THE IMPACT OF THE DECISION MAKER ON THE USE & PERCEIVED VALUE OF INTERNET TECHNOLOGIES

CJ Rhoads, Kutztown University

ABSTRACT

The purpose of this research is to investigate what impact the role of the Information Technology Decision-maker within an organization has on the use and perceived value of new technologies such as the Internet. A survey of 584 companies revealed a significant relationship between the role of the decision-maker and the use of the Internet technologies.

Furthermore, companies where the Chief Information Officer makes the decision are less likely to own their own domain name, but more likely to have a spam filter and large connections to the Internet. Companies where the Chief Executive Officer makes the decisions are more likely to own their own domain name, and invest in customer facing programs, but less likely to utilize all aspects of technology effectively.

INTRODUCTION

Over a three year period, an annual survey was conducted on the use of business technology in companies of all industries and sizes in Berks County, Pennsylvania in preparation for a presentation of the descriptive statistics at an annual Technology Forecast Breakfast held by the Berks County Chamber of Commerce. As can be seen in Figure 1, I noticed a trend which seemed to show a striking change in Internet technology use among the companies in the survey. While the data gathered the first year (2003) had too many differences in question type to include in any statistical analysis, the last two years were similar enough, with enough variety of responses, to investigate further.

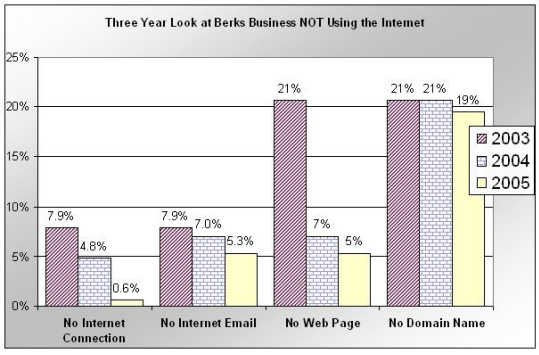

Figure 1. Three Year Look at Internet Use

One of the questions that presented itself upon reviewing this data: Was the Decision-maker one of the factors that influenced the use of Internet technology? Was there a strong relationship between the perceived value of technology and the use of new technologies such as the Internet? This paper focuses on that investigation.

The results of this investigation will help businesses determine who should be on the team when making decisions about information technology projects. Furthermore, if the relationships between perceived technology value and the use of new technologies such as the Internet is strong, it would suggest further research into whether or not there is a causal relationship between the factors.

IMPACT OF THE ROLE OF THE DECISION-MAKER ON USE AND VALUE OF INFORMATION TECHNOLOGY

Despite thousands of investigations and hundreds of deliberate research projects, the argument rages on about whether or not Information Technology (IT) has lived up to its promise regarding its value. (Bannister & Remenyi, 2000; Black & Lynch, 2001; Brown & Hagel III, 2003; Carr, 2003; Dedrick, Gurbaxani, & Kraemer, 2003; Foster & Flynn, 1984; Fried, 1993; Khosla & Pal, 2002; Loiacono, 2004; Mechlin & Berg, 1980; Strassmann, 2004; Tallon, Kraemer, & Gurbaxani, 2000; Thomas, 2004; Varian, 2003; Whitworth, Williams, Palvia, & Aasheim, 2005; Zhu, Kraemer, Xu, & Dedrick, 2004) For a more in-depth look at this issue, Dedrick provided the most comprehensive search of the research and comprehensively outlined the current findings.

For my study, I chose to focus on three factors; the decision-making process, the perceived value of IT, and the use of new technologies such as the Internet, Many questions come to mind.

- Within the decision-making process, who is the final decision-maker on an IT projects?
  1) the head of the whole company such as the Chief Executive Officer (CEO)?
  2) the financial head such as the Chief Financial Officer (CFO)?
  3) the head of operations such as the Chief Operations Officer (COO)? or
  4) the head of Information Technology such as the Chief Information Officer (CIO)?
- Within the decision-making process, what impact does joint or group decision-making have on the use of technology?
- Does it matter if the CIO is part of the decision-making process?
- Does the organizational role of the decision-maker within the decision making process have an impact on the use of new technologies?
- Does the perceived value of IT by the decision-maker (i.e. – answering "Very Valuable" when asked) have any impact on the use of new technologies within a company?

After a brief review of the literature related to these factors, we will discuss the survey results and what they can tell us.

LITERATURE

Factor 1: Decision-making Research

There have been quite a few studies on decision-making that included IT influences. (Abdul-Gader & Kozar, 1995; Aksoy & Albayrak, 2005; Bannister & Remenyi, 2000; Bergman & Feser, 2001; Cummings & Harris, 1999; Fried, 1993; Harrison, Mykytyn Jr., & Riemenschneider, 1997; Henderson & Nutt, 1980; Kalu, 2001; Lahdelma, Miettinen, & Salminen, 2005; Spillan, Harcar, Kucukemiroglu, Breshin, & Antunez de Mayolo, Cesar, 2005)

Calhoun (Bergman & Feser, 2001) found that cultural communication preference impacted the use of information technology within the decision-making process. They identified and studied 17 decision attributes that were related to IT usage.

