ASSOCIATION FOR COMMUNICATION EXCELLENCE

Journal of Applied Communications

Volume 76 | Issue 2 Article 6

Impact Of Communication And Innovation Variables On Adoption Of Sustainable Agricultural Practices

Adewale J. Alonge

Robert A. Martin

Recommended Citation

Alonge, Adewale J. and Martin, Robert A. (1992) "Impact Of Communication And Innovation Variables On Adoption Of Sustainable Agricultural Practices," *Journal of Applied Communications*: Vol. 76: Iss. 2. https://doi.org/10.4148/1051-0834.1466

Impact Of Communication And Innovation Variables On Adoption Of Sustainable Agricultural Practices

Abstract
Groundwater non-point source contamination with agricultural chemicals from conventional high-input agriculture has become one of the major environmental concerns of the 1990s.

Impact Of Communication And Innovation Variables On Adoption Of Sustainable Agricultural Practices

Adewale J. Alonge
Robert A. Martin

Groundwater non-point source contamination with agricultural chemicals from conventional high-input agriculture has become one of the major environmental concerns of the 1990s. A mailed questionnaire was used to collect data from selected Iowa young farmers regarding the sources from which they obtain information about low-input sustainable agricultural practices, and how they perceive these practices in terms of their compatibility, complexity, and profitability. Mass media sources were identified as the most frequent and useful sources of LISA information, while government agencies such as the Cooperative Extension Service was perceived as not doing enough to provide necessary information. Farmers' perceptions of innovations' compatibility and access to information were the best predictors of LISA's adoption.

Introduction

The negative consequences of conventional high-input agriculture on groundwater quality has emerged during the decades of the 1980s and 1990s as one of the most dominant environmental concerns of government and the general public. For instance, sample analysis of wells from fourteen counties in Iowa between 1978-81 revealed that 40 percent exceeded the Environmental Protection Agency's (EPA's) recommended maximum contaminant level of 10 mg. per liter for nitrogen, while over 20 percent of water samples in 47 other counties exceeded this level (Hallberg, 1986). Groundwater contamination with agricultural pesticides has also been recorded in 23 states, with California, New York and Iowa recording the highest levels of contamination (Cohen et al., 1986). It is already estimated that 25 percent of Iowa's population was already exposed to detectable levels of chemicals such as nitrate and pesticide residues through the drink-

Adewale J. Alonge is from Nigeria and serves as a Graduate Research Assistant at Iowa State University. **Robert A. Martin**, an ACE member, is an Associate Professor in the Department of Agricultural Education & Studies at Iowa State University.

ing water (Kelley et al., 1986). In order to mitigate these and other negative consequences of conventional high-input agriculture, farmers are being persuaded to shift to low input sustainable agricultural practices (LISA). Buttel, et al. (1981), defined sustainable agriculture as farming systems in which the application of external inputs such as fertilizer and herbicides is reduced to environmentally-sustainable levels.

There is, however, general concern in agricultural development circles that while farmers seem to have a better awareness of the negative consequences of conventional agriculture, the transition to sustainable agriculture has been slow to occur (Green and Heffernan, 1987). This concern, coupled with emerging research findings on the adoption of conservation technologies have led to the general debate concerning the applicability of traditional diffusion model to environmental technologies. For instance, Swanson et al. (1986), Pampel and es Van (1977), and Jones (1973) have all reported research findings which showed that traditional social and economic variables commonly included in the classical model were poor predictors of the adoption of environmental practices. They, therefore, concluded that variables other than those of the classical diffusion model might be more appropriate for explaining the diffusion of conservation technologies. Swanson et al. (1986), and Napier et al. (1984) concluded from their studies that information and educational programs, the core of the diffusion perspective, are ineffective futile means of inducing adoption of conservation technologies. This conclusion has implications for the role of agricultural extension education in promoting farmers adoption of sustainable agricultural practices.

However, on the other side of the debate are researchers such as Nowak and Korsching (1983), Heffernan and Green (1981), and Taylor and Miller (1978), who hold the view that the traditional diffusion model is still applicable to conservation technologies. They argue that farmers must be aware of the need for the technology, be able to obtain valid agronomic and economic information to evaluate potential consequences, and receive assistance in transferring the technology to their unique ecological and managerial and social conditions. They observed that many farmers rejecting conservation technologies lack the necessary information and assistance needed to evaluate the economic and agronomic dimensions of the recommended practices.

