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Business and Information Technology Usage in Midwestern Veterinary Practices Revisited

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ABSTRACT

This study is the second of two reports on the empirical investigation of computer and related technology use in 266 Midwestern veterinary clinics. The primary purpose of this study was to assess technology use within veterinary clinics and understand which technologies lead to greater perceived levels of end-user computing satisfaction and technology acceptance. The results of this study will help veterinarians determine what information system adoptions are successful in peer practices. The study was conducted by measuring surrogates for perceived success of IT systems among veterinary clinic information system users. Users' perceptions of successful interaction with operational and diagnostic systems were correlated with specific aspects of computer and technology use. The findings provide current and future practitioners with a basis for selecting hardware and software combinations in future automation decisions.

Keywords: *veterinary practice, end-user satisfaction, end-user computing, technology acceptance*

I. INTRODUCTION

Starting in the late 1980s and early 1990s, an increasing number of firms began to offer software targeted for use in veterinary offices. These systems have ranged in scope from simple office and management tools to animal patient history and diagnosis systems to medical inventory control aids. While this marketplace has continued to expand and has affected nearly all veterinary practices [1], there have been indications from the general practitioner that much work remains to fully computerize the veterinary field in a satisfactory way [2]. Academic research in this area confirms these indications.

In an Australian study, MacGregor and Cocks [3] indicate lack of training, poor vendor assistance, and sparse documentation related to veterinary practitioner software all have significant impacts on user satisfaction and hence impact future computerization decisions. As in any application environment, for computer-related technologies to add value, a better understanding of the end users' needs, desires, and limitations must be obtained. Further, the veterinary practitioners of the future can learn from those of today who have implemented computer systems in their offices and make better informed decisions regarding acquisition and use of computer tools aimed at this market. While computer and technology use is increasing rapidly in veterinary clinics, accompanying research into effective use and practice audit is lagging [4]. This study seeks to improve the situation with its findings and recommendations.

For many years, a large and diverse body of information system (IS) researchers has investigated a variety of models offering explanations of why IS implementation may succeed or fail. Included among the many empirical studies which have investigated computer system success or failure [5][6], DeLone and McLean [7] present an organized view of understanding IS success but go on to list the difficulties that can hamper this understanding. IS implementation can take place in a variety of application areas, with users of varying skill levels, and for an array of tasks. For this reason, the ability to definitively assess the success of computerized information systems has remained the subject of much research, often requiring specialized inquiry.

This presents a difficult problem to the small veterinary practice, which begins with deciding whether to automate certain functions in their practice and ends with deciding upon an optimal investment in IT. Clearly the veterinarian who has devoted training and time to his or her medical practice and has little formal training in information technology is at a disadvantage when faced with IT investment decisions. The decision is even tougher when no metrics are available for the practitioner to rely upon.

In spite of the lack of metrics and the ambiguity in those available, a widely accepted surrogate measure for IS success was developed by Doll and Torkzadeh [8]: the End-User Computing Satisfaction (EUCS) instrument. The theory that led to the development of this instrument is based on the premise that if the end user is satisfied with the system he or she is using, then it is considered a success. However, IS success is not a binary variable since the user may be satisfied with portions of the system and dissatisfied with other portions.

The Doll and Torkzadeh [8] instrument allows for this and takes it one step further by categorizing IS success along several critical dimensions. These include *ease of use*, *relevancy of content*, *accuracy*, *presentation format* and *timeliness*. End users who complete this instrument are able to evaluate the system they use in terms of each dimension. When a group of users' responses are pooled and analyzed, an indication of the amount of satisfaction provides a surrogate measure of system success.

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Past research has demonstrated this instrument is both reliable and valid [9][10][11]. EUCS has been applied to various settings where information technology is used in order to investigate those attributes of computerized applications that correlate with success. Although originally developed for measuring success factors in larger organizations, business-to-employee systems [12], m-commerce [13], and smaller organizations have also been studied, including small professional or rural organizations [14] which are similar to the veterinary practices surveyed in this study.

Data was also collected from the Technology Acceptance Model (TAM) adapted to fit veterinary software systems to validate the EUCS measure. TAM is based on the theory of reasoned action [15] and seeks to describe the acceptability of an information system [16]. In general, TAM suggests that two main factors, *perceived usefulness* and *perceived ease of use* provide surrogate measures for system acceptability which includes an individual's attitude towards the use, behavioral intention to use, and actual usage of an information system [16].

TAM is one of the most widely accepted IT usage theories and been analyzed in terms of robustness, parsimony, and predictive power in wide area of information systems and technological business solutions [17][18][19]. For example, TAM has been studied and applied to user acceptance in online and web-based systems [20][21][22][23], banking [24] and in mobile systems [25]. Another important area of application for extensions of TAM [26] has been in the area of health care IT system adoption [27] and health information systems [28]. In general, this instrument has been psychometrically validated in numerous studies across many application areas [29] [30]. This study will further validate it for use in veterinary practices. Then we use it to further validate the EUCS instrument.

