Factors Influencing e-commerce Adoption and Use by Small and Medium Businesses

SCOTT A. WYMER AND ELIZABETH A. REGAN

INTRODUCTION

The adoption and use of e-commerce/e-business Internet technologies (EEIT) by small and medium enterprises (SMEs) has been the focus of considerable research over the past ten years. The interest in this topic has been driven largely by a basic assumption that EEIT offers new opportunities for SMEs to offset competitive disadvantages of size, resources, geographic isolation, and market reach. The predominant research methodologies employed have been surveys, interviews and case studies. A common thread throughout much of this research is the study and application of variables that either act as barriers (inhibiting adoption and use) or act as incentives (promoting adoption and use). These variables, reported in the literature to date, are classified as either incentives or barriers in the adoption models research and the effect of the variable on adoption are clarified through the subsequent collection of data and its analysis. With the proliferation of studies in recent years, a very large number of such variables have been discussed in the literature; resulting in a good deal of inconsistency in the naming, grouping and content of the variables identified as incentives and barriers.

The goal of this research is to bring some common understanding and uniformity to the multitude of variables associated in the literature with adoption and use of EEIT. This paper in particular takes the first step by examining the diverse list of incentives and barriers from the literature and consolidating them into a neutral list of factors to then clarify whether each factor is perceived by SMEs to have a positive or negative influence on the adoption and use of EEIT.

A pilot research study completed in 2002 (Wymer *et al.* 2003), identified a number of factors that respondents consider as limitations in their use or consideration of e-commerce. These pilot results, focusing mainly on barriers, led to the development of this current study, helping to focus a more detailed inquiry into the nature and effect of factors that might either positively or negatively influence decisions about implementation of EEIT by SMEs.

LITERATURE REVIEW AND RATIONALE

Much of the research on adoption and use of EEIT by small and medium businesses has been exploratory in nature, employing a

Abstract

The literature provides an extensive list of incentives and barriers to adoption and use of e-business and e-commerce information technology (EEIT) by small and medium businesses (SMEs). The objective of this current research was to consolidate these factors and determine their level of influence, either positively or negatively from the adopter's perspective, on the adoption decision. A set of 26 factors, used as variables in various adoption models from the literature, were presented in a neutral manner, without pre-classifying them as barriers or incentives, through a survey sent to SMEs. Respondents were asked to rate the effect of these factors on their EEIT adoption decisions. In addition to examining all respondents, the analysis compares perceived differences among factors for SMEs that have adopted a business website, those that intend to adopt and those that will not adopt. Sixteen of the factors were found significant, ten as incentives and six as barriers. The only consistent factor across all groups was cost – perceived as a barrier. The study concluded that factors are perceived differently by adopters, intended adopters and those not intending to adopt. These results should serve as a basis for more accurate use of these factors in adoption models.

Keywords: e-commerce, barriers, small business, adoption, e-business

Authors

Scott A. Wymer
(s.wymer@moreheadstate.edu) is an Assistant Professor of CIS, Morehead State University, Morehead, KY. Research interests include Small Businesses E-Business adoption and Web Information System Technologies, Development and Architecture.

Elizabeth A. Regan
(e.regan@moreheadstate.edu) is Department Chair and Professor, Morehead State University, Morehead, KY. Research interests include IT as a catalyst for innovation, e-Business and End-User Information Systems.

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variety of approaches and theoretical frameworks. It also spans many types of businesses and industries around the globe. Research related to incentives and barriers to technology adoption is found in the literature of several different disciplines including management, organizational behaviour, communications, computer science, information systems, marketing and sociology. Consequently, the research on EEIT innovation and adoption by SMEs applies a variety of theoretical models and foundations from these diverse disciplines. No single model or theory dominates. Among the more frequently applied theoretical models are:

1. Theory of Planned Behaviour (TPB) (Chau and Hu 2001; Harrison *et al.* 1997; Riemenschneider and McKinney 2001; Venkatesh and Brown 2001);
2. Technology Acceptance Model (TAM) (McCoy 2001; Straub *et al.* 1995);
3. Combined TAM-TPB (Venkatesh and Brown 2001; Mathieson 1991)
4. Theory of Reasoned Action (TRA) (Ajzen and Fishbein 1980);
5. Adoption, Innovation, and Diffusion Theory (Rogers 1995);
6. Social Cognitive Theory (Bandura 1996);
7. Unified Theory of Acceptance and Use of Technology (UTAUT) (Anderson and Schwager 2003; Venkatesh *et al.* 2003) and Actor-Network Theory (Tatnall and Burgess 2004)

These models when applied in quantitative studies commonly use, as independent variables, factors which influence adoption either positively or negatively. This broad range of theoretical foundations, found in the literature, probably accounts, at least in part, for the confusing, and sometimes contradictory, collection of variables identified as incentives and barriers to EEIT adoption and use.

These variables defined, as incentives and barriers in different models and research methodologies, vary considerably (Kanter 2001; Lawrence 2002; Nambisan *et al.* 1999; Oden and Strover 2002; van Slyke *et al.* 2001). Most frequently, these variables are identified as either incentives (also referred to in the literature as drivers, determinants, motivators, accelerators, enablers) or barriers (inhibitors) to adoption and use. Considerable inconsistency is noted in the terminology for describing these variables and the range of variables cited by researchers (Harrison *et al.* 1997; Huang *et al.* 2004; Windrum and de Berranger 2004). Some researchers base their analyses on three or four variables, while others may use as many as 15 or more variables (Kanter 2001; Windrum and de Berranger 2004). The findings also frequently diverge; for example, Al-Qirim (2004b) and others found that owner/manager involvement and innovativeness play an important role in shaping SME use of EEIT. However, Windrum and de Berranger (2004) found that the owner/manager role was not a significant variable. Another example can be found in the research identifying technical capability as an important variable to success. However, the source of the capability is unclear. Some studies found that internal technical capability was a key to EEIT success in SMEs, while other studies found that external expertise and support were critical (Huang *et al.* 2004; Windrum and de Berranger 2004). Considerable variation is noted even in the literature seeking to summarize the most commonly identified barriers and incentives (e.g., compare Burgess 2002: 5, Kanter 2001: 319 and Lawrence 2002: 181). Another point of inconsistency is in the application of individual versus organizational models as a theoretical foundation for exploring significant variables or explaining relationships among variables. In addition, some studies focus on assessing barriers to adoption while others focus on incentives or predictors of adoption, but the actual variables are often similar and overlap.