- Decision speed
- Information overload
- Routinization of decision making
- Forecast accuracy
- Decision time horizon
- Problem formulation
- Data quantification
- Decision effectiveness
- Alternatives generated
- Extent of analysis
- Problem identification
- Data availability
- Job complexity
- Timeliness of data
- Data accuracy
- Decision communications
- Decision participation

What Calhoun did not do was study the decision-making process on the use of technology. Benamati (2001) included decision-making styles as a factor on level of technology knowledge transfer (which could be construed as highly correlated with reported use of technology). Banamati found that corporations with more formalized mechanistic structures and more stable direction-oriented cultures were associated with higher levels of knowledge transfer of technology. Conversely, research organizations with more organic structures, more flexible change-oriented cultures, and more customized university policies for intellectual property rights, patent ownership, and licensing were associated with higher levels of technology transfer. Another major impact was the partnership between the corporation and research organization. A trusting relationship in its university research center partner increased technology transfer. (Benamati & Lederer, 2001)

Factor 2: Perceived Value of IT

Given the almost 200 different methods found in the literature on how to calculate the value of IT (Bannister & Remenyi, 2000), it makes sense that we focus simply on whether or not the decision-maker believes that IT is valuable. There is a strong precedent for this approach.

Perhaps the strongest case for utilizing the perceived value of IT rather than the calculated value comes form Tallon (2000). Although they admit that one can debate the validity of utilizing perceptual measures as a proxy for objective measurements, they cite abundant research that shows solid support for the idea that the correlation between the perceived value and the actual value is very strong, even if the actual value is difficult to calculate.

There have been other studies done that point to a relationship between attitude about IT and use of IT. Harrison (1997) found that attitude toward IT had a strong on IT adoption. Abdul-Grader (1995) also found that attitude toward IT influenced use of IT, as well as the sources of information used to decide about IT projects. (Abdul-Gader & Kozar, 1995; Harrison et al.,

1997) In none of these cases was a causality found, however.

Of course, neither does this research purport to establish causality. Whether Attitude about IT influences Use of IT or the Use of IT influences Attitude probably cannot be determined as the two are iteratively intertwined. We can utilize the relationship, however, to establish that the role of the decision-maker influences both the attitude about the perceived valued of IT as well as actual use of IT within an organization.

Factor 3: Use of New Technologies

The dependent factor is the Use of New Technologies such as the Internet. Our questions There has been a great deal of research done over the years on the influences on the speed of adoption rate of various technologies. (Agarwal & Prasad, 1999; Benamati & Lederer, 2001; Bergman & Feser, 2001; Black & Lynch, 2001; Daniel & Grimshaw, 2002; Gopalakrishnan & Santoro, 2004; Harrison et al., 1997; Khosla & Pal, 2002; Levine & Rossmoore, 1994; Peart, 2002; Whitworth et al., 2005) In general, most researchers find that support from both top decision-makers and line-staff influence technology adoption. Furthemore, the amount and quality of the training, as well as the actual benefits of the information technology are the most critical factors that impact how quickly new technologies are adopted.

While there is a great deal of research about the use of the Internet in business, and quite a bit about the mind-boggling speed with which the Internet has become a business tool, most research focuses on just one aspect of Internet use such as e-commerce, web-design, or the use of applications on the web. (Aragon-Correa & Cordon-Pozo, 2005; Banerjee & Kumar, 2002; Bharati & Tarasewich, 2002; Chan-Olmstead & Ha, 2003; Chau, Cole, Massey, Montoya-Weiss, & O'Keefe, 2002; Cobb, 2003; Darley, 2003; Dutta & Roy, 2003; Englander & Moy, 2003; Larsen & Bloniarz, 2000; Maamar, Dorion, & Daigle, 2001; Simmers, 2002; Simpson, 2004)

I wanted to identify a general "use of the Internet" variable that included using the Internet as a tool within business to purchase items as well as putting up a web site, utilizing email, and providing products and services over the web. I believe the more varied the aspects of the Internet utilized in business, the higher the quality of "Internet Use".

RESEARCH METHODOLOGY

Questionnaires were sent in the mail to the technology contact and the main contact of businesses in Berks County in Southeastern Pennsylvania (with directions to have the main technology decision-maker respond) over a two year period. Our response rate was 10% the first year, and 7% the second year (reflecting a different and larger sample population than the first year). The questionnaires were ordinarily faxed back, although the address was included if the respondent wished to send the response in the mail. Incidentally, after some consideration, I chose not to utilize a web-based survey tool due to the inherent bias it would introduce. There have been studies that identified ways to decrease the impact that the technology bias produces on the results (Burkey & Kuechler, 2003), however in this case, since technology use was the main focus of the questionnaire, I felt the bias introduced due to the technical method of survey would not be able to be eliminated. Companies more familiar with technology would be more apt to answer, resulting in the absence of a good sampling from both technical and non-technical corporations. While the use of the fax machine may also introduce a bias, I felt the bias would not impact the results as a web-based survey might.

