IMPORTANCE OF BUYERS' CRITERIA FOR EVALUATING NEW TECHNOLOGY ATTRIBUTES

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Abstract

This paper focuses on the perceived importance of product attributes as buyers' criteria for decision-making. The conceptual framework of this study considers buyers' criteria for assessment of new products as a focal point to understanding the underlying factors and objectives for buying behavior. The objective criteria were measured using a direct rating scale composed of eight items associated with purchasing new agricultural technologies. The findings indicate that farm operators favorably perceived technologies that are reasonably priced, less costly to maintain, save time, reduce drudgery, with quick return on investment, bring more benefits, and require little reorganization of their enterprise. Understanding adopter criteria has vital implications for manager assessment of market opportunities.

Introduction

Current research on diffusion of innovations, as reflected in available literature, has not devoted enough attention to the importance of buyers' criteria for evaluating the attributes of new products or technological innovations. Recent studies suggested that future buyer perception-preference research should address the relative importance of types of product attributes and a host of other research issues (Glazen, 1984: Ostlund, 1974). Therefore, this present paper focuses on the perceived importance of product attributes as buyers' criteria for decision making. Diffusion research that determines adopters' criteria for perceiving and evaluating new products could influence the marketing manager's understanding of product needs and opportunities available in the marketplace.

Buyers use product attributes as evaluative criteria to differentiate among products by constructing an image of relative quality. It is necessary to understand not only how buyers use evaluative criteria, but also how they rank order criteria in terms of importance. Variations in perceived levels of importance of new product attributes may affect a buyer's choice among available new products. These variations appear to be product and person specific (Dickson, 1982).

An examination of each evaluative criterion and its relative level of importance as perceived by buyers of new products is likely to reveal implications for new product development and marketing. This paper discusses findings from a major survey that investigated criteria used by principal farm operators in purchasing new farm technologies in a midwestern state.

Conceptual Framework

Buyer decision-making is a process in which evaluative criteria are considered necessary for understanding purchasing motives (Engel, Blackwell, and Miniard, 1986). In the past, most consumer behavior researchers have investigated beliefs and attitudes rather than defining the critical product attributes used in the evaluation process (Gardner, 1983). Buyers' criteria for assessing new products are additional keys to understanding the underlying factors and objectives of individual buying behavior.

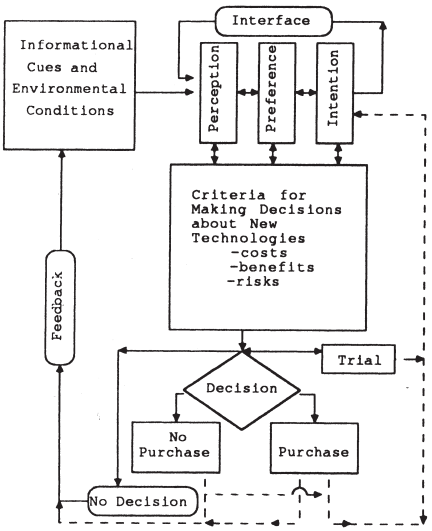
The potential buyer examines new products or technologies in the context of his/her past, present, and future situations. During this process the buyer rates and compares product performance based on his/her ranking of attribute importance (Bettman, 1979), and his or her expectations about the attributes of future substitute and/or complementary products (Scott, 1985). A buyers' evaluation of product attributes is, therefore, governed by criteria that form a cognitive, conative, and affective frame of reference (Engel, Blackwell, Miniard, 1986).

A buyer's decision-making criteria represent some combination of favorable and unfavorable attribute evaluations. These are considered by the buyer before the final purchase decision is made. The relative importance attached to each criterion probably varies from person to person. However, some groups of people, e.g. segments, select similar criteria for decision-making (Dickson, 1982). Complete understanding of how the purchase decision process is made cannot be accomplished without a reference to the buyer's criteria for decision-making. The final purchasing decision can be better predicted by knowing the buyer's reasons for acceptance or rejection of new products/innovations. The theoretical link, between the criteria for evaluation and the intention to purchase behavior, has been empirically tested and is well established in the behavioral literature (Miniard and Cohen, 1983; Ajzen and Fishbein, 1980).

