Decision-maker Preference for Information Sources and Media

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Agricultural processes typically involve numerous decisions. These decisions often are complex, involving substantial interactions between decision variables and the physical and economic environment. Furthermore, long lags often occur between implementation of decisions and the marketing of production. These characteristics suggest that substantial utility improvements can be gained from accurate and relevant information provided to the decision maker in a timely fashion.

Many public and private sources provide information to agricultural firms. Yet, there is limited understanding of the extent to which these meet the needs of individual managers. Individuals differ in the way they collect and interpret information. This has implications for information demand.

The objective of this paper is to improve our understanding of farmers' preference for information. Farmers' evaluation of the usefulness of 23 information products are reported. Multinomial logit techniques are used to relate farmer and firm characteristics to preference for information communication method.

Information Usage

Understanding how information use varies with structural differences within the farming population has major implications for improving efficiency in information dissemination. Information technologies are changing at a rapid rate, altering the ability to measure and interpret data necessary for information development and to disseminate that information to those who can derive value from it.

Various types of information may be acquired by the farmer. One classification of information relates information to its origin (Mawby and Hower). This provides that information is either 1.) noncommunicative or 2.)

communicative. Noncommunicative information refers to information gathered without a personal verbal or written contact with another person. Communicative information refers to the transfer of data and information from a source to a receiver. Communicative information may be transferred by verbal, written or visual interaction between the supplier and the receiver.

Communicative information may be further divided by media of communication, including 1.) interpersonal (interactive-oral) communication, 2.) broadcast (noninteractive-oral), 3.) printed, and 4.) computer media. Interpersonal communication differs from the other forms in that it allows immediate interaction between supplier and receiver of information. Broadcast information implies visual/or audio effects on the receiver who cannot review the information unless it is recorded.

The Data Source

A questionnaire addressing information usage on farms was mailed to a stratified random sample of 1800 Ohio commercial farmers. An initial mailing and two follow-ups were used. Fifty-three percent of the questionnaires were returned. Of these, 730 farmers were actively farming and completed the instrument. An additional 227 returned incomplete surveys. These were primarily retired farmers or others who had exited farming.

Respondent age ranged from 21 to 83, with a mean of 49 years. Nearly 17 percent of the respondents were under 35 years of age. About 13 percent were 65 years or older. Seventy-six percent had formal educations of high school or less. Nearly four percent had post baccalaureate education levels. Nearly 30 percent worked part- or full-time off the farm.

The sample included two types of specialized producers. Grain producers are defined as those who produce at least 200 acres of cash grain crops and

have no dairy or other livestock enterprises. Dairy producers milk at least 20 cows and do not have other significant livestock enterprises. The remaining farmers, termed mixed, are not specialized in either dairy or grain, and often have other livestock enterprises of substantial size. About 31 percent of the respondents are classified as specialized dairy farmers, 40 percent as grain farmers and the remaining 30 percent as mixed enterprises.

Current Information Sources

The mailed questionnaire contained a number of questions designed to elicit the sources of information used in farm decision making. Twenty-three information source categories were identified. Reported in table 1 are the information source categories, the number of farmers using each source and a summary of farmers' evaluations of the usefulness of each source.

The information sources most frequently used by farmers include general farm magazines, local market reports, radio broadcasts, the Cooperative Extension Service, local newspapers, salesmen, and other farmers. Each of these sources were used by more than 90 percent of the respondents. On the other extreme, those information sources used relatively infrequently include computerized information services, brokerage firms, marketing consultants and national newspapers. These sources were used by less than half of the respondents.

Farmers were asked to rank the usefulness of each information sources as VERY USEFUL, USEFUL, NOT USEFUL, or DO NOT RECEIVE. Based on the usefulness rankings, a mean usefulness score was developed. Responses of VERY USEFUL, USEFUL, and NOT USEFUL were assigned weights of 2, 1, and 0, respectively. The weighted responses were then averaged, excluding those who responded that they "DO NOT RECEIVE" the information. Excluding DO NOT RECEIVE responses implies

that these farmers are not in a position to judge the usefulness of the information source. Although this inference may not be strictly true -- farmers may not use a particular information source because it costs more to obtain than it is worth -- including DO NOT RECEIVE responses would presume more than we currently know.

Table 1. Mean Usefulness Scores for Various Information Source Categories.