A. Perceived Usefulness in TAM

IT research provides a general consensus that cognitive instrumental processes [19] and extrinsic motivation [31] determine intention to use information technology. A component of this, *perceived usefulness*, has been demonstrated as a primary indicator of organizational technology adoption [32][33] and suggests "that using a specific application system will increase [a user's] performance within an organizational context" [34]. Perceived usefulness has also been studied in the context of physicians' acceptance of health information systems suggesting health practitioners hold a pragmatic view of technology and its acceptance and use [35][36][27]. In a study by Egea and Gonzáleza [37], physicians' acceptance of the Electronic Health Care Record (EHCR) health IT system was found to be highly dependent on the performance and efficiency improvements (e.g. perceived usefulness) associated with an adoption decision. Therefore, it is reasoned that animal health care providers would hold similar pragmatic views of technology use. Similar results were reported among nurses and their use of telemedicine IT systems [38].

B. Perceived Ease of Use in TAM

Ease of use, defined as "The degree to which the prospective user expects the target system to be free of effort" [34] also has been widely researched as the second determinant of usage intentions in IT systems. Both TAM [34], TAM2 [19] and other instruments [39] include ease of use as a central element but its effect on usage intention has been inconsistent [32][40]. In complex fields of application such as health IT, *perceived ease of use* may be of limited importance in predicting acceptance of IT use since often technologies are on the cutting edge and are developed for a particular complex use [37][41].

II. METHODS

EUCS and TAM measures were collected and used to assess veterinary practices regarding the successful use of information systems. In particular, EUCS scores were used to draw specific inferences about technology use and TAM was used to validate these findings at the instrument level. In general, empirically collected information was used to draw inferences regarding recommended future IT investment in veterinary practices. By measuring and validating EUCS scores related to veterinary clinic information systems; using these results as surrogate measures of acceptability and success; and, correlating acceptability and success with specific aspects of computer use, we believe that drawing inferences regarding IT practices in this area is possible. This will provide current and future practitioners a rudimentary foundation for deciding what hardware and veterinary software combinations to choose. We also collected a variety of demographic data for comparison, including practice size, computer uses, practice type, computer experience, and software used so that comparisons can be made along these lines as well. As discovered in the early days of IS research, numerous factors impact the successful use technology.

A questionnaire was developed and distributed randomly to 1,000 veterinary practices throughout the Midwest of the United States. A mailing list of veterinary clinics available from the Kansas State University College of Veterinary Medicine formed the basis for the random selection. The target population for this study was veterinarians or individuals in a veterinarian clinic whose work-related activities involved the use of information technology. The survey instrument was pre-tested using a sample of veterinarians known to have affiliation with academia.

Following this, a final version of the survey was developed and printed on a single page (front and back) that was formatted as a tri-folded brochure so that respondents could easily complete the form and mail it back. The packages contained a cover letter explaining the purpose of the study and a statement of guaranteed confidentiality to assure individual respondents that only summary statistics would be reported. Additionally, respondents were given a coupon that allowed them to take one free *VetBytes* seminar from the Kansas State University Veterinary Medical Continuing Education program, provided they returned the survey.

The questionnaire was composed of five parts. The first part consisted of a general demographic question designed to elicit information about the respondent's practice. The second part asked questions to assess the respondent's computer usage and

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training [2]. The third part gathered information about veterinary-specific software use [2]. The fourth part asked questions regarding attitudes toward computer use within the practice [42] including items from the EUCS instrument [8], original TAM items [16] and two additional items designed to elicit overall satisfaction and success in order to provide a statistical validation check on the instrument.

III. RESULTS AND ANALYSIS

The response rate was 26.6% (266 usable responses from 1000 questionnaires distributed. Ninety percent of the respondents to the survey were the veterinarians themselves, 5% were veterinarian assistants, 3% were office assistants, and 2% were others. Of those responding to the survey, 52% classified their practice as small animal exclusive, 30% as mixed animal, 8% as small animal predominant, 2% as bovine or equine, 2% as large animal predominant, 6% as being government or academic practices. The majority of clinics reported 1 or 2 veterinarians; however, practice size varied from 1 to 9 veterinarians. This is shown in table 1.

Table 1: Practice Size

# Veterinarians in Practice	% of Respondents
1	36
2	25
3	15
4	10
5	6
6	3
7	2
8	2
9	1
10+	< 1

A. Computer Usage and Training

In order to better understand how technology supports veterinary practices in general, the questionnaire included a series of questions regarding whether information technology was used in the practice and if so, the type of system(s) in use. Ninety-seven percent of the practices that responded indicated a computer system is used in their practice with 68% reporting more than three computers were used in their practices. Of these, the systems were largely Windows based PCs (91%), 90% of which were connected to the Internet (52% DSL, 21% cable, 6% dial-up, 21% satellite and other). Surprisingly, 3% of those surveyed used paper-based systems for their practices and 10% of the computerized practices were not attached to the Internet, usually due to their isolated geographic locations where mobile communications were not readily available.