Statement of Problem and Purpose

The main purpose of the study, therefore, was to test the relevance of information variables to the adoption of selected low-input sustainable agricultural practices by young farmers in Iowa. Specifically, the study set to:

1. identify the sources from which young Iowa farmers obtain information about sustainable agricultural practices.
2. to analyze their perceptions regarding the quality of these information sources.
3. to identify their perceptions regarding the profitability, complexity and compatibility of sustainable practices and
4. to analyze the importance of communication, demographic and innovation perceptions variables in predicting the adoption of sustainable practices.

http://newprairiepress.org/jac/vol76/iss2/6
DOI: 10.4148/1051-0834.1466

Methodology

The study adopted a descriptive survey design. The study was undergirded by a conceptual model which included relevant elements of Ervin's General Decision-Making Model (Ervin, 1982, p.72) and the Nowak-Korsching (1983) Behavioral Model for the adoption of Best Management Practices. The model conceptualized the LISA adoption-decision process as being influenced by farmers' access to information, the quality of the information; their environmental attitude; their perceptions of the relative advantage of LISA practices and their socioeconomic and demographic characteristics. The population for the study was made up of the members of the Iowa Young Farmers' Educational Association, Inc. The association consists of young farmers and farm couples usually between the ages of 18 and 40 who organize and participate in educational, leadership, recreational and community development activities in cooperation with agricultural educators in different parts of Iowa. According to Omer (1987) the membership of the association constituted, in 1986, about 5 percent of all the farmers in Iowa between the ages of 18 and 40.

A data base containing a list of 545 young farmers was accessed for sample selection. A sample of 150 farmers was generated using an Apple random number computer program. A self-administered fixed-response mail questionnaire was the instrument used for data collection. Respondents were expected to rate the degree to which they were well informed about nine widely recommended Best Management Practices for reducing nitrogen and herbicide application rates. These practices included: soil nitrogen testing, banded application of herbicides, crop rotation, reduced herbicide and nitrogen fertilizer rates, taking credits for manure in determining nitrogen input, use of nitrification inhibitor, mechanical weeding and spring/summer application of nitrogen. Re-

Table 1: Percent distribution of respondents according to the frequency of contacts with information sources.

Agencies	Never	Very few	Few	Frequent	Very Frequent	Mean SD
Mass Media e.g., (Farm Magazines)	0.9	1.8	14.2	38.9	44.2	4.239 0.827
Ag. Chemical	4.4	7.1	15.9	38.9	33.6	3.903 1.085
Cooperative Ext.Service	7.1	17.0	37.5	26.8	11.6	3.188 1.078
Soil Conservation Service	13.4	31.3	33.0	16.1	6.3	2.705 1.088
Iowa Experiment Station	23.9	19.5	38.1	15.0	3.5	2.549 1.118
Soil Conservation District	32.1	34.8	18.8	10.7	3.6	2.188 1.110
Iowa Dept of Natural Resources	54.0	32.7	10.6	1.8	0.9	1.628 0.815
Iowa Environmental Protection Agency	70.8	20.4	7.1	0.9	0.9	1.407 0.740

spondents were requested to indicate the sources from which they obtained information about these sustainable agricultural practices, their perceptions regarding the compatibility, complexity and profitability of these practices within their farming systems, and to what extent they had adopted them. Instrument validation was done by three professors selected from the departments of sociology and agricultural education and studies, and by an area extension crop specialist with working and research experience in sustainable agriculture. In addition, graduate students in the Iowa State University Department of Agricultural Education and Studies helped in the pretesting of the questionnaire. A Post-Hoc reliability test was conducted resulting in a reliability coefficient of 0.97.

A total of three mailings including two follow-ups, resulted in a total of 115 usable questionnaires representing a total response rate of 76.7 percent. No statistically significant difference was discovered in the response pattern of early and late respondents. Data analysis was carried out with the Statistical Package for Social Science (SPSS). Descriptive and inferential statistical treatments such as multiple regression and Pearson correlation were applied to the data.

Results and Conclusions

The data in Table 1 present the frequencies with which farmers had come in contact with various sources of information about sustainable agriculture. An analysis of the data in the table reveals that the mass media and agricultural chemical dealers each with 83.1 percent and 72.5 percent of respondents, respectively, got the highest rating as the most frequent sources from which farmers obtain information about sustainable agriculture. When contrasted with government agencies, such as the Iowa Cooperative Extension Service which was rated by only 38.4 percent of respondents as being

Table 2: Percent distribution of respondents according to their perceptions of quality of institutional sources of information