Although the general focus of most diffusion research has been on understnding the final

[1]The authors wish to thank the anonymous reviewers for their useful suggestions and Ms. Mary E. Gannon for her secretarial support throughout this writing project. Also thanks are due to Adel Hassan and Rebecca Lindy for their graphical assistance.

adoption decision (Gatignon and Robertson, 1985), less attention has been paid to defining the steps in the decision process (Hassan, 1984). The focus of the present paper is the types and relative importance of criteria used in evaluating new agricultural technologies. Rogers (1983) argued that examination of the final adoption decision is not sufficient until the intervening processes--from awareness to final decision-making--are known.



A Model for Understanding Criteria for Making Decisions about Purchasing New Technologies[2]

Criteria for new technologies "purchase" decisions are depicted above. The model presents the contextual conditions that effect the formation and rank order of each criterion. The model also contains three cognitive processes that the buyer may use in choosing between different action alternatives. These three processes are: perception, preference, and intention to act. Glazen (1984) confirmed a cognitive interaction between the environment as it is perceived and the environment as it is acted upon with respect to product attributes and choice behavior. In this cognitive process buyers perceived environmental cues such as product information in order to differentiate among products, to assess the relative importance of each product, and to act upon purchasing the preferred product. Only environmental cues or product information that has been understood can influence buyers' criteria for choice (Engel, Blackwell, and Miniard, 1986; Engel, Warshaw, and Kinnear, 1987).

Perceived differences in the attributes of new technologies may lead to variation in the buyer's belief about their relative value. The agricultural technologies discussed in this present paper are discontinuous innovations as as defined by Robertson (1971). He suggested a continuum to classify innovations from continuous innovations (e.g. line extensions) to discontinuous innovations (e.g. new technologies). In assessing innovations, Rogers (1962, 1976, 1983) recommended a set of factors that include relative advantage, compatibility, trialability and observability. Robertson (1984) criticized these traditional set of variables because they may not apply uniformly for all innovations. A similar problem was suggested by Dickson (1982) due to variations in usage situations and their impact on individual preferences.

There are at least two ways of dealing with this issue in the diffusion context. First, one may specify an elaborated set of assessor factors as Robertson (1984) suggests. However, the five attributes suggested by Rogers have the advantage of being more robust across products; and this is important for theory development. Second, the five attributes (or some subset of them) may be used by considering an evaluation for the importance of each attribute by each person for each product. The evaluations are then used to weight the perceived importance of each product attribute. This approach was robust in two studies of new technological products (Scott, 1985; Scott et. al., 1987). Hassan (1984) demonstrated that an elaborated list of evaluative criteria was also effective in understanding the levels of perceived importance attached to new technology attributes.

The evaluative criteria used in this study (Table 1) were measured using a direct rating scale composed of eight items chosen from the literature to represent the factors associated with purchasing new agricultural technologies. The responses to each item were placed on a series of continuums reflecting respective degrees of importance for making evaluative decisions in a way similar to that used by Cohen, Fishbein, and Ahtola (1972).

Research Procedure

Since modern farm practices tend to place primary emphasis on improving farm operations and increasing productivity, farm operators will perceive and assess recommended farm technologies in terms of their importance to the achievement of these objectives. For example, a farm operator who is choosing among several types of farm machinery typically takes into account such considerations as the initial costs, extent of risk related to the entire farm operation, anticipated savings in time, reduction of farm operation, quick return on investment, and a variety of other issues that he/she anticipates will affect farm productivity (Hassan, 1984). Consequently, the farm operator's choice of agricultural technologies will be reflected in the importance of the criteria index to his/her farm operations. This criteria index measures farm operators' perceived importance of efficiency in operating contemporary agribusiness farms. Individuals who score highly on this criteria index are thought to

[2]This model was adopted with modification from Hassan (1984).