Of the software used, most (73%) reported using word processing software. The highest category of use, as might be expected, was veterinary specific software (75%). Many offices also relied on internal software for accounting, billing and record keeping (49%). Table 2 lists the major software application areas in descending order.

Table 2: Applications in Veterinary Practices

Computer Application Area	% of Computerized Practices Reporting Use
Veterinary Specific	75
Word Processing	73
Spreadsheet	50
Financial / Accounting	49
Database Management	34
Literature Search	30
Desktop Publishing	26
Diagnostic Assistance	17
Other	9

Satisfaction with a computer system may be influenced by the amount of training that the end user receives [43]. In order to control for the effects that training may have on end user satisfaction, several questions were asked regarding the type and extent of training received by the respondents. Fifty-nine percent of the respondents reported having been self-trained on computer software use while 41% reported having received formal training in computer software use.

B. Veterinary Software Results

Seventy-five percent of reporting clinics expressed using some type of veterinary-specific software in their practice. Sixteen specific software packages were mentioned by name. The most popular package among those reporting was AVIMARK (87 users), followed by Cornerstone (47 users), Impromed (18 users), INTRAVET (14 users), and DVM Manager (13 users). Table 3 lists all packages and the number reporting use for each.

Table 3: Vet Software Usage

Software Package	# Users
AVIMARK	87
Cornerstone	47
Impromed	18
INTRAVET	14
DVM Manager	13
DVMAX	9
DOTY VET SOFTWARE	5
VETECH	4
AT VET Software	1
COMPUVET	1
PET VET	1
VET Management Online	1
VETCARE	1
VETCOM	1
VET'S PETS	1
VPR	1

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In addition to packages, respondents were asked to list the category of software that they considered most important to their practice. As shown in Table 4, the majority believed that Veterinarian software packages were the most helpful. This software ranges in function from medical reference help to small office support with an emphasis on Veterinarian practices. Others reported that accounting/invoicing software was most important with fewer reporting inventory control or general office software.

Table 4: Most Important Software to Operation

Software Type	Reported Users
Vet Specific	67
Accounting / Invoicing	28
Record Keeping	26
General Office/Business	25

C. Computing Satisfaction and Acceptability Results

The last parts of the questionnaire included the End User Computing Satisfaction (EUCS) [8] and the original Technology Acceptance Model (TAM) [16] instruments as a surrogate measures for system success. The original TAM instrument questions were used (as opposed to TAM2) to enable collected data to be used in an ongoing longitudinal study [44]. The initial study was begun prior to the development of TAM2. We asked respondents to focus their EUCS and TAM responses on the primary computer system used in the veterinary practice. Two of the questions asked the practitioner to directly assess their satisfaction with the system and whether they considered it successful so that EUCS and TAM could be tested for both intermediate (satisfaction) and ultimate (success) criterion validity [45]. The questions for each instrument can be found in appendix A.

In past studies, generalizing attitudinal instruments to new application environments has been cautioned [16, p. 334][8, p. 270]. If evidence supports psychometric stability in the new area, researchers can more confidently use the instrument's results in the investigation of competing tools, features, and technologies [10]. Yet, because both models have been tested extensively for reliability and validity in other disciplines, the models we present here are "strictly confirmatory" and can be either accepted or rejected on that basis [46]. Thus, migrating the TAM and EUCS instruments into an industry for which it was not designed requires a confirmatory factor analysis to assess the model fit. The models are considered to fit the data well if all of the items load on each dimension with approximately the same strength as similar studies in other industries and each of the dimensions load equivalently on the second order factor. Fit indices may be computed and must also fall within certain ranges. Factor loadings and fit indices were derived using Lisrel 8.8 [47][48][49][50] and are shown in appendix B along with correlation matrices. Reliability for this sample was measured using coefficient alpha and it is also presented in appendix B [51].

D. EUCS

Doll and Torkzadeh [8] originally proposed a measurement model consisting of five independent but correlated factors. Subsequent research and additional analysis has provided evidence that the structural model consists of a single second-order latent construct [52], *end user computing satisfaction*, which is reflected in each of the five original dimensions [53][9]. The model is depicted in figure 1 and is annotated with factor loadings calculated from the data collected in this study. As can be seen in figure 1 and appendix B, all loadings are significant, standard errors are in an acceptable range and the overall coefficient alpha is .94.

