

## **RELATIONSHIPS BETWEEN THE PERCEIVED CHARACTERISTICS OF E-EXTENSION AND BARRIERS TO ITS ADOPTION**

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### *Abstract*

*In 2006, Cooperative Extension launched an online information source known as eXtension. Perceptions of eXtension's characteristics, and potential barriers to adoption, are likely to influence an extension agent's decision to adopt eXtension. An online survey instrument was used to collect information related to the adoption of eXtension by Texas Cooperative Extension county extension agents. The primary variables for the study were: (a) relative advantage, (b) compatibility, (c) complexity, (d) trialability, (e) observability, (f) concerns about time, (g) concerns about incentives, (h) financial concerns, (i) planning issues, and (j) technology concerns. Low, negative relationships were found to exist between perceptions of relative advantage and concerns about time, as well as perceptions of compatibility and planning issues. Financial concerns had a low, negative relationship with relative advantage, compatibility, complexity, and trialability. Adequate planning can increase the likelihood that an innovation will be adopted rapidly, but financial concerns must be thoroughly addressed. Reducing or eliminating the barriers related to the perceived characteristics of eXtension would be expected to increase agents' rate of adoption.*

## **Introduction**

In 2002, a Cooperative State Research, Education, and Extension Service (CSREES) white paper warned, “The capacity of the Extension System to change is swiftly eroding through decreasing human resources and decreasing financial capital” (Crosby et al., Problem/Need section, ¶ 2). CSREES is not the only entity to have expressed its concern with the current state of Cooperative Extension; it has been observed that “cultural and technological changes are quickly outpacing the traditional Extension delivery model” (Accenture, 2003, p. 5). Budgetary concerns plague Extension programs across the country, as they have for years (McDowell, 2004). Extension’s funding woes have created unmet needs in many communities and threatened the collaborative nature of the system by forcing partners into direct competition with each other to receive federal dollars (Payne, 2004). The unstable financial situation highlights the need for Extension to move beyond the status quo and embrace innovative methods of educational outreach.

An online information resource known as eXtension (pronounced e-extension, [www.extension.org](http://www.extension.org)) was developed by the Cooperative Extension System as an innovative solution to address some of Extension’s challenges. eXtension was described as “a national Internet-based information and education network that provides public access to land-grant university (LGU) expertise” (McCarthy & Hutchinson, 2004, The Opportunity section, ¶1). It is hoped that eXtension will (a) reduce the duplication of efforts between states, (b) produce profits, (c) increase visibility, and (d) increase customer satisfaction (Accenture, 2003). These benefits are unlikely to be realized without the adoption of eXtension by county-level Cooperative Extension agents and educators (Accenture, 2003). An investigation of the factors affecting agents’ adoption of eXtension would be considered prudent for planning the successful implementation of eXtension.

## **Theoretical Framework**

The theoretical framework for this study was developed from Rogers’ (2003) theory of the diffusion of innovations. According to Rogers, an innovation is “an idea, practice, or object that is perceived as new by an individual” (2003, p. 12). When an individual first learns of an innovation, he/she has entered into the first stage of the innovation-decision process. Rogers defined the innovation-decision process as

the process through which an individual ... passes from first knowledge of an innovation, to the formation of an attitude toward the innovation, to a decision to adopt or reject, to implementation and use of the new idea, and to confirmation of this decision (2003, p. 20).

The speed with which individuals pass through the innovation-decision process is partially dependent upon the individuals’ view of an innovation’s characteristics. Rogers (2003) described five such characteristics: (a) relative advantage, (b) compatibility, (c) complexity, (d) trialability, and (e) observability. Relative advantage is “the degree to which an innovation is perceived as better than the idea it supersedes” (Rogers, 2003, p. 15). Perceptions of relative advantage are largely subjective, but are often linked to social prestige factors and convenience. Compatibility is “the degree to which an innovation is perceived as being consistent with the existing values,

past experiences, and needs of potential adopters” (Rogers, 2003, p. 15). Innovations which appear to be compatible with an individual’s social system are more rapidly adopted. Complexity is “the degree to which an innovation is perceived as difficult to understand and use” (Rogers, 2003, p. 16). As would be expected, innovations that are easy to use tend to have the fastest rates of adoption. Trialability is “the degree to which an innovation may be experimented with on a limited basis” (Rogers, 2003, p. 16). Experimenting with an innovation on a trial basis reduces the uncertainty individuals often have and increases the rate of adoption. Finally, observability is “the degree to which the results of an innovation are visible to others” (Rogers, 2003, p. 16). Observable innovations instigate discussion amongst peers, thereby increasing the rate of adoption.

