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Diffusion-Adoption of Personal Computers and the Internet in Farm Business Decisions: Southeastern Beef and Peanut Farmers

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Diffusion-Adoption of Personal Computers and the Internet in Farm Business Decisions: Southeastern Beef and Peanut Farmers

Abstract

A survey was conducted during 1998 among two targeted segments of southeastern agriculture producers to evaluate questions about the effect of PC and Internet technology on farm operators' business activities and agriculture decision making. Beef cattle producers in Alabama (320) and peanut producers (327) in Alabama, Georgia, and Florida were sampled. 647 questionnaires were mailed. The questionnaire was completed and returned by 241 farmers. The Diffusion-Adoption Model was employed to characterize farmers by stage in the technology adoption process. Farmers who use the Internet were examined for their frequency and nature of Internet use when making farm business decisions.

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Introduction

Extension workers constantly encounter and are well aware of the impacts that technological innovations have on individuals, families, and communities across rural America. A major technology invading the clientele of Extension professionals today is the personal computer (PC) and the Internet (WWW, World Wide Web). U.S. farmers have been besieged by a wave of innovations associated with these technologies. Major shifts are underway in the way information

is accessed by farmers, including a diversification of channels through which farm operators receive information (OTA, 1987).

Rosenberg (1999) predicted that 90% of U.S. households would have access to the Internet by 2005. However, many rural areas will experience a "digital divide" caused by the lack of facilitating infrastructure such as high-speed communication lines (U.S. Department of Commerce, 1995). Whereas 42% of all U.S. households were making use of the Internet in 1995, only 39% of rural households had gained Internet access by the end of the decade (U.S. Department of Commerce, 2000). Although Internet and information technologies are becoming more accessible to rural households, still there is a considerable gap between rural and urban areas.

Information transfer through evolving PC and Internet technologies is enhancing agricultural marketing strategies and improving possibilities for farm profitability (Lasley, Padgitt, & Hanson, 2001). By the end of the 20th Century, information technology was already playing a significant and expanding role in agricultural commerce. One estimate suggests that the Internet generated more than \$524 billion in revenue during 1998, with E-commerce accounting for \$171 billion of this amount (University of Texas Center for Research in Electronic Commerce, 1999).

The PC and Internet are pressing farmers into the Third Wave era (Toffler, 1989) of the technology revolution in agriculture. Expanded application and use of Internet technology by farmers provides valuable information to assist with making farm business decisions (Ferreira, 1999).

Today a growing number of farm operators are adopting the PC for its farm business applications, as well as for researching product markets and obtaining marketing services. The Computer Age has lowered the cost of obtaining, producing, and delivering information while increasing the quantity and rate at which information flows (Paarlberg & Paarlberg, 2000).

The purpose of the analysis discussed here is to apply the diffusion-adoption model to the use of PC and Internet technologies by farm operators and to determine the extent of their integration into farm business decision-making. The diffusion-adoption model offers a logical progression of five sequential stages for the adoption of the PC and Internet by farmers. Relevant criteria for progressing from one stage to another with this information technology are sought. Once the stages are identified, they are applied to the actual adoption experience of farm operators in order to classify them by current adoption stage. Subsequent analysis attempts to identify relevant farm business and operator characteristics associated with farmers at each adoption stage.

Extension Service and Diffusion-Adoption of Information Technology

Appropriate participation of the Cooperative Extension Service in the adoption-diffusion process for the PC and Internet by farm operators is a debated issue (Risdon, 1994). Traditionally, Extension has provided farm operators with timely information about a wide variety of farm management and business technologies to assist them in maintaining profitable and sustainable production. A primary goal of Extension is the dissemination of research information produced by land-grant universities to potential users, particularly farmers.