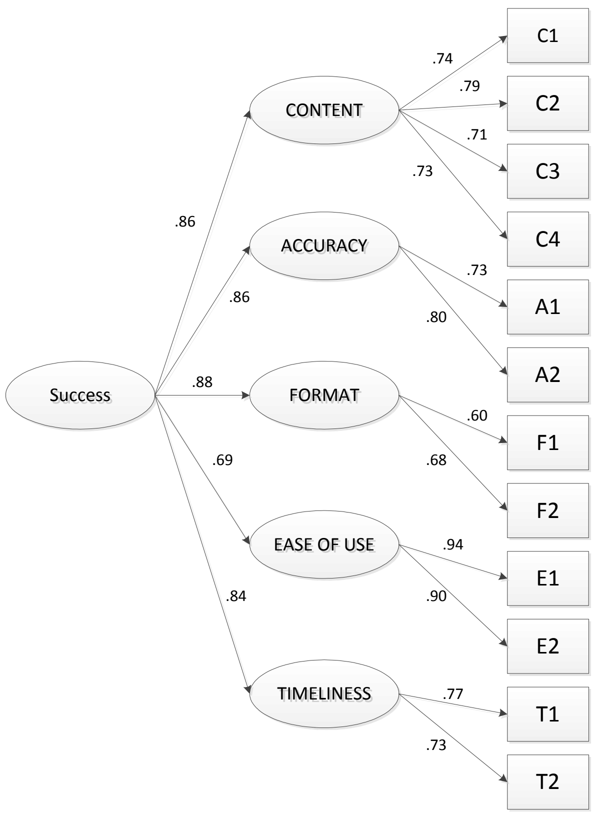

Figure 1: The EUCS Structural Model

Fit indices compare favorably to the results of prior studies [9] as shown in table 5.

Table 5: Comparison of EUCS Fit Indexes

	Doll, Xia & Torkzadeh Study [9]	Current Study
Chi-square (df)	132.43 (44)	185.81 (50)
Chi-square / df	3.01	3.72
Normed Fit Index (NFI)	0.94	0.94

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Goodness of Fit Index (GFI)	0.91	0.93
Adjusted Goodness of Fit Index (AGFI)	0.84	0.89
Root Mean Square Residual (RMSR)	0.030	0.035

Correlations between the average EUCS score and each of the two overall indicator variables (one for overall satisfaction and one for overall success) are very high as expected. This indicates a strong association between these measures and provides support for the premise that EUCS is a psychometrically sound surrogate for system success. This helps support both intermediate (satisfaction) and ultimate (success) criterion validity [45]. These values are shown in table 6.

Table 6: Correlations between EUCS and overall measures of satisfaction and success

	Mean	Std Dev	EUCS	Satisfaction	Success
EUCS	47.8	8.59	1		
Satisfaction	3.8	0.97	0.87	1	
Success	4.0	0.85	0.84	0.81	1

Based on these computations, the model is considered to have passed its confirmatory tests and closely approximates the original Doll, Xia and Torkzadeh [9] model. It is therefore deemed acceptable and will be used to make inferences for this study.

E. TAM

The original TAM model proposed by Davis [16] consists of two independent but correlated factors that load on a single second-order construct, *intention* which is reflected in each of the two original dimensions. The TAM instrument was assessed for convergent validity using confirmatory factor analysis (CFA) in LISREL 8.8 [47][48][49]. The model is depicted in figure 2 and is annotated with factor loadings and error parameters calculated from the data collected in this study. As can be seen in figure 2 and appendix B, all loadings are significant with standard errors in an acceptable range. The χ^2 measure of model fit is reasonable at 112.83 (P = 0.00, df = 41), which yields a ratio of 2.75. The adjusted goodness of fit index (AGFI) of .85 provides additional support as does the low standardized root mean square residual (RMR) of .025. These numbers are reasonably consistent with other published studies [20]. Additional reliability statistics for this sample are presented in appendix B [51].

There was acceptable high correlation among the items within TAM constructs, as suggested by standardized factor loadings (above .74) and item reliabilities (above .53) [54]. All factor loadings were statistically significant at $p < 0.01$ [55]. Table 7 reports the results.