Agencies	Of no use	Little use	Barely useful	Useful	Very useful	Mean SD
Iowa Environmental Protection Agency	42.7	32.0	16.5	7.8	1.0	1.922 0.997
Iowa Dept. of Natural Resources	36.5	30.8	25.0	7.7	0.0	2.038 0.965
Soil Conservation District	26.2	19.6	30.8	16.8	6.5	2.579 1.229
Soil Conservation Service	12.6	20.7	33.3	21.6	11.7	2.991 1.187
Iowa Experiment Station	13.1	8.4	28.0	33.6	16.8	3.327 1.235
Coop. Ext. Service	8.9	8.0	24.1	42.0	17.0	3.500 1.139
Ag. Chemical Dealers	6.2	6.2	23.0	32.7	31.9	3.779 1.147
Mass Media e.g., (Farm Magazines)	1.8	2.7	21.4	50.0	24.1	3.920 0.850

http://newprairiepress.org/jac/vol76/iss2/6
DOI: 10.4148/1051-0834.1466

a frequent source of sustainable agriculture information, or the Soil Conservation Service, the Iowa Experiment Station, the Department of Natural Resources, and the Iowa Experiment Station, each with only 22.4 percent, 18.5 percent, 3.7 percent, and 1.8 percent of respondents, respectively; it becomes obvious that these agencies are not doing enough to promote sustainable agriculture.

The data in Table 2 regarding farmers' perceptions of the relevance of the different information sources, followed the same pattern as those in Table 1. Information emanating from mass media sources and agricultural chemical dealers with 74.1 percent and 64.6 percent of respondents, respectively, were rated by the respondents as the most useful sources of information available to them. This compares with the Cooperative Extension Service and the Iowa Experiment Station with 59 percent and 50.4 percent respectively. Information from the Soil Conservation Services and Districts were rated as either useful or very useful by only 33.3 percent and 23.3 percent of respondents, respectively, while only 8.7 percent and 7.7 percent of the respondents, respectively, rated the information from the Iowa Environmental Protection Agency and the Department of Natural Resources as either useful or very useful in helping them to make a decision about adopting sustainable agricultural practices.

The respondents were also asked to indicate how adequately informed they were about the selected Best Management Practices. The data in Table 3 present the summary of farmers' responses to the question. Many of the respondents indicated that they were fairly well informed about the practices. For instance 77.2 percent, 71.1 percent, 66.7 percent and

Table 3: Percent distribution of respondents according to their perceptions of the adequacy of innovation information about selected sustainable agriculture.

	No Info	Very Little	Little Info	Adequate Info	Very Adequate	Mean SD
Nitrification inhibitor	7.9	12.3	33.3	36.0	10.5	3.289 1.070
Banding of of herbicide	6.1	12.3	30.7	31.6	19.3	3.456 1.122
Lower Herbicide rates	5.3	12.3	30.7	32.5	19.3	3.482 1.099
Reduced Nitrogen Fertilizer rates	4.4	12.3	26.3	38.6	18.4	3.544 1.065
Crop Rotation	3.5	14.0	26.3	35.1	21.1	3.561 1.081
Soil N Testing	4.4	12.3	21.1	36.8	25.4	3.667 1.118
Credits for manure	4.4	8.8	20.2	38.6	28.1	3.772 1.089
Mechanical Weeding	2.6	7.9	18.4	43.9	27.2	3.851 0.998
Spring/summer application of N	3.5	5.3	14.0	44.7	32.5	3.974 1.000

62.2 percent of respondents, respectively, indicated they were either adequately or very adequately informed about spring/summer application of nitrogen fertilizer, mechanical weed control, taking credit for manure and soil nitrogen testing. The percentages of respondents who indicated similar opinions about the other practices ranged from 57.0 percent for reduced nitrogen fertilizer application; crop rotation (56.2 percent); reduced herbicide rates (51.8 percent); banded herbicide application (50.9 percent) to 46.5 percent for the use of nitrification inhibitor. It is, however, instructive to note that over 40 percent of the respondents indicated not having adequate information about five of the nine selected practices.

In order to identify important variables predictive of farmers' adoption of the selected practices, multiple regression and Pearson correlation statistical analyses were conducted. Using a step-wise procedure, a multiple regression model was specified using the following as the independent variables: farmers' perceptions regarding the profitability, compatibility and complexity of the selected practices; the adequacy of innovation information; frequency of contacts, and perceptions of the quality of different sources of information; environmental attitude (perception of the severity of groundwater contamination); and farmers demographic and farm firm characteristics. The dependent variable was the composite adoption index, defined as the proportion of the selected practices that was adopted by the respondents. The results of the regression and Pearson correlation coefficient analyses are presented in Tables 4 and 5.