O'Neil (1999) contends that Extension has a professional duty to develop in-house PC and Internet expertise and to foster awareness of how this technology can be used by its farm clients. According to Bamka (2000), Extension professionals need to teach farm operators how Internet technologies can be used as an on-line business resource. Moreover, they have an important role in assisting farmers to interpret information retrieved from the Internet and to apply that information to their farm operations (Lesley, Padgitt, & Hanson, 2001). However, Samson (1998) cautions that Extension personnel must recognize the barriers that exist in many rural areas hindering farm operators' use of Internet information technology in their farm business.

Currently, the role of Extension is somewhat in flux and clouded by uncertainty as to how to meet the challenges of this new wave of information technology. Commercial entrepreneurs have entered the communication technology arena and raised questions about the kinds and amounts of the technology assistance appropriate to the Extension mission. The Cooperative Extension Service is in the process of realigning its programs related to this technology.

For information technology, as with most new ideas and procedures, there is a decision process that potential adopters undergo. This change process includes a progression consisting of five stages from first awareness of something new to its acceptance and regular use (Rogers, 1983). These stages are characterized as:

- Knowledge,
- Persuasion,
- Decision,
- Implementation, and
- Confirmation.

Potential adopters must pass through a mental and behavioral process of gaining knowledge and implementing change as they proceed along the path to assimilation of a new technology into their everyday practice. For the PC and Internet, the process involves working out how this technology can be applied to farm business management and decision-making tasks.

Extension, both at the state and county levels, has been and remains one of the most notable and successful agents for assisting farmers with knowledge and technology adoption (Fliegel, 2001; Eveland, 1986). Extension agents have an educational mandate to assist farmers through the entire adoption process. However, the Extension role is particularly acute among farmers "left behind" in a rapidly changing communication technology environment (Ryan & Gross, 1943; Beale & Rogers, 1960). To realize this responsibility, current diffusion-adoption progress in PC and Internet use by Extension clientele must be determined.

For this task Rogers (1995) assigned descriptive names to the five stages of the diffusion-adoption continuum. From least to most advanced these are:

- Non-adopter,
- Late majority,
- Early majority,
- Early adopter, and
- Innovator.

This article attempts to classify farm operators into their current stage in the information technology adoption process and to describe the farm and farm operator characteristics associated with each adoption stage.

Procedures

In the research on current PC and Internet use in the farm business reported here, a target population of local farm leaders in two distinct agricultural production areas, beef cattle and peanuts, was selected for study. Each production enterprise represents an independent population. Because the PC and Internet are rather recent technologies, we assumed that farm leaders are most likely to be aware of and knowledgeable about these technologies and their potentials for their farm business than other farmers.

The Alabama Cattlemen's Association was asked for and provided a statewide list of 320 beef producers who served as officers in their county associations. A different strategy was used to identify leaders among peanut producers. For this population, leading peanut producing counties in southeast Alabama, northwest Florida, and southwest Georgia were identified. County Cooperative Extension Service personnel in each county were contacted and asked to identify up to 10 local farm leaders who produced peanuts. This provided a sample of 113 producers from 11 southeast Alabama counties, 29 from 8 north Florida counties, and 185 from 37 southwest Georgia counties.

A mail survey was conducted among the 647 farm leaders comprising the two combined samples. Completed and usable questionnaires were received from 241 farmers, for a response rate of 37%. Response rates were similar for beef producers and peanut producers.

To address the first study objective, we identified a logical progression or sequence of distinct information technology behaviors and decision points consistent with the adoption-diffusion process. These were used to classify our sample of 241 beef and peanut producers into five adoption stages based on their current PC and Internet access and application of this technology to their farm business.

For the second objective, we described the characteristics of farm operators at each adoption stage. Descriptive variables selected for this analysis included farm operator characteristics of age and education, as well as the farm business characteristics of production type (beef or peanut), farm size (acres owned), farmland rented (in or out), and percent of household income from farming.

Non-adopters are farm operators without access to a PC. Farmers who have access to and use a PC but do not have access to the Internet comprised the late majority. The early majority adopters are those farmers who have access to a PC and to the Internet but do not use the Internet in their farm business. Operators currently using the Internet to search for farm business information are early adopters, while innovators are operators who use the Internet for business applications such as purchasing supplies and marketing farm products.