Table 7: TAM Goodness-of-Fit Indexes

Index	Value
Chi-square (df)	112.83 (41)
Chi-square / df	2.75
Normed Fit Index (NFI)	0.97
Goodness of Fit Index (GFI)	0.91
Adjusted Goodness of Fit Index (AGFI)	0.85
Root Mean Square Residual (RMR)	0.025

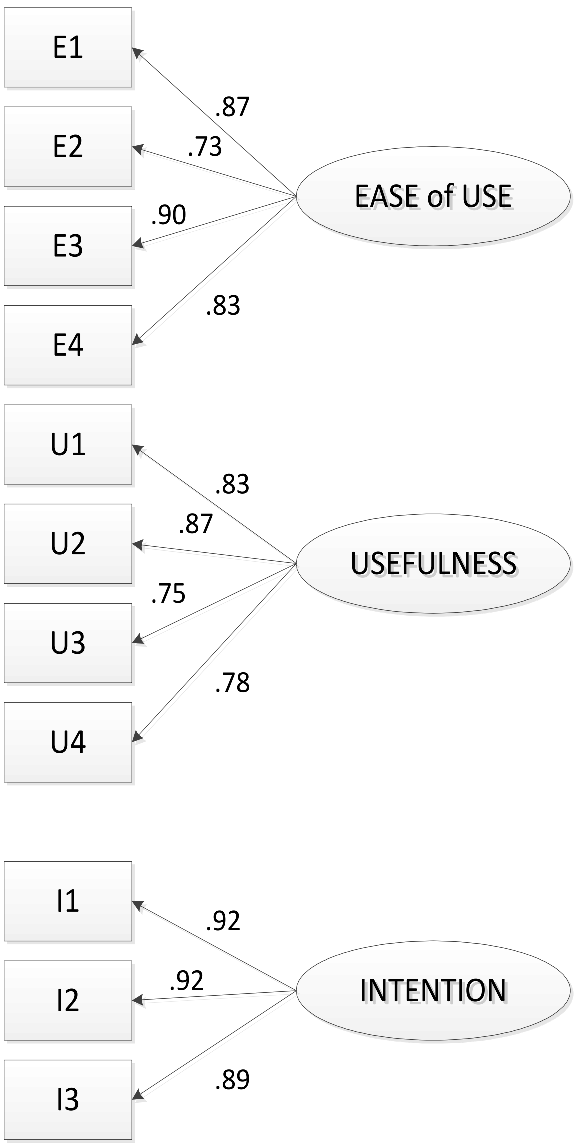

Figure 2: The TAM Structural Model

A path diagram was generated for the model using LISREL 8.8. The result is consistent with past studies illustrating standardized causal path findings for the original TAM instrument [20]. Figure 3 illustrates the path diagram.

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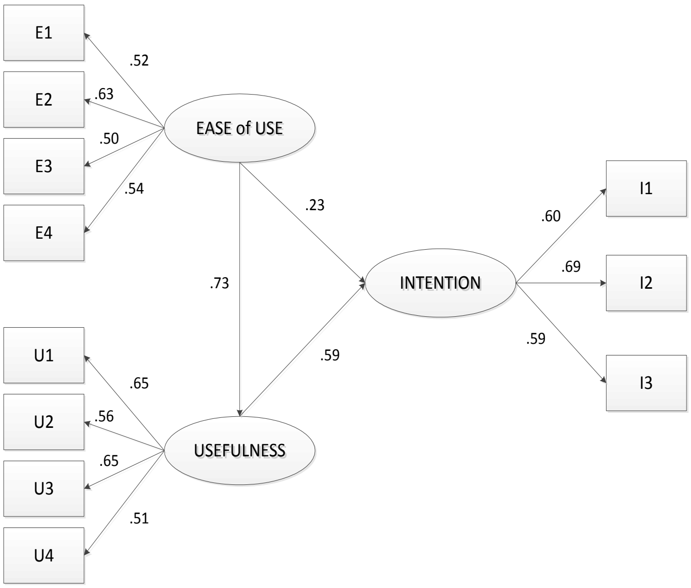

Figure 3: The TAM Path Diagram

F. TAM and EUCS Correlation

The TAM and EUCS instruments were tested for correlation since both provide surrogate measures for system success based on different but related theoretical perspectives. The results showed a reasonable degree of correlation at .72. The subscale items of TAM were also correlated highly with overall EUCS as shown in table 8.

Table 8: TAM subscale and EUCS Correlations

Item	EUCS
U1: Increases productivity	0.56
U2: Improves quality of care	0.43
U3: Enhances effectiveness	0.60
U4: Useful	0.55
E1: Clear interaction with software	0.64
E2: Easy to use	0.57
E3: Intuitive	0.41
E4: Does what is wanted	0.56
I1: Will use frequently in future	0.55
I2: Will continue to use	0.60
I3: Intent to use	0.55

$p < 0.001$

G. Satisfaction Score Correlations

Having determined that the data support the models and that the models can be used as surrogate measures of system success, we will now assess which characteristics of the information systems used in veterinary practices significantly correlate with the TAM and/or EUCS models. Table 9 summarizes these findings and indicates which of the EUCS items correlated significantly with the types of systems used and the attitudes toward them. The results indicated that practices without internal networks, Internet connectivity, or office application training experienced lower degrees of satisfaction. Practices using their computers for decision support, information storage, communication, and email were likely to have higher satisfaction scores. Further, we found that higher satisfaction scores correlate significantly with the following attitudes toward computer use (Table 9 illustrates):

- the system increases productivity,
- the system enhances effectiveness,
- interactions with the system are clear and understandable,
- valuable information is preserved, and
- the current system will continue to be used in the future.