Researchers have often framed their research in terms of the barriers to adoption; that is, those factors which are thought to negatively impact an individual’s perceptions of an innovation (Berge, Muilenburg, & Van Haneghan, 2002; Berge, 1998; Curbelo-Ruiz, 2000; Haber, 2006; Kuck, 2006; Maguire, 2005; Murphrey & Dooley, 2000; Murphy & Terry, 1998; Nelson & Thompson, 2005; Porter, 2004; Roberts & Dyer, 2005). However, few studies have focused exclusively upon the relationship between an individual’s perceptions of the characteristics of an innovation and perceptions of barriers to the adoption of that innovation. One such study investigated Web-based distance education, a close cousin to eXtension. Li (2004) examined the relationships between faculty perceptions of Web-based distance education and the barriers to that innovation. Relative advantage, compatibility, complexity, and trialability were related to one or more perceived barriers. Li concluded the elimination of perceived barriers would positively, and significantly, influence faculty perceptions of Web-based distance education. Schifter (2000) concurred with Li, noting that participant adoption increases when barriers and inhibitors are eliminated. Likewise, the identification of similar relationships with regard to eXtension may provide an understanding of how to expedite its adoption.

### **Purpose and Objectives**

The findings presented in this article were part of a larger study undertaken to understand the influence of selected factors on the adoption of eXtension by Texas Cooperative Extension county extension agents (Harder, 2007). The section of the study presented here was correlational in nature. The objective was to describe relationships between agents’ perceptions of eXtension based upon Rogers’ (2003) characteristics of an innovation, and their perceptions of potential barriers to the adoption of eXtension.

### **Procedures**

The target population was Texas Cooperative Extension county extension agents employed in 2007. According to the Texas Cooperative Extension office, there were 533 county agents (K. A. Bryan, personal communication, February 12, 2007). Cochran’s (1977) formula was used to determine the sample size ( $n = 237$ ) for the study. County extension agents were randomly selected to participate (Gall, Gall, & Borg, 2007).

An online questionnaire was used to collect data. The original instrument was developed by Li (2004) to examine the diffusion of distance education at the China Agricultural University. Li’s

original instrument was modified by the researchers to fit the context of eXtension, based upon constructs adopted from Li (2004), Rogers (2003), and related studies from the literature. It was then converted to an online format.

The instrument was reviewed for content validity by a panel of experts composed of faculty members in the Department of Agricultural Education, Leadership, and Communications at Texas A&M University and the national marketing director of eXtension. A pilot study was conducted to test face validity and establish reliability.

The instrument contained four sections. The second and third sections were related to the objectives reported here. The second section asked participants to rate their agreement with 28 statements related to their perceptions of eXtension, based upon a six-point Likert-type scale (1 = *Strongly Disagree*, 2 = *Disagree*, 3 = *Somewhat Disagree*, 4 = *Somewhat Agree*, 5 = *Agree*, 6 = *Strongly Agree*). The scale was interpreted as follows: *Strongly Disagree* = 1.00 – 1.50, *Disagree* = 1.51 – 2.50, *Somewhat Disagree* = 2.51 – 3.50, *Somewhat Agree* = 3.51 – 4.50, *Agree* = 4.51 – 5.50, *Strongly Agree* = 5.51 – 6.00. Rogers' (2003) characteristics of an innovation were used to categorize the statements into constructs as follows: (a) relative advantage, (b) compatibility, (c) observability, (d) trialability, and (e) complexity. The third section asked participants to rate their agreement with 31 statements related to their perceptions of potential barriers to eXtension, using the same Likert-type scale as the second section. The statements were clustered into five constructs: (a) concerns about time, (b) concerns about incentives, (c) financial concerns, (d) planning issues, and (e) technology concerns.