A number of research studies have attempted to group variables into categories, but once again, there is much inconsistency. For example, Al-Qirim (2004b) used four categories: technological, organizational, manger/owner and environmental variables. Caldeira and Ward (2002) use the following four categories: internal context, external context, process and content. Magnusson (2004) categorizes variables into the three dimensions of content, context and process. In some cases the categories of variables related to categories in a theoretical model, while in other instances appear to be fairly arbitrary, used primarily for convenience of organization.

Research methods

The first step in this current research was a thorough review of the literature and development of an extensive list of variables suggested as significant barriers or incentives to adoption and use of technology. This review focused on, but was not limited to, the adoption and use of EEIT by SMEs. Studies related to adoption and use of information and communication technologies (ICT) in general were also considered. A systematic qualitative process of charting, matching and consolidating variables was employed to identify those factors which appeared to be most prevalent in the literature. Details taken into consideration in the process were source, frequency of application, overlap in terminology, significance of research findings and contradictions in prior findings.

No prior methodology could be identified for systematically examining incentives and barriers variables in the literature. Therefore, the following procedures were developed to distill the rather extensive list of variables to the 26 factors included in the current survey:

1. All identified variables found in the literature were listed by author and study. (Thirty different studies were used for this listing.)
2. Variables were then reorganized, alphabetized and consolidated to eliminate variables from different studies that identified the same variable with different terminology.
3. Consolidated variables were identified and charted with details of all authors who researched each variable.
4. Any groupings, classification, or factoring (i.e., relationships) used in the literature among the variable was noted.
5. Variables were ranked based on the relative significance as reported in the research findings or the frequency with which the variables were identified in the literature.
6. The most frequently cited variables in the literature were consolidated into the 26 factors used in the research survey. These variables were stated in a neutral format and respondents were asked to indicate the impact that they had, or might have, as an incentive or barrier on their decision to use, or not to use, Web and Internet technologies.
7. Based on the groupings and classifications identified in Step 4 above, the variables were then mapped into categories. Several iterations of this mapping resulted in the four categories of environmental factors, knowledge factors, organizational factors and technology factors used in this study.

Environmental factors. Environmental factors identified in the literature relate to markets, competitive pressures, government rules and regulations, suppliers, vendors, partners and customers. Pflughoeft *et al.* (2003) examines a number of marketplace forces including competitive conditions, transactions with trading partners, competitive threats and demands of marketplace participants. Al-Qirim (2004b) used the environmental factors of competition, external support (from technology vendors) and supplier/buyer pressure. Sinkkonen (2001) identifies limited knowledge of customers and competitive pressures among factors affecting adoption decisions. Some studies examining transactions with trading partners or vendors are Windrum and de Berranger (2004), Purao and Campbell (1998), Lawrence (2002) and Kanter (2001). Windrum and de Berranger (2004) did not find that pressure from suppliers and allied firms was a statistically significant factor for adoption of intranets or extranets among their sample. Jensen (2003) discusses the impact of government policy on adoption.

For the current survey, environmental factors were consolidated into five factors stated in neutral terms: competitive pressure from other Internet adopters within the industry (Competitive Pressure); government rules and regulations (Government); viable market or customer base for e-commerce (Market); availability of the right partners with whom to work (Partners/Vendors); and readiness of suppliers for electronic business (Supplier Readiness).

Knowledge factors. Knowledge factors relate to executive knowledge and experience, employee expertise, recognition of needs and opportunities and exposure and experience with technology and change management. Knowledge factors appear to be more prevalent in the literature than the other three categories of factors. Wojkowski and Hardesty (2001) suggest that for successful adoption of EEIT, the CEO must have a reasonable working knowledge of the new technology and people must see the need for change and understand why it must be.

Level of EEIT knowledge is examined in a wide variety of studies (Kanter 2001; Silvius 2004; Venkatesan 2003). Nambisan and Wang (1999) identified three categories of knowledge barriers that keep companies from adopting EEIT technologies. These include project-related knowledge barriers, application-related knowledge barriers and technology-related knowledge barriers. Knol and Stroeken (2001) focus on lack of strategic insight, looking especially at three dimensions: lack of strategic insight regarding alternative product options; alternative market and customer approach; and desired forms of cooperation. Among the factors examined by Paper *et al.* (2003) was a lack of understanding of the capabilities and limitations of e-commerce. Purao and Campbell (1998) looked at factors such as unfamiliarity with the Internet and lack of knowledge about initiating the process of adopting EEIT technology.

Pflughoeft *et al.* (2003) examines firm-specific characteristics such as level of IT knowledge base, managerial support and willingness to commit resources. Al-Qirim (2004a) used two knowledge factors– manager's innovativeness and manager's involvement (identified as manager/owner factors rather than knowledge factors). Caldeira and Ward (2002) examine top management perspectives toward IS/IT adoption and top management attitudes toward IS/IT adoption (categorized as 'internal context'). They found that in the firms that were more successful in adopting and using IS/IT, a business partnership or strong personal relationship between top managers and a qualified IS/IT expert was identified. Diochon and Wright (2003:) suggest that 'recognition of strategic opportunities for using IT builds incrementally as usage increases'.

The nine knowledge factors, stated in neutral terms, included in the current survey are: employee experience with making major changes (Change Experience); owner/manager experience with computers and the Internet (Executive Experience); willingness to adopt new technology (Innovativeness); availability of models

of successful industry use (Models); perceived need for change or implementation of Web and Internet technologies (Need); a company's prior experience with new technology implementation (Prior Experience); trust or confidence in Web and Internet technologies (Trust); understanding of available opportunities and options with e-commerce (Understanding); and perceived value or relevance to the business (Value).

Organizational factors. The third category is organizational factors that relate directly to availability and use of internal resources. Organizational factors identified in the literature relate to enterprise size (Al-Qirim 2004b; Huang *et al.* 2004), type of products and services, capital, human resources, expertise, efficiency, priorities and profitability. Some studies examined the influence of factors such as the information intensity of products and services (Al-Qirim 2004b; Huang *et al.* 2004). Diochon and Wright (2003) examined efficiency, effectiveness and expertise. Riemenschneider and McKinney (2001) found cost, security and training to be barriers to EEIT adoption. Researchers considering money issues include Bacheldor (2003), Caldeira and Ward (2002), Kanter (2001) and Lawrence (2002). Organizational factors (called internal context factors) examined by Caldeira and Ward (2002) include availability of financial resources, human resources, users' attitudes, power relationships, organizational structure and IS/IT competencies. Huang *et al.* (2004) looked at growth orientation, ownership structure and size of firms in addition to information intensity of products/processes. In Kanter's (2001) study of dot-coms, the most frequently identified barrier to adoption of EEIT was that 'staff has inadequate technical or web-specific skills' (38% of respondents).