Table 9: Characteristics Correlating with Success

Characteristic	Correlation
Internet Use	0.203**
Training Dollars	0.129*
Backups Used	0.227**
Restored Data	0.185**
Use of a Server	0.238**
System Used for Decision Making	0.408**

* $p < 0.05$ ** $p < 0.01$

IV. DISCUSSION

The statistical findings can be further illuminated with a practical interpretation. Our analysis falls into two categories. First, we present an interpretation of what is used in veterinary offices currently with system success and user satisfaction. The purpose for this discussion is to provide information regarding which systems are successful and are not successful or are only marginally successful so that future decisions by veterinary practitioners can be made regarding acquisition, training and total investment in office systems. Second, we present a more detailed interpretation of attitudes toward computer usage in veterinary practices and the success and end user satisfaction of these systems. This is necessary because the correlations we report regarding computer attitudes and system success, although statistically significant, are only mild in their strength of association. Our statistical findings must therefore necessarily be tempered with a logical analysis.

The results of this study suggest that practicing veterinarians have recognized the value of information technology (IT) and have actively sought to utilize it to help improve their practices. Approximately 97% of the reporting veterinarians in this study utilize office computer systems to some extent in their practice. Most of these report utilizing software developed specifically for veterinary practices. Further investigation of the demographics has revealed that many of the veterinarians who reported no IT use operate their practices in the field, thus precluding most IT solutions. Even mobile solutions could only be used in a store-and-update-later mode since many of these veterinarians work in rural settings where connectivity is nonexistent.

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Most practicing veterinarians report that veterinary specific software is the most important application in their office, yet when further queried about its effectiveness, the results are mixed. Many of these types of programs are not perceived as being effective. See table 10. Among the exceptions were DVM Manager and AVIMARK, which were rated very favorably by most reporting offices. Most of those who rated these as unacceptable, however, reported that they had received no training to use it. Veterinarian software seems to be a volatile and highly competitive market, judging from the number of business failures and acquisitions and mergers that have taken place in that industry. In some cases, companies which produced vet-specific software were absorbed by larger companies whose focus is on research and development in pharmaceuticals, bodily function monitoring and those areas that are adjacent to but not core with office practitioner software. This might make the decision to acquire software a more difficult one for the veterinarian seeking to establish a practice or to upgrade an existing practice.

Table 10: Software Satisfaction Average Scores

Software	AVG (EFFECTIVENESS)	Count	STDDEV (EFFECTIVENESS)
VETCOM	5.00	1*	0.00
DVM Manager	4.31	13	0.75
AVIMARK	4.25	87	0.88
VETECH	4.25	4*	0.50
AT VET	4.00	1*	0.00
Impromed	3.94	18	1.00
INTRAVET	3.93	14	0.92
Cornerstone	3.87	47	1.08
COMPUVET	3.00	1*	0.00
VET Management Online	3.00	1*	0.00
VET'S PETS	3.00	1*	0.00
VETCARE	3.00	1*	0.00
DVMAX	2.89	9	1.36
DOTY VET	2.20	5	1.10
VPR	2.00	1*	0.00
PET VET	1.00	1*	0.00

* small sample size prohibits meaningful interpretation of these packages.

It appears that most veterinarians who operate practices in a fixed location believe that better decisions are made, communications are enhanced and the practice is improved with the aid of some set of information technology components. Our goal is to aggregate the results and develop a set of solutions based on industry practice within animal medical science and best practices from varying types of other industries to assist the veterinarian who wishes to build or improve a practice by processing office and clinical information with computer technology. Generally speaking a small office network consisting of 2 to 10 machines is a relatively inexpensive way to enhance productivity. Practitioners must deal with a client base both in person and over the phone and keep records of visits, lab analyses, medications and treatments and must often share this information with several staff members within the office. Office software that allows file sharing is considered a must in most small businesses of this sort. Our results show that most vet offices are generally satisfied with networked solutions, both internal and external, and so connectivity should be viewed with a high level of priority. The veterinarian can bring a wealth of information available over the Internet directly into the office in real time and use this information to treat rarely encountered problems or to view new treatment options that are just emerging.