The reliability of the instrument was tested by calculating Cronbach's alpha coefficient for each internal scale (Cronbach, 1951). A reliability level of .80 or higher was considered acceptable (Gall, Gall, & Borg, 2007). Reliability levels for the internal scales are presented in Table 1.

Table 1  
*Reliability Levels of Internal Scales*

Internal Scale	$\alpha$ Levels
Relative Advantage	.887
Compatibility	.873
Complexity	.860
Trialability	.952
Observability	.881 <sup>a</sup>
Concerns about time	.890
Concerns about incentives	.924
Financial concerns	.909
Planning issues	.921
Technology concerns	.883

*Note:* Reliability levels  $\geq$  .80 were considered acceptable.

<sup>a</sup>Original  $\alpha$  level was .758; one item was deleted.

Data were collected online according to Dillman's (2000) tailored design method. Of the original 237 E-mail addresses, 236 were valid. A final response rate of 66.90% ( $n = 158$ ) was obtained. Eight participants opted out. There were 25 responses removed due to missing or incomplete data, reducing the number of usable responses to 125.

Non-response error was controlled by comparing early and late respondents on the primary variables of interest. Results may be generalized to the target population when no significant differences exist between early and late respondents (Lindner, Murphy, & Briers, 2001). There were no significant differences between early and late respondents for the majority of the primary variables of interest, with the exception of observability. Findings related to observability are limited to the sample due to the significant difference between early and late respondents.

Demographic data was collected from the participants as a part of the larger study (Harder, 2007). The majority of respondents had primary responsibilities in the areas of agriculture ( $n = 45$ ), family and consumer sciences ( $n = 39$ ), and 4-H/youth development ( $n = 26$ ). There were fewer agents in the areas of horticulture ( $n = 8$ ) and natural resources ( $n = 3$ ). No respondents reported community development as a primary agent role. All of the respondents had obtained a minimum of a bachelor's degree. Most (84.8%) of the agents were at least thirty years of age. Of the respondents who reported gender, 46% were female and 51% were male.

Relationships between perceptions of eXtension and potential barriers were described by calculating Pearson's product-moment correlation coefficient using Davis' (1971) convention.

## **Findings**

The objective was to describe the relationships between perceptions of eXtension and potential barriers to the diffusion of eXtension. Agents' perceptions of eXtension were described according to (a) relative advantage, (b) compatibility, (c) observability, (d) complexity, and (e) trialability. Potential barriers to the adoption of eXtension were analyzed according to (a) concerns about time, (b) concerns about incentives, (c) financial concerns, (d) planning issues, and (e) technology concerns. The means and standard deviations for the primary variables are presented in Table 2, so that the findings which follow may be interpreted in context (Harder & Lindner, in press).

Table 2  
*Descriptive Statistics for the Primary Variables*

Variable	<i>M</i>	<i>SD</i>
Complexity	4.48	.77
Compatibility	4.35	.87
Concerns about time	4.12	.87
Trialability	4.11	.88
Concerns about incentives	3.90	1.00
Planning issues	3.84	.93
Financial concerns	3.77	1.01
Relative advantage	3.75	.82
Technology concerns	3.66	.97
Observability	2.85	.98

*Note.* Scale: 1 = *Strongly Disagree*, 2 = *Disagree*, 3 = *Somewhat Disagree*, 4 = *Somewhat Agree*, 5 = *Agree*, 6 = *Strongly Agree*.

### ***Relative Advantage***

The correlations between respondents' perceptions of relative advantage and the potential barriers to the diffusion of eXtension are presented in Table 3. A significant, low negative relationship existed between perceptions of concerns about time and perceptions of relative advantage,  $r(125) = -.21, p < .05$ . A significant, low negative relationship existed between perceptions of financial concerns and perceptions of relative advantage,  $r(125) = -.20, p < .05$ . No other significant relationships existed.