The data in Table 4 show that only two variables, namely, farmers' perceptions of the compatibility of the selected practices with their farming systems and the adequacy of innovation information, were the best predictors at the 0.05 confidence interval. The two variables accounted for 25.6 percent of the variance in farmers' adoption of the selected practices. While the model does not explain a lot of the variables accounting for differential adoption, it does point out the importance of farmers' perception and information variables in the adoption of sustainable agriculture. Similarly, the results of the Pearson correlation coefficient analysis as presented in Table 5 reveal that only those variables dealing with farmer perceptions of innovation characteristics, the adequacy of innovation information available to them, and their contact with institutional sources of information showed significant correlation coefficients

Table 4: Multiple Regression analysis to predict the adoption of selected LISA practices.

Predictor Variables	Multiple R	Cumulative % Variance explained	Std. Error
Perception of innovations' compatibility	.454	20.58	.382***
Level of innovation information	.506	25.6	.236*

*P=.05
***P=.001

http://newprairiepress.org/jac/vol76/iss2/6
DOI: 10.4148/1051-0834.1466

with composite adoption index at the 0.05 level of significance. Demographic and farm firm characteristics of respondents were not significant at the 0.05 confidence interval.

The study arrived at the following conclusions:

1. Mass media sources and agricultural chemical dealers, more than government institutions such as the Cooperative Extension Service are perceived by the farmers to be the most frequent and useful sources of information about sustainable agriculture. While the importance of mass media sources in creating innovation awareness cannot be overestimated, it is nonetheless important that formal agencies such as the Cooperative Extension Service intensify their effort to provide farmers with specific agronomic and economic information which are critical at the latter and more crucial stages of their adoption-decision process.
2. While the results of this study did not provide a clear-cut answer regarding the relevance of classical diffusion variables to the adoption of sustainable agricultural innovations, it nonetheless, reaffirmed the critical role of communication variables in the adoption-decision process. Because the possibility exists that the failure of demographic and farm firm variables to predict adoption sustainable practices may well have been due to the homogeneity of the study's population; future studies with a more heterogeneous population are recommended.
3. The research findings revealed that farmers' perceptions of the compatibility of sustainable practices with their farming system was the most important predictor of the level of innovation adoption. This implication of this finding is that the pro-innovation bias of the classical diffusion model, as reflected in the failure to include farmers' perceptions of innovation in past adoption studies (Rogers, 1983), may be inappropriate for the study of the adoption of sustainable agricultural practices.

Implications for Agricultural and Extension Education

The perceptions by farmers that government agencies such as the Cooperative Extension Service, the Experiment Station and the Soil Conservation Services were not doing enough to provide adequate information about sustainable agriculture has implications for agricultural and extension education. It calls for the need by the agencies to intensify their educational and research efforts in order to provide farmers with relevant information that will ease their transition from high-input agriculture to more sustainable agricultural practices. This issue becomes critical when it is realized that similar findings regarding the weaknesses of these agencies had been reported by the United States Department of Agriculture as early as 1980. In the study, the USDA (1980) reported that at least 25 percent of the farmers interested in the low-input agriculture considered the university research centers and the Cooperative Extension Services either unwilling or unable to provide them with help. It would appear that almost 12 years after this observation was made, the situation has not changed considerably. While the important role of the mass media in creating more positive environmental attitudes among farmers is not in doubt, it is not a substitute for the one-on-one contact that is necessary to convince farmers to make the

transition to sustainable practices. This is where the role of government agencies such as the Cooperative Extension Service becomes indispensable.

The finding of the study regarding the significant positive relationship between farmers' adoption of sustainable agriculture and their perceptions of adequacy of innovation information and institutional contacts has several research implications. It throws some light on the on-going debate in the innovation-adoption literature regarding the relevance of the classical communication model to the adoption of sustainable agriculture (Nowak and Korsching, 1983; Lovejoy and Parent, 1982; Heffernan and Green, 1981; Taylor and Miller, 1978; Pampel and es Van, 1977). The findings of this study seem to support the findings of Nowak and Korsching (1983), Taylor and Miller (1978), Lasley and Nolan (1981), Belknap and Saupe (1988) who reported the relevance of communication variables to the adoption of sustainable agricultural practices. It is, however, instructive to note the failure of demographic and farm firm variables usually included in the classical diffusion model, to show any statistically significant relationship with farmers' adoption of sustainable practices. On the other hand, farmers' perceptions regarding the compatibility, complexity and profitability of sustainable agriculture showed significant relationship with adoption. Hence, the shaping of perceptions may constitute a pivotal issue in the promotion of sustainable agriculture in the future. This is a major educational and programmatic challenge to the Cooperative Extension Service.

