome these uncertainties. The same is true for information that can be used to break a decision maker out of a habitual pattern of behavior if it exists.

However, this information must be communicated within the present social structure if decision makers are to receive the information they need to break out of that structure. Perhaps transistor radios; inexpensive, illustrated, and easy-to-read publications; voluntary organizations, word-of-mouth communication, rural labor syndicates, or other experimental communications techniques might be able to transmit the needed information to the traditional decision maker. Then as economic development progresses, higher national incomes will make it possible to establish an advanced media system which can replace these simple, transitional methods.

REFERENCES CITED

- Arrow, Kenneth J. "Utility and Expectation in Economic Behavior." In Sigmund Koch, Psychology: A Study of a Science. Vol. 6. New York: McGraw-Hill. 1963.
- Asch, S. E. "Effects of Group Pressure Upon the Modification and Distortion of Judgments." In Harold Guetzkow, Groups, Leadership and Men. Pittsburgh: Carnegie Press. 1951.
- Atkinson, John W. "Motivational Determinants of Risk-Taking Behavior." Psychological Review 64 (1957): pp. 359-372.
- Block, Jack and Petersen, Paul. "Some Personality Correlates of Confidence, Caution and Speed in a Decision Situation." Journal of Abnormal and Social Psychology 51 (1955): pp. 34-41.
- Carter, Richard F. "Communications and Affective Relations." Journalism Quarterly 42 (1965): pp. 203-212.
- Cartwright, Dorwin and Festinger, Leon. "A Quantitative Theory of Decision." Psychological Review 50 (1943): pp. 595-621.
- Charnes, A. and Cooper, W. W. "The Theory of Search: Optimum Distribution of Search Effort." Management Science 5 (1958): pp. 44-50.
- Clark, J. Maurice. Studies in the Economics of Overhead Costs. Chicago: The University of Chicago Press. 1923.
- Clodius, Robert L. and Mueller, Willard F. "Market Structure Analysis as an Orientation for Research in Agricultural Economics." Journal of Farm Economics 43 (1961): pp. 515-533.
- Cohen, Arthur R.; Brehm, Jack W. and Latané, Bibb. "Choice of Strategy and Voluntary Exposure to Information under Public and Private Conditions." Journal of Personality 27 (1959): pp. 63-73.

- Commons, John R. Institutional Economics. Madison: University of Wisconsin Press. 1959. Original version 1934.
- Cyert, Richard M. and March, James G. A Behavioral Theory of the Firm. Englewood Cliffs: Prentice-Hall, Inc. 1963.
- Dean, Alfred, et al. "Some Factors Related to Rationality in Decision-Making Among Farm Operators." Rural Sociology 23 (1958): pp. 121-135.
- Deutsch, Morton and Gerard, Harold B. "A Study of Normative and Informational Social Influences upon Individual Judgment." Journal of Abnormal and Social Psychology 51 (1955): pp. 629-636.
- Dewey, John. Logic: The Theory of Inquiry. New York: H. Holt and Company. 1938.
- Díaz Bordenave, Juan. Sociological and Psychological Factors Related to Information Seeking Among Farmers of the Brazilian Northeast. Unpublished Ph.D. Thesis. Michigan State University. 1966.
- Dillon, John L. and Heady, Earl O. Theories of Choice in Relation to Farmers' Decisions. Iowa Agricultural Experiment Station Bulletin 485. October 1960.
- Duncan, David C. "Psychology for Economists." Occupational Psychology 32 (1958): pp. 197-203.
- Edwards, Ward. "The Theory of Decision Making." Psychological Bulletin 51 (1954): pp. 380-417.
- _____. "The Prediction of Decisions Among Bets." Journal of Experimental Psychology 50 (1955): pp. 201-214.
- Erasmus, Charles J. Man Takes Control. Minneapolis: University of Minnesota Press. 1961.
- Feather, J.T. "Subjective Probability and Decision under Uncertainty." Psychological Review 66 (1959): pp. 150-164.

- Festinger, Leon. "Studies of Decision: I. Decision-Time, Relative Frequency of Judgment and Subjective Confidence as Related to Physical Stimulus Difference." Journal of Experimental Psychology 32 (1943): pp. 291-306.
- _____. "Studies of Decision: II. "An Empirical Test of the Quantitative Theory of Decision." Journal of Experimental Psychology 32 (1943): pp. 411-423
- _____. A Theory of Cognitive Dissonance. Stanford: Stanford University Press. 1957.
- Freedman, Jonathan L. and Sears, David O. "Selective Exposure." In Leonard Berkowitz (ed.), Advances in Experimental Social Psychology. Vol. 2. New York: Academic Press. 1965.
- Friedman, Milton. Essays in Positive Economics. Chicago: University of Chicago Press. 1953.
- Friedman, Milton and Savage, Leonard J. "The Utility Analysis of Choices Involving Risk." In George J. Stigler (ed.), Readings in Price Theory. Vol. 6. Homewood, Illinois: Richard P. Irwin, Inc. 1952.
- Headley, J.C. and Carlson, A.B. "Problem Solving--The Decision Process and Management Behavior." Journal of Farm Economics 45 (1963): pp. 1219-1225.
- Henderson, James M. and Quandt, Richard E. Microeconomic Theory. New York: McGraw-Hill. 1958.
- Johnson, Glenn L., et al. (eds.). Managerial Processes of Midwestern Farmers. Ames, Iowa: Iowa State University Press. 1961
- Johnson, Glenn L. and Haver, C.B. Decision Making Principles in Farm Management. Kentucky Experiment Station Bulletin 593. 1953.