Information Source	Percent Receiving	Mean Usefulness Score
Specialized Farm Magazines	76.12	1.412
General Farm Magazines	95.80	1.309
Local Market Reports	93.48	1.277
Agricultural Newspapers	82.92	1.254
Veterinarian	72.35	1.186
Radio Reports	92.61	1.162
Cooperative Extension Service	90.01	1.146
Commercial Newsletters	53.69	1.037
Other Farmers	92.76	1.026
Salesmen	90.73	1.003
USDA and Government Publications	87.12	0.958
Accountant	67.72	0.942
Tax Preparer	78.87	0.941
Television Reports	86.54	0.921
Crop Reporting Service Reports	82.48	0.891
National Newspapers	41.24	0.856
Local Newspapers	92.32	0.829
Marketing Consultant Service	39.67	0.796
Computerized Information Services	31.69	0.751
Lender	73.80	0.749
Attorney	65.99	0.532
Brokerage Firm	37.62	0.453
Insurance Agent	77.27	0.393

Table 1 lists the information sources sorted by descending mean useful score. The first ten sources listed all have usefulness scores greater than

one, indicating the mean response is centered between USEFUL and VERY USEFUL. Information source categories earning the least favorable evaluations are marketing consultant services, computerized information services, lenders, attorneys, brokerage firms, and insurance agents. These all received evaluations with means between USEFUL and NOT USEFUL. These low evaluations resulted even though usefulness scores were computed excluding farmers who DO NOT RECEIVE these sources.

The top ranked information source categories are dominated by printed communication forms issued only periodically (weekly, monthly or less often). On the other hand, the six lowest ranking sources are typically more specialized sources, most involve interpersonal communication with the possibility for more timely access to information.

The Multinomial Logit Model

In this section, multivariate statistical techniques are used to address the question of "what farmer or firm characteristics influence the demand for information source communication method?". The dependent variable represents alternative communication forms. Because this dependent variable is categorical, a qualitative choice model is required.

Three frequently used specifications for analyzing qualitative dependent variables are the linear probability model, the probit model and the logit model (Capps and Kramer; Pindyck and Rubinfeld). Capps and Kramer have shown that maximum likelihood (OLS) estimation of the linear probability model can provide estimates quite similar to the maximum likelihood estimation of the probit and logit models. However, estimates from the linear probability model are generally biased, inefficient, and inconsistent with a unit prediction range. Both the probit and logit models can be specified to overcome these

statistical problems. Although there is little empirical basis for discriminating between the logit and probit models, the theoretical foundation of the logit model is more applicable to econometric theory (Capps and Kramer). Furthermore, the multinomial probit model involves probability expressions that are multiple integrals of the multivariate normal density (Aldrich and Nelson). Thus, the multinomial probit model is computationally impractical. The multinomial logit model, which is identified with the logistic distribution function, was used in these analyses. Maximum likelihood procedures are employed in the estimation.

The Dependent Variable

Four forms of information communication are indentified: 1) Inter-personal, 2) broadcast, 3) printed, and 4) computer. The 23 information sources listed in the survey (table 1) were placed into one of these four categories (table 2). For instance, INTER-PERSONAL communication includes all information sources which allow two-way oral communication. BROADCAST describes radio and television broadcasts. PRINTED media includes all magazines, newspapers and other publications. Computerized sources were unique as an information source presented by COMPUTER media.

The dependent variable employed in the multinomial logit analysis is based on the information communication classification (table 2) and the results of the usefulness evaluations reported in table 1. The classification process is completed for each farmer's response as follows:

1. The mean usefulness score is calculated for the information sources included in each of the four information communication categories.[1]

[1] All sources with DO NOT RECEIVE/USE responses were excluded from the computation of the mean usefulness scores.

2. The farmer is assigned to the information communication class for which his average usefulness score is largest. For instance, if a farmer's average evaluation for radio and television broadcasts are higher than for any other classification, he is classified as preferring BROADCAST information sources.[2]

Following this procedure, each farmer is uniqely identified as preferring one communication form as determined by the strength of his evaluation for the sources in that category.

Table 2. Categorization of Information Sources by Communication Method.

Inter-Personal	Broadcast	Printed	Computer
Salesmen	Television Reports	Local Newspapers	Computerized Info Serv
Lender	Radio Reports	Cooperative Ext Serv	
Veterinarian		General Farm Magazines	
Marketing Consultant		National Newspapers	
Tax Preparer		Commercial Newsletters	
Brokerage Firm		Local Market Reports	
Attorney		USDA and Government Pubs	
Insurance Agent		Agricultural Newspapers	
Accountant		Crop Reporting Service	
Other Farmers		Specialized Farm Mags	

[2] Farmers with ties among communication categories were excluded from the analysis.