Software made specifically for the veterinary office can be difficult to choose when so many vendors offer so much and when those who must make acquisition decisions are not well trained in information technology. Because these products may not deliver precisely what the vet needs, we recommend a try before you buy policy. Many veterinarian software houses (e.g., Henry Schein, Veterinary Software Publishing, Inc. and others) allow potential customers to download trial or demo software for free for a specified period (usually 30 days). The vet can have the office staff research the needs of the practice and then locate one or two packages that seem to meet these needs, download them for free and use them for a short period of time to see if they can deliver what they promise. Upon completion, the staff should administer the EUCS or TAM items and rate each program under evaluation. The program with the highest score can then be selected (*ceteris paribus*). Some issues that such an evaluation, based on our experience with TAM and EUCS, should include:

1) How easy is the program to learn? Is training available? If so, how much does it cost per person and how long will it take? Where can it be obtained?
2) How easy is program use once learned?
3) Is the program useful? Does it meet the needs of the veterinary practice and can it grow with the practice? The veterinarian or the staff might ask, "What does it allow me to do that I can't do now?" This may be evaluated in terms of either fewer unhealthy animals (better treatment opportunities) or in terms of business volume (the ability to treat more animals in the same period of time). These questions help the practitioner focus on the optimal allocation of time information sharing and availability so that productivity is enhanced.
4) What does it cost? Do the benefits received from the software exceed its acquisition cost? (Acquisition cost includes the cost of training, installation and configuration.) Placing a value on benefits received from computer information systems is problematic and has been the focus of several past studies [56][57] with no definitive answers for the practitioner. However, by looking at what clinicians are using currently and determining whether these systems are successful may go a long way toward providing some guidance in this decision process [4].

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5) Are mobile solutions a viable additive to the veterinary practice? Mobile devices such as tablets, smart phones, personal digital assistants (PDAs) and small electronic voice recorders are relatively inexpensive and easy to handle for field operations. They can be programmed to accept data vital to the practice and transmit it back to the office server either remotely as through a cellular telephone connection or locally once the vet returns to the office. Whether they are a good investment for the veterinarian is unclear and was not the focus of this study, however, the same business question regarding other office technology can be asked to help make this decision as well. That is, the vet could ask, "What can it help me do that I couldn't do before, and how will this affect my productivity—will more animals be saved or in better health, or will I be able to treat more of them?" The findings of the study demonstrate that enhanced communication capability of veterinary systems promote system satisfaction. Mobile devices could promote this further.

Finally, we must not overlook the reason the veterinarian chose the animal health field in the first place. In many cases it was due to the love of animals and the desire to help them healthy. He or she did not enter the field to become an expert in information systems, yet as an entrepreneur and IS user, more knowledge in this area results in better decisions. Our study indicates most veterinarians feel office automation is necessary in the pursuit of this profession, but realize it is only one tool in a set of tools employed to accomplish the goal of helping animals and bringing peace of mind to their owners. To this end, the veterinarian can delegate many functions involved with acquiring, installing and configuring the office information technology to his or her staff or contractors. Job announcements should include the requirement that applicants have aptitude in computer skills and the desire to work with and learn them. Veterinarians can also turn to consultants and to universities for assistance. Most business colleges have a small business development center that can provide information and sources of assistance. Delegation can move the responsibility of the office and clinic systems to others involved in the practice, support the veterinarian's practice through information sharing, require less training and time commitments by the veterinarian and allow the vet to do what he or she has intended to do all along—treat animals.

Other findings of this study are of primary interest to IS researchers. First, both the original TAM instrument [16] and the EUCS instrument [9] were confirmed and validated for use in the area of veterinarian practices. Further, the loadings for the TAM model in this field proved to be very similar to those described by researchers studying general health IT systems [41][37]. As shown in other health IT studies, *perceived ease of use* appeared to be of limited importance in predicting acceptance of IT use since often technologies are on the cutting edge and are developed for a particular complex use. This study had a similar result and demonstrated that a weaker relationship between ease of use and intention to use exists.

V. CONCLUSION

This study analyzed the use of information technology within a sample of representative veterinary offices in an effort to learn more about how such technology is being used and whether its use has met the needs of these practitioners. Our findings indicate that the vast majority of practitioners do rely on this technology to help them manage their practices and that they are largely satisfied with it. This translates into systems that we can deem as successful according to the theories posited by Davis [16] and Doll and Torkzadeh [8]. From this data, we get an idea of what is working in vet offices and are able to make certain inferences. We translated those inferences into recommendations for vets who seek to automate a new office or for those who are considering changes in their current practice. Our recommendations offer not just what is successful in this industry, but what has been successful in standard business practices. For those vets whose practice is mobile and not confined to an office, information technology may still make sense as the advancements in communications technology have been rapid and pervasive, but the decision to incorporate IT into a mobile practice still must depend on whether the cost of investment is exceeded by the benefits received. We have attempted to use the information gathered in this study to help the veterinarian formulate an IT investment strategy while still allowing him or her to concentrate on service to animal health.