- Katona, George. Psychological Analysis of Economic Behavior. New York: McGraw-Hill. 1951.
- _____. "Rational Behavior and Economic Behavior." Psychological Review 60 (1953): pp. 307-318.
- _____. "Economics and Psychology." In Sigmund Koch, Psychology: A Study of a Science. Vol. 6. New York: McGraw-Hill. 1963.
- Knight, Frank H. Risk, Uncertainty and Profit. New York: Augustus M. Kelley, Bookseller. 1921.
- Lanzetta, John T. and Kanareff, Vera A. "Information Cost, Amount of Payoff, and Level of Aspiration as Determinants of Information Seeking in Decision Making." Behavioral Science 7 (1962): pp. 459-472.
- Lewin, Kurt; Dembo, Tamara; Festinger, Leon; and Sears, Pauline Snedden. "Level of Aspiration." In J. McV. Hunt, Personality and the Behavior Disorders. Vol. 1. New York: The Ronald Press Company. 1944.
- Liebhafsky, H.H. The Nature of Price Theory. Homewood, Illinois: The Dorsey Press, Inc. 1963.
- Lionberger, Herbert F. Adoption of New Ideas and Practices. Ames, Iowa: The Iowa State University Press. 1960.
- Manne, Alan S. Economic Analysis for Business Decisions. New York: McGraw-Hill. 1961.
- Marschak, Jacob. "Remarks on the Economics of Information." In Contributions to Scientific Research in Management. Symposium at the University of California, Los Angeles. January 29-30, 1959. pp. 79-100.
- _____. "Toward an Economic Theory of Organization and Information. In R.M. Thrall, C.H. Coombs, and R.L. Davis. Decision Processes. New York: John Wiley and Sons, Inc. 1954.

- Marshall, Alfred. Principles of Economics. Third Edition, London: Macmillan and Co. 1895.
- Miller, David W. and Starr, Martin K. Executive Decisions and Operations Research. Englewood Cliffs: Prentice-Hall, Inc. 1958.
- Myren, Delbert T. "The Role of Information in Farm Decisions under Conditions of High Risk and Uncertainty." In Proceedings of the Symposium on Communications in Agricultural Development. Mexico City. October 1964.
- Nagel, Ernest. "Assumptions in Economic Theory." American Economic Review (1963): pp. 211-219.
- Newcomb, Theodore M. "An Approach to the Study of Communicative Acts." Psychological Review 60 (1953): pp. 393-404.
- Newell, Allen; Shaw, J.C., and Simon, Herbert A. "Elements of a Theory of Human Problem Solving." Psychological Review 65 (1958): pp. 151-166.
- Oppenheim, Felix E. "Rational Choice." Journal of Philosophy 50 (1953): pp. 341-350.
- Rieck, Robert E. and Pulver, Glen C. An Empirical Measure of Decision Making in Evaluating Farm and Home Development in Wisconsin. Madison: Wisconsin Agricultural Experiment Station Research Bulletin 238. June 1962.
- Rogers, Everett M. Diffusion of Innovations. New York: The Free Press of Glencoe. 1962.
- _____. "Media Exposure and Modernization Among Colombian Peasants." Public Opinion Quarterly 29 (1965): pp. 614-625.
- Rotter, Julian B. Social Learning and Clinical Psychology. New York: Prentice-Hall, Inc. 1954.

- Samuelson, Paul A. "Problems of Methodology--Discussion." American Economic Review (1963): pp. 229-230.
- Savage, L.J. The Foundations of Statistics. New York: John Wiley and Sons, Inc. 1954.
- Shackle, G.L.S. "Expectation in Economics." London: Cambridge University Press. Second Edition. 1952.
- _____. "The Economist's Model of Man." Occupational Psychology 32 (1958): pp. 345-375.
- Shannon, Claude E. and Weaver, Warren. The Mathematical Theory of Communication. Urbana: The University of Illinois Press. Paperback version 1963. Original version 1949.
- Shubik, Martin. "Objective Functions and Models of Corporate Optimization." Quarterly Journal of Economics 75 (1961): pp. 345-375.
- Siegel, S. "Level of Aspiration and Decision Making." Psychological Review 64 (1957): pp. 253-262.
- Simon, Herbert A. Administrative Behavior. New York: The Macmillan Co. 1948.
- _____. "Theories of Decision-Making in Economics and Behavioral Science." American Economic Review 49 (1959): pp. 253-283.
- _____. "Economics and Psychology." In Sigmund Koch, Psychology: A Study of a Science. Vol. 6. New York: McGraw-Hill. 1963.
- Stigler, George J. "The Economics of Information." Journal of Political Economy 69 (1961): p. 213-225.
- Tobin, James and Trener, Dolbear, F. Jr. "Comments on the Relevance of Psychology to Economics Theory and Research." In Sigmund Koch, Psychology: A Study of a Science. Vol. 6. New York: McGraw-Hill. 1963.

- Tolman, Edward C. "Principles of Performance." Psychological Review 62 (1955): pp. 315-326.
- Veblin, Thorstein B. "The Limitations of Marginal Utility." Journal of Political Economy 17 (1909): pp. 620-636.
- Von Neumann, J. and Morgenstern, O. Theory of Games and Economic Behavior. Princeton: Princeton University Press. 1947.
- Weisskopf, Walter A. The Psychology of Economics. London: Routledge & Kegan Paul Ltd. 1955.
- Wilkening, Eugene A. Adoption of Improved Farm Practices as Related to Family Factors. Madison: Wisconsin Agricultural Experiment Station Research Bulletin 183. December 1953.