The multinomial logit model was specified as follows:

$$\ln \frac{P_i}{P_j} = B_{0ij} + B_{1ij}\,\text{SALES} + B_{2ij}\,\text{AGE} + B_{3ij}\,\text{EDUCATE} + B_{4ij}\,\text{OWNER} + B_{5ij}\,\text{PTIME} + B_{6ij}\,\text{COMPUTER} + B_{7ij}\,\text{RECORDS} + B_{8ij}\,\text{TENANCY} + B_{9ij}\,\text{GRAIN} + B_{10ij}\,\text{DAIRY}$$

Where subscript i = ith class of the qualitative dependent variable
subscript j = jth class of the qualitative dependent variable
$\ln (P_i / P_j)$ = Natural logarithm of the probability of a class i relative to the probability of a class j
SALES = gross farm sales (thousands of dollars)
AGE = age measured in years
EDUCATE = education level (0 if high school, 1 if college)
PTIME = off-farm work (0 if full-time farmer, 1 otherwise)
OWNER = number of owners (0 if single owner, 1 otherwise)
COMPUTER = computer used in management (1 if yes, 0 if no)
RECORDS = records use in management (1 if yes, 0 if no)
TENANCY = proportion of total land controlled by lease
DAIRY = dairy farm (1 if dairy farm, 0 otherwise).
GRAIN = grain farm (1 if dairy farm, 0 otherwise).

Model Results

Farm size, measured in gross sales (thousands of dollars), is a significant determinant of communication method preference for two of the six estimated functions (table 3). Larger farms are less likely to prefer PRINTED communication forms to BROADCAST communication sources. Larger farms, however, have a higher probability of being in the COMPUTER preference category than prefering PRINTED information sources. Larger farms are expected to have greater economic returns from timely, relevant and accurate information. Because the number of units of production is greater, the gains from improved information are simply multiplied by a larger output factor. Computerized information services may improve timeliness of information, or allow the

manager to do more detailed analysis of the decision. Larger farms may also be associated with innovators managers who are more innovative.

TABLE 3. Maximum Likelihood Estimates of Log Probabilities of Factors Associated with Demand for Information Communication Form.

	$\ln(P_2/P_1)$[a]		$\ln(P_3/P_1)$[a]		$\ln(P_4/P_1)$[a]		$\ln(P_3/P_2)$[a]		$\ln(P_4/P_2)$[a]		$\ln(P_4/P_3)$[a]	
	B	t	B	t	B	t	B	t	B	t	B	t
CONSTANT	1.4521	1.48	1.1416	1.20	-3.6842	-2.27 **	-0.3105	-0.44	-5.1363	-3.42 ***	-4.8258	-3.28 ***
SALES	0.0005	0.49	-0.0011	-0.97	0.0015	1.28	-0.0017	-1.88 *	0.0010	1.09	0.0027	2.57 **
AGE	-0.0030	-0.19	0.0016	0.10	0.0216	0.89	0.0046	0.40	0.0246	1.12	0.0200	0.93
EDUCATE	-0.4410	-1.01	0.3062	0.77	-0.0863	-0.14	0.7472	2.30 **	0.3547	0.64	-0.3925	-0.74
PTIME	-0.2885	-0.74	-0.5175	-1.37	-0.3945	-0.65	-0.2290	-0.78	-0.1060	-0.19	0.1230	0.22
OWNER	0.0379	0.10	0.2699	0.76	0.2426	0.45	0.2320	0.86	0.2047	0.41	-0.0273	-0.06
COMPUTER	-0.4056	-0.79	0.3696	0.81	1.3149	2.11 **	0.7751	2.04 **	1.7205	3.07 ***	0.9454	1.81 *
RECORDS	-0.2146	-0.59	0.0139	0.04	0.9005	1.37	0.2285	0.86	1.1151	1.82 *	0.8866	1.46
TENANCY	-0.2964	-0.79	-0.2070	-0.58	0.9558	1.52	0.0894	0.33	1.2522	2.15 **	1.1628	2.04 **
GRAIN	0.1724	0.42	0.1815	0.45	0.3372	0.58	0.0091	0.03	0.1648	0.32	0.1556	0.31
DAIRY	-0.4102	-0.86	0.3743	0.86	-0.9886	-1.12	0.7845	2.26 **	-0.5784	-0.68	-1.3629	-1.67 *
Model Chi-square[b]			60.040 ***									
Pseudo R-Square			0.148									
Change in Probabilities[c]												
SALES	0.00013		-0.00027		0.00024		-0.00039		0.00010		0.00019	
AGE	-0.00073		0.00039		0.00330		0.00107		0.00233		0.00145	
EDUCATE	-0.10657		0.07517		-0.01317		0.17444		0.03360		-0.02837	
PTIME	-0.06971		-0.12705		-0.06018		-0.05347		-0.01004		0.00889	
OWNER	0.00916		0.06627		0.03701		0.05417		0.01939		-0.00197	
COMPUTER	-0.09801		0.09073		0.20060		0.18097		0.16296		0.06834	
RECORDS	-0.05187		0.00341		0.13737		0.05335		0.10562		0.06409	
TENANCY	-0.07162		-0.05083		0.14582		0.02086		0.11860		0.08406	
GRAIN	0.04166		0.04457		0.05144		0.00214		0.01561		0.01125	
DAIRY	-0.09912		0.09190		-0.15081		0.18315		-0.05479		-0.09852	