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APPENDIX A: INSTRUMENT QUESTIONS

EUCS
Item Question

C1: Does the system provide the precise information you need?
C2: Does the information content meet your needs?
C3: Does the system provide reports that seem to be just about exactly what you need?
C4: Does the system provide sufficient information?
A1: Is the system accurate?
A2: Are you satisfied with the accuracy of the system?
F1: Do you think output is presented in a useful format?
F2: Is the output information clear?
E1: Is the system user friendly?
E2: Is the system easy to use?
T1: Do you get the information you need in time?
T2: Does the system provide up-to-date information?

(From: Doll and Torkzadeh [8])

TAM
Item Question

U1: My Veterinary Software increases my productivity.
U2: My Veterinary Software improves the quality of care that I deliver.
U3: My Veterinary Software enhances my effectiveness.
U4: My Veterinary Software is useful in my job.
E1: Interaction with my Veterinary Software is clear and understandable.
E2: My Veterinary Software is easy to use.
E3: Interacting with my Veterinary Software does not require a lot of mental effort.
E4: It is easy to get my Veterinary Software to do what I want it to do.
I1: I will use my Veterinary Software frequently in the future.
I2: I will use my Veterinary Software for a long time.
I3: I intend to use my Veterinary Software.

(Modified From: Davis [16])

APPENDIX B: INSTRUMENT RESULTS

EUCS Correlation Matrix (Coefficient alpha on diagonals)

	A1	A2	C1	C2	C3	C4	E1	E2	F1	F2	T1	T2
A1	1.0											
A2	.82	1.0										
C1	.63	.57	1.0									
C2	.61	.61	.78	1.0								
C3	.47	.46	.67	.61	1.0							
C4	.67	.65	.68	.68	.61	1.0						
E1	.51	.50	.61	.61	.51	.50	1.0					
E2	.46	.50	.57	.58	.50	.49	.84	1.0				
F1	.62	.68	.57	.58	.55	.68	.54	.52	1.0			
F2	.73	.73	.57	.60	.52	.65	.52	.53	.67	1.0		
T1	.63	.62	.59	.64	.58	.67	.56	.61	.66	.60	1.0	
T2	.69	.66	.58	.62	.54	.74	.42	.45	.63	.58	.77	1.0

EUCS Subscale correlations

	Accuracy	Timeliness	Content	Ease of Use	Timeliness
Accuracy	1.0				
Timeliness	.72	1.0			
Content	.70	.76	1.0		
Format	.80	.72	.74	1.0	
Ease of Use	.54	.57	.65	.60	1.0

Factor loadings for the second order EUCS model

	CONTENT	ACC	FORMAT	EASE	TIME
C1	0.74				
	(0.05)				
	15.39				
C2	0.79				
	(0.05)				
	15.36				
C3	0.71				
	(0.06)				
	12.27				
C4	0.73				
	(0.05)				
	14.20				
A1		0.73			
		(0.04)			
		16.57			
A2		0.80			
		(0.05)			
		16.87			
F1			0.62		
			(0.05)		
			13.48		
F2			0.68		
			(0.05)		
			14.49		
E1				0.94	
				(0.06)	
				16.62	
E2				0.90	
				(0.06)	
				16.07	
T1					0.77
					(0.05)
					15.75
T2					0.73
					(0.05)
					15.26

Standard errors shown below the loading; t-value shown below that

TAM Correlation Matrix (Coefficient alpha on the diagonals)

	U1	U2	U3	U4	E1	E2	E3	E4	I1	I2	I3
U1	1.0										

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U2	.66	1.0									
U3	.78	69	1.0								
U4	.71	.55	.75	1.0							
E1	.65	.47	.61	.60	1.0						
E2	.54	.36	.57	.51	.70	1.0					
E3	.37	.25	.38	.36	.57	.72	1.0				
E4	.50	.45	.50	.49	.65	.65	.61	1.0			
I1	.62	.49	.61	.71	.57	.54	.36	.54	1.0		
I2	.58	.47	.61	.63	.57	.52	.36	.48	.84	1.0	
I1	.56	.45	.55	.66	.48	.50	.34	.43	.81	.82	1.0

TAM Subscale correlations

	Usefulness	**Ease of Use**	**Intention**
Usefulness	1.00		
Ease of Use	0.72	1.00	
Intention	0.76	0.66	1.00

Factor loadings for TAM model

	Usefulness	**Ease of Use**	**Intention**
U1	0.87		
	(0.057)		
	15.26		
U2	0.73		
	(0.062)		
	11.70		
U3	0.90		
	(0.059)		
	16.16		
U4	0.83		
	(0.058)		
	14.24		
E1		0.83	
		(0.060)	
		13.88	
E2		0.87	
		(0.058)	
		14.94	
E3		0.75	
		(0.062)	
		11.97	
E4		0.78	
		(0.061)	
		12.66	
I1			0.92
			(0.054)
			16.91
I2			0.92
			(0.055)
			16.73
I3			0.88
			(0.056)
			15.80

Standard errors shown below the loading; t-value shown below that