The five organizational factors included in the current survey are: availability of technical staff or consultants with web-skills (Technical Expertise); priority relative to other projects that require existing resources and time (Priority); resulting reduction in number of employees (Employee Reduction); projected profitability of e-commerce (Profitability); and access to capital for start-up (Capital).

Technological factors. The research literature identifies a number of technology-related factors that potentially affect EEIT adoption decisions. Technological factors include technology availability, cost, security, reliability and capabilities. Al-Qirim (2004b) examines relative advantage, cost and compatibility. Caldeira and Ward (2002) identify several technology variables including availability of external expertise and services, quality of software available in the market, vendor support, type of IS/IT solutions available to the firm, IS/IT objectives and assumptions and evaluation of IS/IT benefits. In Kanter's (2001) study of global digital trends, one of the most frequently identified barriers to adoption of EEIT was that technology and tools were inadequate, unavailable or unreliable (34% of respondents) (see also Jensen 2003). Raymond *et al.* (2001) examined the presence of and access to information networks. Some of the variation in factors and findings may be attributed to whether researchers focused exclusively on electronic commerce or used a somewhat broader definition of information technology.

Six technological factors are included in the current survey: Cost to setup and maintain (Cost); technology for selling products or services online (EC Technology); access to network services or infrastructure to support Web and Internet Technologies (Infrastructure); reliability of Web and Internet technologies (Reliability); security issues (Security); and availability or adequacy of existing technology (Technology Availability).

In summary, the research literature on factors influencing EEIT adoption decisions produced an extensive list of factors, many of them overlapping or seemingly using different terminology for essentially the same factor. Moreover, factors cited as incentives and barriers often overlapped. Incentives or barriers found to be significant by one researcher were not always found significant by others. Therefore, it was decided to take the approach of identifying factors as neutral statements and asking respondents to indicate whether they were barriers or incentives, or not a factor, in their decisions to adopt or not adopt EEIT. The null hypothesis tested in the case of each of the 26 factors was that the factor would have no impact as an incentive or a barrier on the decision to use Web and Internet technologies. To our knowledge, this is the first study to take this approach. Table 1 shows all of the factors that were considered in this study, the category they are in, and the wording as it appeared in the survey instrument.

Data collection

Data were collected through the use of a mailed survey instrument. The final form of the instrument was developed in three stages.

1. A pilot study was completed first. This was composed of a simple two-page survey distributed at a regional small business conference. Usable responses to the pilot survey were collected from 29 conference attendees. Data collected from this pilot (Wymer *et al.* 2003) were used to develop a first draft of the larger four-page instrument used in this study.
2. A first draft of the final instrument was printed and distributed to ten local small businesses. Follow-up interviews were completed with three of these businesses to clarify respondents' understanding of the questions and responses.

Table 1. Factors influencing EEIT adoption decisions, and the description of the factors as they appear in the survey instrument

Code	*Factor name*	*Factor description as it appears in survey instrument*
Environmental factors		
a	Competitive Pressure	Competitive pressure from other Internet adopters within my industry
b	Government	Government rules and regulations
c	Market	Viable market or customer base for e-commerce
d	Partners/Vendors	Availability of the right partners with whom to work
e	Supplier Readiness	Readiness of suppliers for electronic business
Knowledge factors		
f	Change Experience	Employee experience with making major changes
g	Executive Experience	Experience of top executives with computers and the Internet
h	Innovativeness	Your company's willingness to adopt new technology
i	Models	Models of successful use in my industry
j	Need	Perceived need for change or implementation of Web and Internet Technologies
k	Prior Experience	The company's prior experience with new technology implementations
l	Trust	Trust or confidence in Web and Internet Technologies
m	Understanding	Understanding of available opportunities and options with e-commerce
n	Value	Perceived value or relevance to the business
Organizational factors		
o	Capital	Access to capital for start-up
p	Employee Reduction	Resulting reduction in number of employees
q	Priority	Priority relative to other projects that require existing resources and time
r	Profitability	Projected profitability of e-commerce
s	Technical Expertise	Availability of technical staff or consultants with web-skills
Technology factors		
t	Cost	Cost to setup and maintain
u	EC Technology	Technology for selling products or services online
v	Infrastructure	Access to network services or infrastructure to support Web and Internet Technologies
w	Reliability	Reliability of Web and Internet Technologies
x	Security	Security issues
y	Technology Availability	Availability or adequacy of existing technology and tools
z	Other	Other _____

3. Results from these interviews were used to edit and clarify questions for the final full survey. The final copy of the survey was printed on optical scan forms for easier and more accurate data entry.

The target population surveyed was small and medium businesses in the 49 Appalachian counties of Kentucky, USA. These counties are part of a rural area that has traditionally been fairly impoverished and lacking in physical infrastructure (Dodson *et al.* 2002; Oden and Strover 2002). All SMEs in this Eastern Kentucky region were included in the population with the exception of, gas stations and franchised restaurants. This population comprised 2,156 qualifying businesses in total (these businesses make up approximately 96% of all businesses in the region). No sampling was done. The surveys were mailed using first class postage to identified executives in each business. The executive names and addresses of businesses were obtained from a commercially available database from Harris InfoSource, Inc. A SME was defined as having 500 or fewer employees. This criterion of 500 or fewer employees is the most common measure used by the United States Small Business Administration in defining a small business. (In the final returned results however, only 10 businesses were actually over 100 employees.)

Of the 2,156 total surveys mailed, 180 were returned undeliverable due to bad addresses. Leaving 1,976 presumed to have been delivered to regional businesses. Of these, 107 completed surveys were returned, giving a 5.41% response rate. Of the 107 returned surveys, 5 were from businesses over 500 employees and therefore were excluded from the data sample. This leaves a total of 102 small businesses in the final sample. The response rate of 5.41% is lower than is usually reported (commonly between 8% and 12%) however, the survey was sent to the entire population of area SMEs; there was no pre-screening or sampling. Two possible reasons for the low response rate are the length of the survey and the timing since the survey was sent at the end of the year, which is generally a time of heavy paperwork for SME executives.