Table 1: Response Frequencies for Each Criterion Item as Ranked by Order of Importance

Scale Item	Possible Responses: Not Important 0	1	2	Somewhat Important 3	4	5	Very Important 6	7	8	No Response	Mean* $\bar{X}$	Standard* Deviation
1. Initial costs	6 (0.7)	5 (0.5)	6 (0.7)	14 (1.5)	56 (6.1)	61 (6.6)	171 (18.6)	119 (13.0)	444 (48.4)	36 (3.9)	6.80	1.57
2. Maintenance costs	9 (1.0)	5 (0.5)	12 (1.3)	21 (2.3)	55 (6.0)	92 (10.0)	205 (22.3)	152 (16.6)	330 (35.9)	37 (4.0)	6.48	1.66
3. Anticipated savings in time	6 (0.7)	5 (0.5)	11 (1.2)	28 (3.1)	70 (7.6)	95 (10.3)	205 (22.3)	153 (16.7)	300 (32.7)	45 (4.9)	6.38	1.65
4. Reduction in drudgery of farm operations	11 (1.2)	14 (1.5)	30 (3.3)	61 (6.6)	98 (10.7)	110 (12.0)	172 (18.7)	113 (12.3)	244 (26.6)	65 (7.1)	5.83	1.98
5. Extent of risk related to farm operation	18 (2.0)	18 (2.0)	31 (3.4)	61 (6.6)	83 (9.0)	132 (14.4)	178 (19.4)	101 (11.0)	227 (24.7)	69 (7.5)	5.71	2.04
6. Benefit to farm operations	19 (2.1)	16 (1.7)	25 (2.7)	70 (7.6)	96 (10.5)	140 (15.3)	198 (21.6)	104 (11.3)	184 (20.0)	66 (7.2)	5.57	1.98
7. Quick return on investment	26 (2.8)	14 (1.5)	40 (4.4)	47 (5.1)	104 (11.3)	146 (15.9)	168 (18.3)	84 (9.2)	196 (21.4)	93 (10.1)	5.51	2.08
8. Amount of reorganization of farming operations	34 (3.7)	17 (1.9)	44 (4.8)	64 (7.0)	114 (12.4)	174 (19.0)	157 (17.1)	97 (10.6)	142 (15.5)	75 (8.2)	5.20	2.09

*Mean and Standard Deviation were calculated with missing data equal to mean response for each item.

Note: Data presented as absolute frequencies and as Percentages in Parentheses (%) N = 918

place more emphasis on economic efficiency in making purchasing decisions. These farm operators should, therefore, perceive new technology favorably. Their favorable perception may come in part as a result of higher level of exposure to cues received from a variety of information sources, e.g., product ads in farm journals.

The data used in this present paper were collected as part of an extensive research project jointly sponsored by the Ohio Agricultural Research and Development Center, the Ohio Cooperative Extension Service, the National Institute for Farm Safety, and the Nationwide Insurance Company. The data were collected from study participants living in nine counties chosen at random from the extension districts in Ohio. A structured questionnaire was administered by trained interviewers. Ninety-five percent of the sample, (N=918), had actually completed an interview. There were no significant differences between the characteristics of the sample and the characteristics of the rural population of Ohio as found in the 1982 Ohio census.

The criteria index was operationalized by using a Likert-type scale. The scale measured the relative importance of efficiency factors in making decisions about purchasing new technologies. The reliability of the criteria index was assessed using the standardized item alpha. The standardized item alpha measures the internal consistency of multiple-item scales. The computation formula for the standardized item alpha is as follows:

$$\text{alpha (s)} = \frac{K\bar{r}}{1+(K-1)\bar{r}}$$

where K= the number of items in the scale

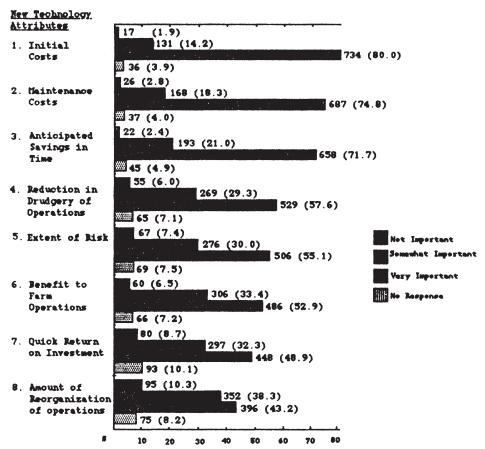
$\bar{r}$= the average correlation between items

The standardized item alpha for the criteria index is 0.83. This high coefficient (possible coefficients range from 0 to 1.0) indicates that the scale is very reliable and that the individual scale items can be used as a composite index.