Finally, the low predictive power of the research model indicates that a large gap still exists in our understanding of the important variables influencing farmers' adoption of sustainable agriculture. This situation calls for the development of more comprehensive and holistic research models to overcome this knowledge gap. This study suggests that the following variables may be very important for inclusion in a future innovation-adoption model for sustainable agriculture:

1. **Farmers' environmental attitude:** This factor could be operationalized by quantifying farmers' perceptions of the environmental consequences of conventional agricultural practices.
2. **Communication Variables:** These variables could include such issues as access to sustainable agriculture information and farmers' perceptions of the relevance of available information.
3. **Farmers' perceptions of sustainable practices:** The assumption in the classical diffusion paradigm that innovations are value-free is not tenable as far as sustainable practices are concerned, hence LISA adoption-decision model should include variables dealing with farmers perceptions of the appropriateness of LISA practices to their farming systems realities and goals.
4. Finally, traditional diffusion variables dealing with **farmers' social, demographic and farm firm characteristics** should be included.

References

Belknap John and William E. Saupe. (1988). Farm family resources and the adoption of no-plow tillage in southwestern Wisconsin. *North Central Journal of Agricultural Economics, 10* (1): 13-23.

DOI: 10.4148/1051-0834.1466

Buttel, F., G. Gillespie, O. Larson and C. Harris. (1981). The social bases of agrarian environmentalism : A comparative study of Michigan and New York farm Operators. *Rural Sociology*, 46(3):391-410.

Cohen, C. Z., C. Eiden and M. N. Lorber. (1986). Monitoring groundwater for pesticides contamination of groundwater from agricultural uses. In R.F. Krueger and J. N. Seiber (eds.), *Treatment and disposal of pesticide wastes* (pp. 297-325). Washington, D. C.:American Chem. Society.

Green, P. Gary and William D. Heffernan. (1987). Soil Erosion and perception of the problem. *Journal of Rural Studies* 3 (Nov.): 151-157.

Hallberg, R. George. (1986). Agricultural chemicals in ground water: Extent and implications. *American Journal of Alternative Agriculture*, 2(1): 3-15.

Heffernan, W., and G. Green. (1981). Applicability of the adoption-diffusion model to resource conservation: the pro-position. Paper presented at the annual Meetings of the Rural Sociological Society, San Francisco.

Jones, Guy. (1973). Review of communication of innovation. *Rural Sociology*, 33 (Spring): 71-75.

Kelley, R. , G. Hallberg, L. Johnson, R. Libra, C. Thompson, R. Splinter, and M. DeTroy. (1986). Pesticides in groundwater in Iowa. In agricultural impacts on groundwater. Worthington, Ohio: Natural Well Association.

Lasley, P. and M. Nolan. (1981). Landowner attitudes towards soil and water conservation in the List Muddy Creek project. Columbia, Mo.:University of Missouri, Department of Rural Sociology.

Lovejoy, S. and D. Parent. (1982). Conservation behavior: A look at the explanatory power of the traditional adoption-diffusion model. Paper presented at the annual meeting of the Rural Sociological Society, San Francisco.

Napier, T. L., Thraen, C. S., Gore, A. and Goe, W. R. (1984). Factors affecting adoption of conventional and conservation tillage practices in Ohio. *Journal of Soil and Water Conservation*, 39: 205-209.

Nowak, P. and P. Korsching. (1983). Social and institutional factors affecting the adoption and maintenance of agricultural BMPs. In F. Schaller and G. Bailey (eds.), *Agricultural management and water quality*. Iowa State University Press, Ames, Iowa.

Omer, Mahmoud Hassan. (1987). Analysis of selected factors associated with participation of Iowa young farmers in agricultural extension programs. Unpublished doctoral dissertation, Iowa State University, Ames, Iowa.

Pampel, F. and van Es, J.C. (1977). Environmental quality and issues of adoption research. *Rural Sociology*, 42(Spring): 57-71.

Rogers, Everett M. (1983). *Diffusion of innovations*. New York: Free Press.

Swanson, L., S. Camboni, and T. Napier. (1986). Barriers to adoption of soil conservation practices on farms. In S. Lovejoy and T. Napier(eds.). *Conserving soils: insights from socioeconomic research*. Ankeny, Iowa: Soil Conservation Society of America.

Taylor, D., and W. Miller. (1978). The adoption process and environmental innovations: A case study of a government project. *Rural Sociology*, 43(3): 634-648.

U.S.D.A . (1980). Report and recommendations on organic farming. Prepared by USDA study team, July 1980. Washington, D. C.: Government Printing Office.