The survey instrument was composed of 25 questions, several with multiple parts (for a total of 116 question parts). The instrument consisted of: 6 questions of personal information to identify the respondent; 8 questions to gather basic data about the business, including extensive information on the geographic extent of their major market segments; 10 questions on the organization's IT use and infrastructure, including one question examining primary information sources for scanning for EEIT knowledge; 1 question, with 46 parts focused on EEIT use and implementation; and the last question, composed of 26 parts, dealing with factors that influence decisions regarding adoption of EEIT.

The data from this last question, dealing with factors that influence decisions about use of EEIT, are the main focus of this paper. This question asked: 'For each of the factors below, please rate the impact that it has had, or might have, on your use of Web and Internet technologies'. The factors that were under consideration are shown in Table 1 along with the actual language used in the survey. Each factor was phrased in a neutral manner to try to avoid any suggestion that it might affect the adoption decision either negatively or positively. Responses were collected through a 7 point Likert scale where the lowest value of -3 indicated a 'major barrier,' the midpoint 0 indicated 'no effect or influence,' and the highest value of a +3 indicated a 'major incentive.' Thus, each factor could be rated as a barrier, an incentive or 'no effect' on the decision to adopt and use EEIT. (See Question 1 in Appendix B for copy of question as it appears in the survey.)

RESULTS AND DATA ANALYSIS

This section presents results and analysis of data from two areas of our survey instrument: respondent demographics, describing the survey respondents and their businesses; and respondents' evaluation of factors that influenced their decisions, as either incentives or barriers, to adopting EEIT. Some details on respondents' use of EEIT are included and greater detail is included on the adoption of websites. In particular, the current state of adoption of a website by each business studied is used to divide the businesses into subpopulations for further analysis of perceived incentives and barriers.

Respondent demographics

The breakdown of the size of the companies responding, based upon the number of employees, was: less than 10 employees (22 respondents or 21.57%); 11–50 (47 respondents or 46%); 51–100 (20 respondents or 19.61%); 101–500 (10 respondents or 9.80%). (In total, 87% of the businesses had 100 or fewer employees, which is the number commonly used in small business research to designate a business as a small, in comparison to SME research which includes medium businesses up to 500 employees.) Regarding individuals filling out the surveys on behalf of their businesses, approximately 63% of respondents indicated on the survey that they were individually responsible for IT decisions and resources in their respective companies. Another 25.5% report themselves as directly recommending or influencing IT decisions and resources. The remaining 11% reported having some responsibility for IT decisions and resources in their company (see question 2 in Appendix B).

A number of e-business and Internet technologies were examined in this study, but this paper will focus on the adoption of company websites and the use of e-commerce on the sites. Forty-seven (46%) respondents reported having a website and listed their domain name. This is in line with common findings in the US which indicate that approximately 50% of US small businesses have a website (Glover 2000). Of the remaining 55 (54%) businesses: 36.8% reported that they have plans to develop a website within one year, 12.3% plan to develop one within 2-5 years, 44% report that they are considering it but have no definite plans and only 7.02% report that they will not develop a company website (see question 3 in Appendix B). Of the 47 respondents that report having a website, only 10 process any sales via their website and only 3 companies process any significant amount, i.e., over 10% of their total sales are online.

The data from the survey were first compiled and statistical tests performed to identify factors significant as incentives or barriers for the entire population. Then, to further examine how certain factors might influence the decision to adopt, additional analyses were conducted. First, adopters of websites versus all non-adopters of websites are compared. Then, non-adopters of websites are divided into sub-groups based upon whether they expressed an intention to adopt a website or no intention of adopting a website. Thus, data are reported for the following five different groupings:

- All Respondents
- Adopters, defined as all respondents who had adopted a website at the time of the survey (46% of all respondents),
- Intend to Adopt, defined as those respondents who expressed an intention to adopt a website within the next 1–5 years (26.5% of all respondents),
- Will Not Adopt, defined as those respondents who will not adopt or who have no plans to adopt a website (27.5% of all respondents).
- Non-Adopters defined as those respondenets who 'intend to adopt' and those who 'will not adopt'. (54% of all respondents) (henceforth called: non-adopters).

Factors influencing the adoption decision

Significant factors were identified using standard T-tests. The null hypothesis considered, based upon our use of neutral factors, was that there would be no effect for each factor on the adoption decision and therefore the factor would have a zero value. Factors were considered significant if a t-Test indicated the factor did have an effect upon adoption, with a minimum confidence level of 95%. (Details of the analysis for all factors for all groups considered are shown in Appendix A.) Of the 26 factors that were considered (Table 1), only 16 factors were shown to be statistically significant for at least one of the 5 groups examined. For the group of All Respondents, ten factors were significant at the 0.05 level or higher, based upon the T-tests. These factors included: six incentives (Innovativeness, Need, Competitive Pressure, Value, Government, and Reliability) and four barriers (Cost, Priority, Security, and Capital). In addition, when all respondents were subdivided into Adopters and Non-Adopters of websites five more factors become significant within at least one group. The additional factors include four incentives perceived as significant by website Adopters only (Executive Experience, Models of use, Prior Experience and Available Technologies), plus one barrier perceived as significant only by website Non-Adopters (Partners/Vendors).

When the group of Non-Adopters is further divided into those who Intend to Adopt and those who Will Not Adopt a website, one additional factor (Market) shows up as a barrier for the Will Not Adopt group.

Figures 1 and 2 show the magnitudes of these 16 significant factors plotted. The y-axis indicates the strength of influence of the factor on the adoption decision represented by the mean value of the factor within the indicated group. In both of these figures, mean values are only shown for a particular factor if that factor was significant for the group being plotted. (Detailed results showing both magnitude and level of significance are given for all groups in Appendix A.) Figure 1 shows a comparison of the level of influence between Adopters and Non-Adopters. Figure 2 shows a comparison of the level of influence between the three levels of adoption: Adopters, those who Intend to Adopt and those who Will Not Adopt. These two graphs clearly demonstrate the differences in perceptions of factors between the groups under study; and particularly the propensity of Adopters to view more factors as incentives, while Non-Adopters view more factors as barriers.