Findings

The completed and returned questionnaires from our sample of farm leaders revealed that 25% were non-adopters who had no access to a PC at home or work (Table 1). Another 22% were at the late majority stage with access to and use of a PC but no Internet connection. The smallest percentage of farmers (11%) were in the early majority stage, where they had Internet capability available but did not use this technology for their farm business.

Early adopters are the more progressive farmers who use the Internet for accessing agricultural information to aid in managing their farm business. These operators represented 29% of these farm leaders and the largest segment in the diffusion-adoption chain. Because the study focused on farm leaders, this proportion seems consistent with the progressive but cautious demeanor typical of early adopters. Innovators, who act more independently of their peers in their farm business activities, account for only 13% of these farm leaders

1-399	9.7	5.8	0	11.6	6.5	7.8	
400 and Over	0	1.9	0	1.45	3.2	1.2	
(N)	(62)	(52)	(27)	(69)	(31)	(241)	6.6
Percent of Income from Farm							
0	16.3	9.6	22.2	11.6	6.5	12.6	
1-50	43.5	40.4	33.3	27.5	41.9	36.9	
51-100	40.3	50.0	44.4	60.9	51.9	50.2	
(N)	(62)	(52)	(27)	(69)	(31)	(241)	9.7
p<.05; **p<.01							

Type of farm production was the only farm characteristic found to differ significantly across adoption stages among the selected farm factors considered. It was expected that beef (livestock) and peanut (crop) production would involve distinct production needs and business management practices that would distinguish among stages. Such a difference was found in the adoption of information technology by beef and peanut producers, but there was no pattern to the differences across diffusion-adoption stages. Other farm characteristics, including size of farm, defined in terms of acres owned, farmland rented in and rented out, and the amount of income received from farming yielded no significant differences among farmers at the various adoption stages.

Because age appears highly related to education, we then controlled on age to obtain a more accurate understanding of the relationship between our other descriptive characteristics and stage in the adoption process. With age controlled at three levels, education no longer differed significantly across diffusion-adoption stages, while farm production type is significant only among middle-age farm operators. Farm leaders 45 to 55 years of age who produce beef are represented more in the extreme stages of either non-adopters or innovators.

For this sample of peanut and beef producers, age appears as the dominant factor in PC and Internet adoption for the farm business. One explanation for the primacy of age might be the perceptions older individuals, including farmers, have of this technology. We speculate that because both the PC and Internet require learning new skills and changing behavioral practices, many older persons may perceive this technology as threatening and perhaps mysterious.

Also, education among these farm leaders is closely associated with age. As such it plays only a supporting role in determining PC and Internet adoption. When we controlled for age, education is no longer significant, and the link with age becomes clear. PC and Internet adoption is not directly related to farm leaders' education but more closely linked to having younger people in the household who provide exposure to the technology and some of its uses.

Our final objective was to investigate the Internet use by the farm operator and spouse within the household. For this analysis, only the 109 early adopter and innovator households who were currently using the Internet for the farm business were considered. Internet use by spouses is widespread and extensive within farm households with Internet access. Spouses in more than half (57%) of these farm households with Internet access reported using the Internet weekly or daily. The percentages were 28% daily and 29% weekly. A farm operator who is the only Internet user accounts for fewer than one-third of these households. No information was obtained on the type of information spouses sought on the Internet.