Table 3  
*Correlations between Perceptions of Potential Barriers to eXtension and Relative Advantage*

Potential Barrier	Relative Advantage		
	<i>r</i>	<i>p</i>	Magnitude
Concerns about time	-.21*	.02	Low
Concerns about incentives	-.10	.29	
Financial concerns	-.20*	.03	Low
Planning issues	-.16	.08	
Technology concerns	-.06	.53	

*Note.* Magnitude:  $.01 \geq r \geq .09$  = Negligible,  $.10 \geq r \geq .29$  = Low,  $.30 \geq r \geq .49$  = Moderate,  $.50 \geq r \geq .69$  = Substantial,  $r \geq .70$  = Very Strong.

\* $p < .05$ .

### ***Compatibility***

The correlations between respondents' perceptions of compatibility and the potential barriers to the diffusion of eXtension are presented in Table 4. A significant, low negative relationship existed between perceptions of financial concerns and perceptions of compatibility,  $r(125) = -.20, p < .05$ . A significant, low negative relationship existed between perceptions of planning issues and perceptions of compatibility,  $r(125) = -.23, p < .05$ . No other significant relationships existed.

Table 4

*Correlations between Perceptions of Potential Barriers to eXtension and Compatibility*

Potential Barrier	Compatibility		
	<i>r</i>	<i>p</i>	Magnitude
Concerns about time	-.10	.25	
Concerns about incentives	-.05	.55	
Financial concerns	-.20*	.02	Low
Planning issues	-.23*	.01	Low
Technology concerns	-.08	.36	

*Note.* Magnitude:  $.01 \geq r \geq .09$  = Negligible,  $.10 \geq r \geq .29$  = Low,  $.30 \geq r \geq .49$  = Moderate,  $.50 \geq r \geq .69$  = Substantial,  $r \geq .70$  = Very Strong.

\* $p < .05$ .

**Observability**

The correlations between respondents' perceptions of observability and the potential barriers to the diffusion of eXtension are presented in Table 5. There were no significant relationships between potential barriers to the diffusion of eXtension and observability.

Table 5

*Correlations between Perceptions of Potential Barriers to eXtension and Observability*

Potential Barrier	Observability		
	<i>r</i>	<i>p</i>	Magnitude
Concerns about time	-.01	.90	
Concerns about incentives	-.15	.11	
Financial concerns	-.10	.39	
Planning issues	-.03	.75	
Technology concerns	-.14	.12	

**Complexity**

The correlations between respondents' perceptions of complexity and the potential barriers to the diffusion of eXtension are presented in Table 6. A significant, low negative relationship existed between perceptions of financial concerns and perceptions of complexity,  $r(125) = -.25, p < .01$ . No other significant relationships were found.

Table 6

*Correlations between Perceptions of Potential Barriers to eXtension and Complexity*

Potential Barrier	Complexity		
	<i>r</i>	<i>p</i>	Magnitude
Concerns about time	-.16	.08	
Concerns about incentives	.08	.40	
Financial concerns	-.25**	.01	Low
Planning issues	-.08	.38	
Technology concerns	-.15	.10	

*Note.* Magnitude:  $.01 \geq r \geq .09$  = Negligible,  $.10 \geq r \geq .29$  = Low,  $.30 \geq r \geq .49$  = Moderate,  $.50 \geq r \geq .69$  = Substantial,  $r \geq .70$  = Very Strong.

\*\* $p < .01$ .

### ***Trialability***

The correlations between respondents' perceptions of trialability and the potential barriers to the diffusion of eXtension are presented in Table 7. A significant, low negative relationship existed between perceptions of financial concerns and perceptions of trialability,  $r(125) = -.21$ ,  $p < .05$ . No other significant relationships were found.

Table 7

*Correlations between Perceptions of Potential Barriers to eXtension and Trialability*

Potential Barrier	Trialability		
	<i>r</i>	<i>p</i>	Magnitude
Concerns about time	-.15	.09	
Concerns about incentives	-.14	.12	
Financial concerns	-.21*	.02	Low
Planning issues	-.12	.20	
Technology concerns	-.06	.53	

*Note.* Magnitude:  $.01 \geq r \geq .09$  = Negligible,  $.10 \geq r \geq .29$  = Low,  $.30 \geq r \geq .49$  = Moderate,  $.50 \geq r \geq .69$  = Substantial,  $r \geq .70$  = Very Strong.