To further simplify the comparison of the 3 sub-groups (Adopters, Intend to Adopt, and Will Not

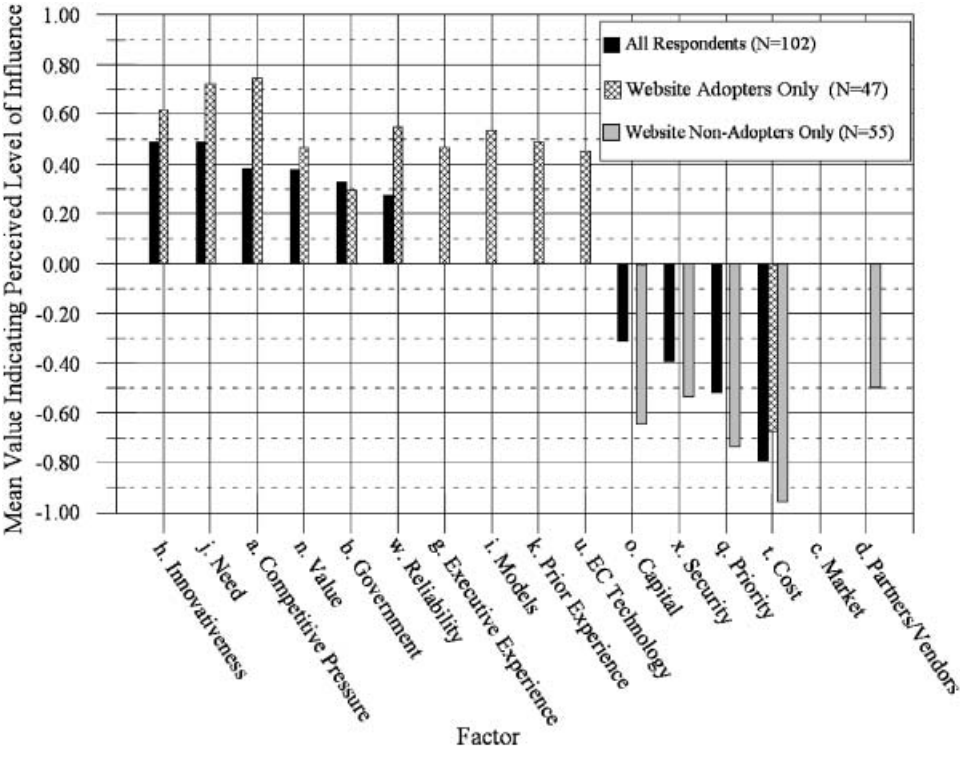

Figure 1. Factors that were statistically significant as incentives and barriers for EEIT adoption decision. Data are shown for three different groups: All respondents, website adopters and website non-adopters. The perceived influence factor was measured on a seven-point Likert scale with endpoints: +3 as a significant incentive, −3 as a significant barrier, and a centre point of zero as having no effect on the adoption decision. (Detailed data for this figure are given in Appendix A).

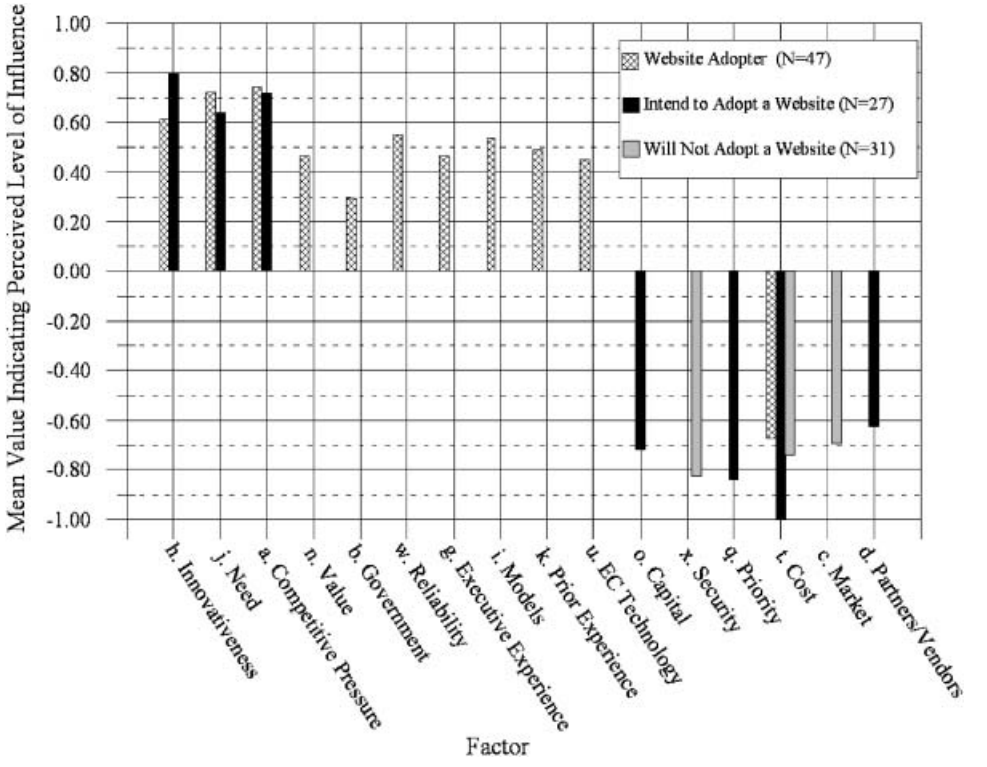

Figure 2. Factors that were statistically significant as incentives and barriers for EEIT adoption decision. Data is shown for three different groups: website adopters, non-adopters who have indicated they intend to adopt a website within 1–5 years and those non-adopters who have indicated they will not adopt a website. (Detailed data for this figure are given in the tables shown in Appendix A).

Adopt) Table 2 and Table 3 summarize the analysis showing a comparison of the relative rankings of the factors based on their mean values within each group. In these tables, the factor with the highest absolute value of the mean in each group is ranked with a value of 1 for that group, and subsequent higher rank values indicate a decreasing absolute value of the mean. Table 2 shows the relative rankings for all of the statistically significant factors that had a positive mean value, i.e. those labelled as 'incentives.' While Table 3 shows the relative rankings for all of the statistically significant factors that had a negative mean value, i.e. those labeled as 'barriers'.

In order to more explicitly examine the differences in influence of factors between the different adoption groups, a one-way ANOVA was performed to highlight those factors for which there were statistically significant

Table 2. Comparison of the relative ranking of those significant factors that were considered as incentives between groups at different levels of adoption

		Ranking based on mean value			
	Factors considered as incentives	*All Respondents*	*Adopters*	*Intend to Adopt*	*Will Not Adopt*
j	Need	1	2	1	–
h	Innovativeness	2	3	2	–
a	Competitive Pressure	3	1	–	–
n	Value	4	7	3	–
b	Government	5	9	–	–
w	Reliability	6	4	–	–
u	EC Technology	7	8	–	–
i	Models	–	5	–	–
k	Prior Experience	–	6	–	–
g	Executive Experience	–	7	–	–

Designation letters correspond to those shown in Table 1 for the given factor.