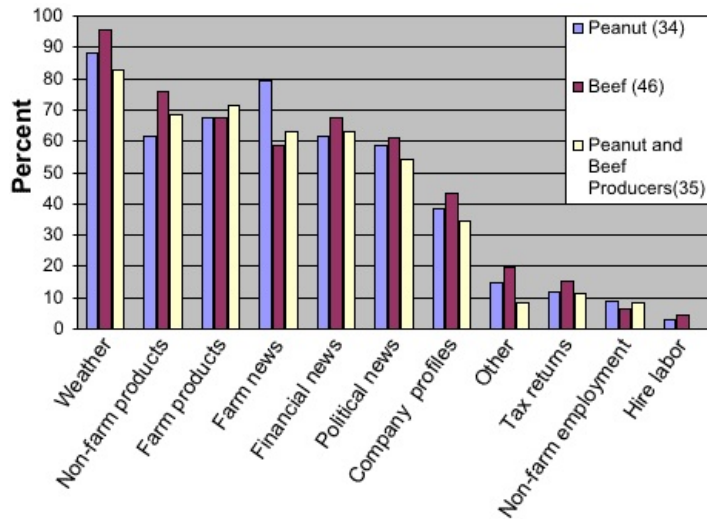
The types of information sought by farm operators on the Internet focused only on that associated with the farm business and the amount of time associated with this farm business related use. We found that a majority of both peanut and beef producers use the Internet from 1 to 5 hours a week to obtain farm information. Although beef producers appear to be more rapid adopters of information technology than peanut farmers, a larger portion of them report using the Internet less than 1 hour a week. Conversely, fewer peanut farmers use the Internet for their farm business, but those who do utilize the technology make more frequent use of it than do beef producers. None of these producers reported using the Internet over 20 hours a week.

Figure 1 describes the kinds of information farm producers obtain from the Internet for use in their farm business. Over half of those who use the Internet search for information on weather, non-farm and farm products, and agricultural finance and political news. The Internet is used less to obtain information on company profiles, taxes, non-farm employment, farm labor, or topics other

than those listed.

Figure 1.

Kinds of Information Sought on the Internet by Southeastern Peanut and Beef Producers, 1998



Weather information was cited most by all farm producers. Beef producers search on-line for information pertaining to non-farm products more often than for farm products, and farm news is sought more often than economic or political news. In contrast, peanut producers indicated farm news is the primary Internet topic they search for on-line. The Internet is seldom used by either group for seeking information on non-farm employment and hiring of farm labor.

Although age is the primary factor in determining adoption of the PC and Internet by farm operators, once the technology is adopted, age seems to play a minor role in determining the amount of usage or the type of information sought on-line. The only topics that age significantly affects are the search for information regarding farm and non-farm products. Younger farm operators make more use of the Internet to search for non-farm and farm products than do operators 45 years and older.

Conclusion

Current technology estimates suggest that more American farmers are connecting to the Internet and searching for farm-related business and non-farm information. Our findings confirm that PC and Internet usage has become a component of many farm operators' business management tools. Certainly, farm business information retrieval is used by a sizable number of southeastern leaders among peanut and beef cattle producers. Over half the survey participants reported having Internet access, and almost 40% use the Internet to search for information pertaining to their farm business.

With a benchmark for PC and Internet adoption established, future research can proceed to examine whether the information gained on-line is proving to be an asset in agribusiness decision-making. Further research and Extension efforts must define the benefits from information technology and how the technology can be enhanced to assist farmers in making decisions for their farm business. For Extension programming, the task is to adjust and tailor activities and programs to articulate with these external information networks. In many ways, the role of Extension agents is becoming a more difficult one to navigate.

It should be remembered that the farmers surveyed in this study are recognized farm leaders in their commodity production area. They are not representative of the many operators of small farms who make up a sizeable proportion of southeastern farms. There is a large segment of the farm population that has not yet adopted the PC and an even larger segment that is not connected to the Internet. One reason is a lack of infrastructure availability in many rural areas that prohibits Internet access. Because such limitations remain for many small farm households, the use of the Internet for retrieving farm business information has not replaced the need for traditional sources of information.

For now and the immediate future, Extension professionals must maintain traditional communication channels to small farmers in order to ensure that Internet non-adopters and late majority adopters continue to have access to emerging farm information. Simultaneously, Extension should encourage and direct farm operators to explore the potential advantages of the PC and Internet for obtaining farm information and for managing their farm business.

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