Findings and Conclusions

Response frequencies and percentages for each of the assigned nine levels of perceived importance in evaluating new agricultural technology attributes are presented in Table 1. The nine levels of perceived importance (not important=0-1-2; somewhat important=3-4-5; very important=6-7-8) are then collapsed into the three major levels in order to summarize the data as shown in Table 2.

Table 2: Summary of Buyers' Perceived Importance In Evaluating New Technology Attributes



Note: Data presented as absolute frequencies and as Percentages in Parentheses (%) (N=918)

The rank ordering of the adoption criteria factors (see Table 2), according to their perceived importance, is informative since it provides insight into the weight the buyers place on each of the decision-making items. Each of the three top ranked items were perceived by seventy percent or more of the respondents to be very important. These criteria items, ranked by the order of their percentages, are (1) initial costs, (2) maintenance costs, and (3) anticipated savings in time. Approximately fifty-five percent of the respondents perceived each of the three other factors to be very important in making decisions about new farm technologies. These criteria factors in rank order are reduction in drudgery of farm operation, extent of risk related to entire farm operation, and benefit to farm operations. Quick return on investment and amount of reorganization of farming operations each were perceived to be very important by slightly less than forty-five percent of the respondents and were ranked seventh and eighth, respectively.

These finding suggest that initial costs, maintenance costs, and time saving are the most important factors in making decisions about purchasing new farm technologies. These high ratings for these three factors are not surprising since farmers know that most farm technology is very expensive and can be time saving. Quick return on investment was ranked lower than the other decision-making factors included in the index. Such rankings suggest that farm operators are concerned about the long-term return on investment in new technology.

The lower ranking of risk in the adoption of a new farm technology was expected because new agricultural technology nearly always is tested prior to its introduction by the manufacturer. This pretesting of new technologies often reduces the perceived risk. Therefore, farm operators may know what results to expect when the purchasing decision is made. Risk associated with purchasing was perceived to be at least somewhat important by a majority of farm operators.

Amount of reorganization of farming operations was ranked lowest in terms of its importance, even though it was perceived to be very important by a large minority and at least somewhat important by a majority of the respondents. This suggests that if the technology being considered for adoption satisfies the more highly ranked criteria factors as primary conditions, purchasing decisions will occur even if farming operations require some reorganization. It should be noted, however, that reorganization of farm operations was considered to be very important by a large minority of the respondents. This suggests that technologies which require significant reorganization of the farming enterprise will be more strongly resisted.

In essence, the findings indicate that farm operators evaluate farm technologies for purchasing in the context of their impact on the farm enterprise. Technologies that are reasonably priced, less costly to maintain, produce a savings in time, reduce drudgery in farm operations, bring more benefit to the entire farm operation, produce a quick return on the investment, and require little reorganization of the farming enterprise will be perceived more favorably than technologies that have other characteristics attached to them. The findings of this study indicate that farm operators when making decisions about the purchase of farm technologies typically take into account factors related to improving farm efficiency and increasing farm productivity. These objectives were measured by the adoption criteria index.

Implications

It was not the purpose of this paper to empirically utilize the criteria suggested in predicting adoption behavior. The purpose, however, was to demonstrate the existence of these criteria, its perceived importance, and its conceptual relevance to the decision process. The present paper has demonstrated that evaluative criteria can be used in future research as a tool to predict the pattern and timing of new technology adoption. However, as with macro studies of innovation diffusion that relied on personality variables to predict product adoption, an eclectic model is more predictive than a model composed only of product attributes or personality variables.

One's perception, preference, and intention are controlled in part by the cognitive, conative, and affective elements that impact on and result from the evaluation process. Because of this, evaluative criteria and their relative importance are modified by the person, product, and situation. Ongoing research has shown that an eclectic approach causing these elements is strongly predictive of adoption behavior (Brown, 1981; Hassan, 1984; Hassan, 1985; Hassan and Scott, 1987; Scott et. al., 1987). Further, research has also shown that the number of variables needed to predict adoption can be reduced with little loss of predictive power; providing those variables used in the model have been suggested by theory or by empirical testing for that category of products, a similar segment, and a similar situation.

In a broader context, these findings have implication for non-agricultural marketing managers as well. Because consumer behavior models are well developed, and have been applied to marketing action, it is likely that a marketing manager can create effective segmentation strategies based on an understanding of the criteria a given segment may use to evaluate his or her new products.