* One, two and three asterisks indicate statistical significance at the 0.1, 0.05 and 0.01 levels of probability, repectively.

a. Group 1 = Inter-personal, 2 = Broadcast, 3 = Printed, 4 = Computer.

b. A measure of goodness of fit, restricted to lie between zero and one. This measure does not incorporate an adjustment for the number of degrees of freedom. (Aldrich and Nelson, pg 57)

c. This is the derivative of the function with respect to the named independent variable evaluated with all other variables at their mean. (Maddala, pg 23).

Age was expected to influence preference for information communication method. Older farmers were hypothesized to have lower demands for computerized information sources relative to the other three categories. The were also hypothesized to have greater preference for the more informal information sources of BROADCAST and INTER-PERSONAL communication. However,

age was not statistically significant in any of the equations. This suggests that age alone is not an important determinant of communication method preference.

Education also was hypothesized to influence preference for information communication method. Greater education, it was hypothesized, would make the decision maker more aware of the wide array of alternative information sources and the ways in which information may be used to improve decision making. Furthermore, increased education was hypothesized to increase the likelihood of preferring COMPUTERized information services. Increased education often is associated with the willingness to adopt new technologies, and more highly educated farmers are more likely to have the prequisite knowledge required to make use of computers. Education, however, was a significant explanatory variable only for the function comparing PRINTED to BROADCAST sources -- preference for PRINTED increased with education.

Two variables were incorporated to express the respondent's role in the business. Part-time farmers (PTIME = 1) and businesses with multiple owners/managers (OWNER=1) were expected to have differing information needs, and thus differing preferences for communication method than their full time and single owner counterparts. However, neither variable was significant.

TENANCY measures the proportion of the farm's total land base that is controlled by lease. Increased tenancy, particularly share leasing of land, increases the demands on the farm's information system. Landlords have vested interests in the outcome of production and marketing decisions, and are likely to require more careful decision processes of their tenants. Tenancy was a statistically significant explanatory variable in two of the equations. Increased tenancy was associated with higher probabilities of prefering

COMPUTER based information systems as compared to BROADCAST and PRINTED sources.

RECORDS is a binary variable which indicates whether or not the farmer uses financial records for firm level profitability analyses. Good internal records likely are substitutes for specific external information sources. Furthermore, the use of internal records for analysis of business profitability and decision making is probably strongly correllated with management skill. Farmers who indicated that financial RECORDS were used for firm profitiabilty analysis had siginificantly greater probability of preference for COMPUTER based information sources than for BROADCAST sources.

Respondents who indicated that computers are used in the management of the business are denoted with binary variable (COMPUTER = 1). Computer users were hypothesized to have different information needs than those managers who do not employ computers. Computer-using managers were hypothesized to prefer both COMPUTER-based and PRINTED sources relative to BROADCAST and INTER-PERSONAL sources. Results of the logit analysis largely support these hypotheses. Computer using managers preferred COMPUTER-based sources to all other information communication categories. They also preferred PRINTED sources to BROADCAST sources.

Because enterprise type was expected to influence the firms' information needs, binary variables were included to identify dairy and cash grain operators. Mixed livestock producers are represented in the constant term. GRAIN was not statistically significant, but DAIRY was significant for two of the six equations. Dairy farmers indicated a preference for PRINTED information relative to both BROADCASTs and COMPUTER-based sources.

Summary

Statistical analyses of farmer responses indicated substantial differences in use of 23 information sources and in their evaluations of the usefulness of these sources. Farmers tended to prefer sources that were more general in the scope of topics addressed. They also gave lower evaluations to sources that were conveyed by inter-personal communication methods.

Multinomial Logit analyses were used to determine factors associated with preference for four communication methods: inter-personal, broadcast, printed and computer-based media. Increased farm size (sales), increased tenancy, the use of financial records in business decisions and the use of computers in management all increased the probability of preferring computer-based information sources. Level of education, use of computers in management and dairy as the primary enterprise are associated with preference for printed information sources relative to broadcast information sources.

These results suggest that information providers, whether public or commercial, may need to target their audiences carefully if their products are to be successful. Information source attributes are likely to be important determinants of demand. Farmer and firm characteristics are potentially may be useful for product targeting.

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