\* $p < .05$ .

## **Conclusions**

The objective was to describe the relationships between perceptions of eXtension (relative advantage, compatibility, observability, complexity, and trialability) and potential barriers (concerns about time, concerns about incentives, financial concerns, planning issues, and technology concerns) to the diffusion of eXtension. There were no significant relationships between perceptions of observability and any potential barrier. This was consistent with Li's (2004) conclusion that perceptions of observability were not related to how faculty perceived potential barriers to Web-based distance education.

Concerns about time negatively affected how agents perceived relative advantage. This was not consistent with Li (2004), who concluded the perceived relative advantage of Web-based distance education was negatively related to planning issues. However, planning issues were

negatively related to how agents perceived eXtension's compatibility. Li found planning issues to be related to the perceived compatibility of Web-based distance education.

Financial concerns were most often related to perceptions of eXtension. Relative advantage, compatibility, complexity, and trialability were negatively affected by financial concerns. Only the relationship between complexity and financial concerns was supported by Li (2004).

### **Implications**

It is important to note this study did not attempt to establish whether increasing eXtension's rate of adoption is a desirable outcome for Cooperative Extension agents. However, this assumption has been made for the purposes of framing discussion. Certainly this important question should be addressed prior to acting upon the implications and recommendations presented here.

Understanding the relationships between agents' perceptions of eXtension and potential barriers provides valuable information which may be used to effectively target resources allocated to promoting the adoption of eXtension. While decreasing or eliminating *any* of the five barriers identified in this study would be expected to positively increase perceptions of eXtension (Schifter, 2000), the results of this study indicated a particular need to address financial concerns. Financial concerns were related to perceptions of four out of five of the characteristics of eXtension. Decreasing or eliminating financial concerns would be expected to have the most significant impact on improving perceptions of eXtension and its rate of adoption.

As mentioned previously, the findings for this objective differed from Li's (2004) findings in several ways. Rogers' (2003) description of the diffusion process—an innovation diffuses through a *social system* over time—provides an explanation for the differences between the two studies. Although eXtension and Web-based distance education are similar innovations, the social systems associated with Chinese faculty members and Texas Cooperative Extension county agents are vastly different. Some discrepancies in perceptions were to be expected. Diffusion research must focus not only on the innovation itself, but the social system within which the diffusion is expected to occur.

There was consistency between the two studies with regard to the lack of a relationship between observability and any of the perceived barriers despite the differences in social systems. The nature of the online innovations studied may account for the common findings. Rogers (2003) noted that software components of innovations are difficult to observe and are associated with slower rates of adoption. Both Web-based distance education and eXtension qualify as software components and do not lend themselves towards establishing the same type of observability that might be associated with a more visible innovation, such as a hybrid car.

The results of this study supported Li's (2004) conclusion that planning issues were negatively related to perceptions of compatibility. Planning issues, in the context of this study, included opportunities to learn about the innovation, how the innovation fit the vision of the organization, and the existence of a need for the innovation. Rogers (2003) listed these factors as influential in how individuals determine an innovation's compatibility. The implication is adequate planning can significantly increase the probability that adopters will view an innovation as compatible.

Change agents should be cautioned against launching an innovation prematurely; patience will yield more fruitful rewards.

### **Recommendations**

Recommendations for practice are based upon the assumption that increasing the adoption of eXtension by extension agents is desirable. To do so, barriers related to (a) concerns about time, (b) planning issues, and (c) financial concerns should be decreased or eliminated, in order to increase perceptions of four of the five characteristics of eXtension. Special consideration should be given to addressing financial concerns due to its influence on perceptions of multiple characteristics.

Research is recommended to understand the influence of (a) concerns about time and financial concerns on perceived relative advantage, (b) financial concerns and planning issues on perceived compatibility, (c) financial concerns on perceived complexity, and (d) financial concerns on perceived trialability. Future studies should examine how the relationships between perceptions of eXtension and the barriers to eXtension differ according to social system. This study should be replicated in states other than Texas to better understand the factors related to the diffusion of eXtension throughout the entire Cooperative Extension system.

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