Summary

This present paper has demonstrated that people do use evaluative criteria in the decision process and that the relative importance assigned to those criteria are critical to the adoption of new technologies. Understanding those criteria, and their relative importance, provides in-

sight into the factors and objectives of decision making. Plotting the most important criteria for a given person (or segment), product, and situation and combining those criteria in parsimonious eclectic model will allow more accurate prediction of adoption patterns for new products. Evaluation of the criteria themselves will provide managerial insight into the wants and needs of consumers. That, in turn, may lead to the development and marketing of innovations to satisfy those wants and needs.

References

Ajzen, Icek and Martin Fishbein. 1980. Understanding Attitudes and Predicting Social Behavior. New Jersey: Prentice-Hall.

Bettman, James R. 1979. An Information Processing Theory of Consumer Choice. Massachusetts: Addison-Wesley.

Brown, L. A. 1981. Innovation Diffusion. New York: Methuen and Company.

Cohen, Joel B., Martin Fishbein and Olli T. Ahtola. 1972. "The Nature and Uses of Expectancy-Value Models in Consumer Attitude Research." Journal of Marketing Research Volume 9 (November) 456-460.

Dickson, Peter R. 1982. "Person-Situation: Segmentation Missing Link." Journal of Marketing Volume 46 (Fall) 56-64.

Engel, James F., Roger D. Blackwell, Paul W. Miniard. 1986. Consumer Behavior. New York: The Dryden Press, Fifth Edition.

Engel, James, Martin R. Warshaw and Thomas Kinnear. 1987. Promotional Strategy: Managing the Marketing Communications Process. Illinois: Irwin, Sixth Edition.

Gardner, Meryl Paula. 1983. "Advertising Effects on Attributes Recalled and Criteria Used for Brand Evaluations." Journal of Consumer Research Volume 10 (December) 310-318.

Gatignon, Hubert, Thomas S. Robertson. 1985. "A Propositional Inventory for New Diffusion Research." Journal of Consumer Research Volume 11 (4) 849-867.

Glazen, Rashi. 1984. "Multiattribute Perceptual Bias as Revealing of Preference Structure." Journal of Consumer Research Volume 11 (1) 510-521.

Hassan, Salah S. 1984. "Criteria for Making Decisions about Adoption of New Technologies: A Test of a Diffusion-Economic Constraint Model." Ph. D. dissertation. The Ohio State University. Columbus, Ohio.

Hassan, Salah S. and Dale N. Shook. 1986. "Diffusion of Consumer-Oriented Retailing Innovations Among Banks in a Developing Economy Context." Retailing: Theory and Practice for the Twenty-first Century, Special Conference Proceeding. The Academy of Marketing Science.

Hassan, Salah S. and Stanley V. Scott. 1987. "An Eclectic Model of Innovation Diffusion and Adoption Behavior." Working Paper. Department of Business, Skidmore College.

Miniard, Paul W. and Joel B. Cohen. 1983. "Modeling Personal and Normative Influences on Behavior." Journal of Consumer Research Volume 10 (September) 169-180.

Ostlund, Lyman E. 1974. "Perceived Innovation Attributes as Predictors of Innovativeness." Journal of Consumer Research Volume 1 (June) 23-29.

Robertson, Thomas. S. 1984. "Marketing's Potential Contribution to Consumer Behavior Research: The Case of Diffusion Theory." Advances in Consumer Research Volume XI. Utah: Association of Consumer Research.

_____1971. Innovation, Behavior and Communication. New York: Holt, Reinhart, Winston.

Rogers, Everett M. 1962. Diffusion of Innovations. New York: The Free Press.

Rogers, Everett M. and F. F. Shoemaker. 1971. Communication of Innovations: A Cross-Cultural Approach. New York: The Free Press, Second Edition.

Rogers, Everett M. 1983. Diffusion of Innovations. New York: The Free Press, Third Edition.

Scott, Stanley, R.Friend, K. Brobeck and V. Gehring. 1982. "Predicting the Adoption of A University Tech Center's Products." In Progress-Boise State University.

Scott, Stanley V. 1985. "A Microanalytic New Product Adoption Paradigm: A Disaggregation Evaluation of Individual Differences in the Adoption of Technological Products." Ph. D. dissertation. The Ohio State University. Columbus, Ohio.