Table 3. Comparison of the relative ranking of those significant factors that were considered as barriers between groups at different levels of adoption

		Ranking based on absolute mean value			
	Factors considered as barriers	*All respondents*	*Adopters*	*Intend to Adopt*	*Will not Adopt*
t	Cost	1	1	1	2
q	Priority	2	–	2	–
x	Security	3	–	–	1
o	Capital	4	–	3	–
c	Market	–	–	–	3
d	Partners/Vendors	–	–	4	–

Designation letters correspond to those shown in Table 1 for the given factor.

differences between groups. Results for the analysis of significant differences between all website Adopters and all website Non-Adopters are shown in Table 4. Results for the analysis of significant differences between the two sub-groups of website Non-Adopters (i.e., those who Intend to Adopt and those who Will Not Adopt) are shown in Table 5. It is interesting to note that (with the exception of the Competitive Pressure factor) all factors that showed a statistically significant difference between the groups of either Adopters versus Non-Adopters, or Intend to Adopt versus Will Not Adopt (in Tables 4 and 5 respectively) are shown as incentives

Table 4. Results of ANOVA analysis of factors, highlighting significant differences between website Adopters and Non-Adopters

					Within group means and significance	
	Factor	*df*	*F*	*Between group significance*	*Adopters*	*Non-Adopters*
a	Competitive Pressure	86	12.767	0.001	** 0.744	0.000
d	Partners/Vendors	85	9.812	0.002	0.286	* −0.500
k	Prior Experience	85	7.183	0.009	** 0.488	−0.163
l	Models	87	6.266	0.014	* 0.535	−0.178
w	Reliability	85	6.156	0.015	** 0.548	−0.023
o	Capital	88	5.897	0.017	0.045	* −0.644
s	Technical Expertise	90	4.553	0.036	0.455	−0.255

*indicates a factor significant in that group at the 0.05 level, ** indicates a factor significant in that group at the 0.001 level) (df indicates the Degrees of Freedom.)

Table 5. Results of ANOVA analysis of factors, highlighting significant differences between respondents who Intend to Adopt a website and those who indicate they Will Not Adopt a website

					Within group means and significance	
	Factor	df	F	Between group significance	Intend to Adopt	Will Not Adopt
n	Value	46	13.522	0.001	* 0.720	−0.182
j	Need	46	9.275	0.004	** 0.640	−0.136
u	EC Technology	45	5.024	0.030	0.333	−0.227
h	Innovativeness	45	4.518	0.039	** 0.800	−0.143
c	Market	45	4.417	0.041	0.130	* −0.696

*indicates a factor significant in that group at the 0.05 level
** indicates a factor significant in that group at the 0.001 level
df indicates the Degrees of Freedom

in one group but as barriers in the comparison group. That is, if one of these statistically different factors were perceived as an incentive by Adopters the same factor is perceived as a barrier by Non-Adopters. The same holds true between the two groups of Intend to Adopt and Will Not Adopt, with those who Intend to Adopt viewing all factors that were a significant difference between the two groups as incentives and those who Will Not Adopt viewing all of the exact same factors as barriers.

DISCUSSION

The literature examining adoption of EEIT by businesses discusses a very large number of factors that influence EEIT adoption or use decisions either as barriers or incentives. This study consolidates many of the factors found in the literature into 26 neutral factors. All factors were assumed to be neutral (as a null hypothesis) and a t-Test indicated that 16 of the 26 factors did have a noticeable effect upon the adoption decision (with at least a 95% confidence level). These 16 can be seen in Figures 1 and 2, as well as in the detail tables for each group in Appendix A. In terms of the 4 categories of factors considered (Environmental Factors, Knowledge Factors, Organizational Factors and Technical Factors), some factors were shown as significant within each category.

For the five different adoption groups, the only consistent factor that came out significant across all groups was the cost of EEIT. All groups considered this factor as a barrier to EEIT use. Cost was, on average, the most important barrier for all groups, with the exception of those who indicated they would not adopt, for which it is the second most important. Two factors that had little attention in the literature (Effect of Government Rules and Regulations and Models of successful use) appeared as significant in this study for website Adopters. It is not clear at this time how government rules and regulations may have acted as an incentive. This will be investigated through further follow-up interviews, but one hypothesis could be the substantial initiatives that the state of Kentucky's government has in trying to encourage technology development in the state and in the rural regions such as our survey area in particular.

Another factor that stood out strongly when looking at Adopters was Competitive Pressure. On average it was the most important factor for Adopters and it also showed the most significant difference between the groups of Adopters and Non-Adopters. It is widely recognized that Competitive Pressure is an important factor in whether companies adopt (Al-Qirim 2004b; Burgess 2002; Sinkkonen 2001). Yet surprisingly, it was not significant for those who Intend to Adopt. This could be because recognition and understanding of the strategic issues, like pressure from competition, increase with increasing usage (Diochon and Wright 2003). This issue requires further exploration to detect a possible direct link between the knowledge and use of EEIT with an awareness of opportunity and competition.

Looking at the differences in how factors are perceived among groups at the various levels of adoption (Figure 2) can give us insight into the important factors that IS research needs to examine in applications of adoption models with EEIT and SMEs. As might be expected, Adopters saw numerous incentives (10 were significant, see Tables 2 and A2) among the factors considered, but only one barrier (Cost). While those who indicated that they Will Not Adopt show only three factors as significant and those were all perceived as barriers (Security, Cost, Market)(see Tables 3 and A4). Although overall, for All Respondents as a group, Security showed up as a significant barrier, the only separate group for which it showed as significant was for those who Will Not Adopt. For this group of non-adopters, Security was the most important barrier. Perceptions of security did not feature prominently in the literature as a factor for adoption, but this result seems to imply that it is an important factor influencing perceptions of the technology, particularly by those who are considering adoption and should be explored further.

As might be expected, those in the middle of the adoption spectrum, those who have indicated they Intend to Adopt but had not done so at the time of the survey, showed a greater mix of perceived factors as both barriers and incentives. Three were considered as incentives (Need, Innovativeness, Value) and four as barriers (Cost, Priority, Capital and Partners/Vendors). Three of these four barriers (Cost, Priority and Capital) deal with resource issues and would seem to indicate that a major reason these companies delay adoption is a lack of resources to initiate and support EEIT. The significant barrier dealing with a perceived lack of available partners with which to work is one that is reported by other researchers as a critical issue for small businesses (Burgess 2002), and this same variable also showed up as a statistically significant difference between Adopters (who considered it as an incentive) and those who only Intend to Adopt (who considered it a barrier).

Three factors were perceived as incentives for those who indicated that they Intend to Adopt a website, these are: perceived value of EEIT to the business (Value), perceived need that the business has for those technologies (Need), and a general, self-reported, measure of the company's willingness to adopt new technology (Innovativeness). When the two Non-Adopters subgroups (Intend to Adopt and Will Not Adopt) are compared however, Need, Value and Innovativeness appear as significant differences between these two

subgroups (Table 5). (Interestingly, however, these three factors did not show up in the significant differences between Adopters and all Non-Adopters (Table 4). This result may be attributed to the fact that group of all Non-Adopters includes the subgroup of those who Intend to Adopt and these three factors are very important to them.) The two factors Need and Value play a large role in many adoption theories, but a measure of a company's level of innovativeness does not. More data are needed on this topic to look at whether this finding on innovativeness would hold true if it was measured objectively instead of in a self-reported manner, but these findings seem to indicate that perhaps measures of innovativeness should be given more weight in adoption theory.

CONCLUSIONS AND IMPLICATIONS

The major limitation of this study is that the population of SMEs surveyed is limited to the state of Kentucky. The extent to which the participants are representative of all small and medium businesses has not been established. However, the demographics reported by participants do not provide any evidence that is inconsistent with typical characteristics associated with small and medium businesses. However, this limitation should be kept in mind when evaluating study results.

This study also effectively points out the complexity in making assumptions about using these factors as variables in quantitative analysis of adoption models. Many factors show up as significant for only one or two of the 5 groups and of all 26 factors only one, Cost, was consistently significant across all groups. Also, as demonstrated clearly in Tables 4 and 5, many factors must be handled carefully because a single factor can be perceived as having both a positive and negative effect on the adoption decisions for various subpopulations. It is hoped that this analysis can help researchers more effectively utilize these factors in future research.

In conclusion, this study found that of the 26 factors consolidated from the multitude of variables reported in the literature, only 16 were statistically significant. Moreover, perceptions regarding incentives and barriers differed among Adopters, those who Intend to Adopt and those with no intention of adopting a website (Will Not Adopt). Some of the 16 factors found significant in this study have not received much attention in prior studies and may need greater emphasis in future study of EEIT adoption in small and medium businesses. These include three incentives: Government, Innovativeness and Industry Models and one barrier – Security. Consistent with the literature, the more important barriers to EEIT use adoption dealt with cost and resource limitations.

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Appendix A

The four tables shown in the appendix represent the raw descriptive statistics for the results from the Likert scale measurement of perceived influence of factors as either barriers or incentives to adoption of EEIT. The first table, Table A1, shows the results for the entire population of All Respondents. The next 3 tables: Tables A2, A3 and A4 show data for the three distinct groups: website Adopters, those who Intend to Adopt and those who Will Not Adopt a website, respectively. The results shown are for the indicated sub-populations for data values measured on a seven-point scale with endpoints: +3 as a significant incentive, -3 as a significant barrier, and a center point of zero as no effect on the adoption decision. These tables also show the results of standard T-tests (with the null hypothesis being there is no effect on adoption and therefore a zero value), including the resulting t-value, level of significance, and lower and upper 95% confidence levels.

Table A1. (All Respondents) – Data from all respondents showing factors listed in order of descending mean value

							95% Confidence	
	Factor	*N*	*Mean*	*Standard deviation*	*t-value*	*Level of significance*	*Lower*	*Upper*
H	Innovativeness **	90	0.489	1.416	3.745	0.000	0.230	0.748
J	Need **	90	0.489	1.238	3.275	0.002	0.192	0.785
A	Competitive Pressure **	89	0.382	1.039	3.468	0.001	0.163	0.601
N	Value *	90	0.378	1.442	2.485	0.015	0.076	0.680
B	Government **	89	0.326	1.031	2.981	0.004	0.109	0.543
W	Reliability *	88	0.273	1.101	2.324	0.022	0.039	0.506
U	EC Technology	88	0.250	1.243	1.886	0.063	−0.013	0.513
g	Executive Experience	90	0.233	1.438	1.539	0.127	−0.068	0.535
k	Prior Experience	88	0.205	1.186	1.618	0.109	−0.047	0.456
i	Models	90	0.189	1.373	1.305	0.195	−0.099	0.476
e	† Supplier Readiness	90	0.178	1.303	1.294	0.199	−0.095	0.451
r	† Profitability	88	0.159	1.355	1.101	0.274	−0.128	0.446
f	† Change Experience	88	0.148	1.300	1.066	0.289	−0.128	0.423
s	† Technical Expertise	93	0.097	1.616	0.578	0.565	−0.236	0.429
p	† Employee Reduction	90	0.078	0.810	0.910	0.365	−0.092	0.248
l	† Trust	91	0.077	1.335	0.550	0.584	−0.201	0.355
y	† Technology Availability	91	0.066	1.263	0.498	0.620	−0.197	0.329
z	† Other	29	0.034	0.906	0.205	0.839	−0.310	0.379
m	† Understanding	88	−0.011	1.450	−0.074	0.942	−0.319	0.296
v	† Infrastructure	88	−0.034	1.442	−0.222	0.825	−0.340	0.271
c	Market	88	−0.102	1.524	−0.779	0.438	−0.363	0.159
d	Partners/Vendors	88	−0.102	1.232	−0.630	0.531	−0.425	0.221
o	Capital *	91	−0.308	1.412	−2.079	0.040	−0.602	−0.014
x	Security *	89	−0.393	1.427	−2.600	0.011	−0.694	−0.093
q	Priority **	91	−0.516	1.471	−3.350	0.001	−0.823	−0.210
t	Cost **	91	−0.791	1.410	−5.351	0.000	−1.085	−0.497

Designation letters correspond to those shown in Table 1

* significant at the 0.05 level for this group of all respondents

** significant at the 0.001 level for this group of all respondents

† not statistically significant for any of the groups analysed

Table A2. (Adopters) – Data from all website adopters, showing only significant factors for this group listed in order of descending mean value

	Factor	N	Mean	Standard deviation	t-value	Level of significance	95% Confidence Lower	95% Confidence Upper
j	Need	43	0.721	1.315	3.594	0.001	0.316	1.126
h	Innovativeness	44	0.614	1.401	2.905	0.006	0.188	1.040
a	Competitive Pressure	43	0.744	1.071	4.556	0.000	0.415	1.074
n	Value	43	0.465	1.486	2.053	0.046	0.008	0.922
b	Government	44	0.295	0.904	2.167	0.036	0.021	0.570
w	Reliability	42	0.548	1.087	3.266	0.002	0.209	0.886
u	EC Technology	42	0.452	1.214	2.415	0.020	0.074	0.831
g	Executive Experience	43	0.465	1.437	2.123	0.040	0.023	0.907
k	Prior Experience	43	0.488	1.009	3.174	0.003	0.178	0.799
i	Models	43	0.535	1.351	2.596	0.013	0.119	0.951
t	Cost	43	−0.674	1.410	−3.138	0.003	−1.108	−0.241

Table A3. (Intend to Adopt) – Data from respondents who indicated they intend to adopt a website, showing only significant factors for this group listed in order of descending mean value

	Factor	N	Mean	Standard deviation	t-value	Level of significance	95% Confidence Lower	95% Confidence Upper
J	Need	25	0.640	1.114	2.874	0.008	0.180	1.100
h	Innovativeness	25	0.800	1.258	3.179	0.004	0.281	1.319
n	Value	25	0.720	1.339	2.688	0.013	0.167	1.273
d	Partners/Vendors	24	−0.625	1.439	2.128	0.044	−1.233	−0.017
o	Capital	25	−0.720	1.621	2.221	0.036	−1.389	−0.051
q	Priority	25	−0.840	1.675	2.507	0.019	−1.532	−0.148
T	Cost	25	−1.040	1.428	3.641	0.001	−1.630	−0.450

Table A4. (Will Not Adopt) –Data from respondents who indicated they will not adopt a website showing only significant factors for this group listed in order of descending mean value

	Factor	N	Mean	Standard deviation	t-value	Level of significance	95% Confidence Lower	95% Confidence Upper
c	Market	23	−0.696	1.428	2.336	0.029	−1.313	−0.078
x	Security	23	−0.826	1.497	2.646	0.015	−1.473	−0.179
t	Cost	23	−0.739	1.421	2.494	0.021	−1.354	−0.125

Appendix B

This appendix provides the survey questions for which data is presented, exactly as they were asked in the survey. The question numbers indicated refer to the order in which these questions are referenced in this article, not necessarily to the order they appeared in the survey instrument.

Question 1 –

For each of the factors below, please rate the impact that it has had, or might have, on your use of Web and Internet technologies:

−3	*−2*	*−1*	*0*	*+1*	*+2*	*+3*
Major Barrier			No Effect or Influence			Strong Incentive

		Level of Impact						
		Barrier ---------- Incentive						
	Factor under consideration	*−3*	*−2*	*−1*	*0*	*1*	*2*	*3*
a	Availability of technical staff or consultants with web-skills	☐	☐	☐	☐	☐	☐	☐
b	Priority relative to other projects that require existing resources and time	☐	☐	☐	☐	☐	☐	☐
c	Availability or adequacy of existing technology and tools	☐	☐	☐	☐	☐	☐	☐
d	Availability of the right partners with whom to work	☐	☐	☐	☐	☐	☐	☐
e	Readiness of suppliers for electronic business	☐	☐	☐	☐	☐	☐	☐
f	Employee experience with making major changes	☐	☐	☐	☐	☐	☐	☐
g	Experience of top executives with computers and the Internet	☐	☐	☐	☐	☐	☐	☐
h	Government rules and regulations	☐	☐	☐	☐	☐	☐	☐
i	Perceived need for change or implementation of Web and Internet Technologies	☐	☐	☐	☐	☐	☐	☐
j	Resulting reduction in number of employees	☐	☐	☐	☐	☐	☐	☐
k	The company's prior experience with new technology implementations	☐	☐	☐	☐	☐	☐	☐
l	Perceived value or relevance to the business	☐	☐	☐	☐	☐	☐	☐
m	Security issues	☐	☐	☐	☐	☐	☐	☐
n	Technology for selling products or services online	☐	☐	☐	☐	☐	☐	☐
o	Access to network services or infrastructure to support Web and Internet Technologies	☐	☐	☐	☐	☐	☐	☐
p	Cost to set-up and maintain	☐	☐	☐	☐	☐	☐	☐
q	Viable market or customer base for e-commerce	☐	☐	☐	☐	☐	☐	☐
r	Understanding of available opportunities and options with e-commerce	☐	☐	☐	☐	☐	☐	☐
s	Projected profitability of e-commerce	☐	☐	☐	☐	☐	☐	☐
t	Your company's willingness to adopt new technology	☐	☐	☐	☐	☐	☐	☐
u	Access to capital for start-up	☐	☐	☐	☐	☐	☐	☐
v	Trust or confidence in Web and Internet Technologies	☐	☐	☐	☐	☐	☐	☐
w	Models of successful use in my industry	☐	☐	☐	☐	☐	☐	☐
x	Competitive pressure from other Internet adopters within my industry	☐	☐	☐	☐	☐	☐	☐
y	Reliability of Web and Internet Technologies	☐	☐	☐	☐	☐	☐	☐
z	Other _____	☐	☐	☐	☐	☐	☐	☐
		−3	−2	−1	0	1	2	3
		Barrier ---------- Incentive						

Question 2 –

What is your level of responsibility for business decisions regarding computing and information technology resources within your company?

☐ Directly Responsible ☐ Some Responsibility
☐ Only Recommend or Influence Decisions ☐ No Responsibility

Questions 3 & 4 –

Does your business already have a website on the Internet?

☐ Yes ☐ No

a. If yes, what is the Internet name or domain (e.g. yourname.com) of your website:

_____

b. If no, what is your timeline for setting up a website?

☐ Within 1 year ☐ Within 2–5 years ☐ No definite plans ☐ Will not do it

Question 5 –

If you process Sales Transactions via your website, what percentage of total sales comes from your website?

☐ We don't process Sales Transactions via our website
☐ Less than 10%
☐ 10 to 30%
☐ 30 to 50%
☐ More than 50%