Unusable responses were eliminated prior to the analysis. The remaining 584 surveys were compared to the population of businesses within the county (a typical county in Southeastern Pennsylvania) to ensure the sample was properly stratified to include the proper proportion of small, medium, and large businesses, as well as a wide range of industries. Figure 2 shows the organizations by number of employees, and the years in which the data was gathered. An eyeball analysis revealed that the sample roughly matched the demographics of the county organizations as identified by the Chamber of Commerce statistics and no single group was underrepresented. The second batch of questionnaires were sent out to a larger list of local companies and returned a slightly larger proportion of tiny organizations (1-5 employees). However, a review of the data determined that this slight anomaly did not impinge upon the validity of the non-parametric statistic used for comparison regarding the use of technology since the entire sample was tested as a whole rather than breaking up the data into years prior to testing.

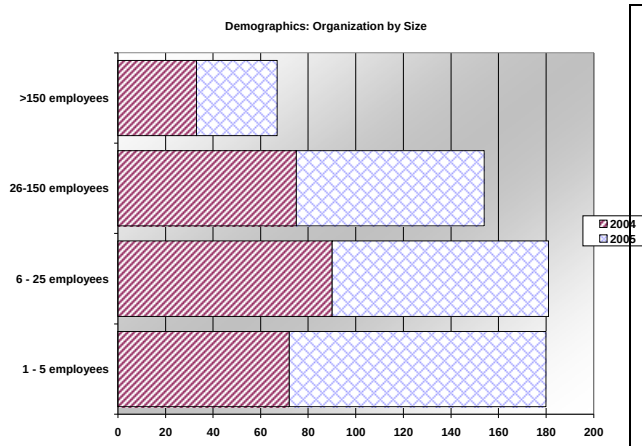

Figure 2. Stratified Size Demographics

The independent variable, Role of Technology Decision-maker within the organization, was nominal. The question is shown in Figure 3.

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        Who, within your company, makes
technology decisions?
         CEO/President/Owner
         CFO/Controller/Finance VP
         COO/Operations/Manager
         Individual Dept Mgrs
         CIO/IT Director/ IT Manager*
         Other:_______
         *IT stands for Information Technology.
May also be DP (Data processing), EDP
(Electronic Data Processing), or IS
(Information Systems)
```

Figure 3. Decision-maker question.

Multiple answers were accepted, providing us with 720 different potential responses to the question. The response frequency was grouped into various categories for the analysis.

The dependent variable, Technology Use, was an index derived from a combination of the answers to the questions in Figure 4: To determine the level or quality of use of technology, I utilized the responses to a number of questions about various technologies all relating to the Internet. There is a precedent for combining answers into an index. Several researchers combine different aspects of technology use into an "index" so that the comparison is applicable across different technologies, different industries, and different company sizes. (Aksoy & Albayrak, 2005; Bergman & Feser, 2001; Foster & Flynn, 1984; Fried, 1993; Harrison et al., 1997)

```
        Email: What percentage of your
employees have a business Internet email
address
        1 - 5%
        6-25%
        26-50%
         51-75%
         76 - 100%

        Web: Do you currently have one or more
domain name(s) registered in your companies'
name and only used by your company?
         Yes
         No

        Ecommerce: During the next 12 months,
do you plan to implement transaction
processing (e-commerce) on your web site?
         Yes
         No
         Already doing

        WebDevel:To whom do you turn for web
site development?
         Local developer
         Non-local developer
         In house developer
         No web page

        Connection: What kind of connection to
the Internet do you have at your company?
         Dialup
         T-1 (full, fractional, frame relay)
         DSL
         Cable (i.e. - Comcast)
        Wireless (Satellite)
         None
        InfilteredSpam: If you receive
unfiltered email, what percentage do you
consider to be spam? (spam is unwanted bulk
email)
         1 - 5%
        6-25%
        26-50%
         51-75%
         76 - 100%
        FilteredSpam: If you receive email
already filtered for spam, what percentage of
spam do you still get?
         1 - 5%
        6-25%
        26-50%
         51-75%
         76 - 100%
```

Figure 4. Internet Technology Related Questions

Based on the answers, an organization was characterized as "Savvy, Blossoming, Base, or Unversed" in their use of Internet technology. The rules utilized to establish are listed in Figure 5.

Savvy	Email >=4, Web = 1, Ecommerce <>2, WebDevel <> 4, Connection <>1 or 5, Unfilteredspam > 0 or FilteredSpam > 0
Blossoming	Email >2, Web = 1, Ecommerce =1, WebDevel <> 4, Connection <>5, Unfilteredspam > 0 or FilteredSpam > 0
Base	Email <4 and >1, Web = 1, Ecommerce =1, WebDevel <> 4, Connection <>2, Unfilteredspam > 0 or FilteredSpam > 0
Unversed	Email <=1, Web = 2, Ecommerce 2, WebDevel = 4, Connection = 1 or 5, Unfilteredspam = 0 or FilteredSpam = 0

Figure 5. Rules for Use of Technology Index Score

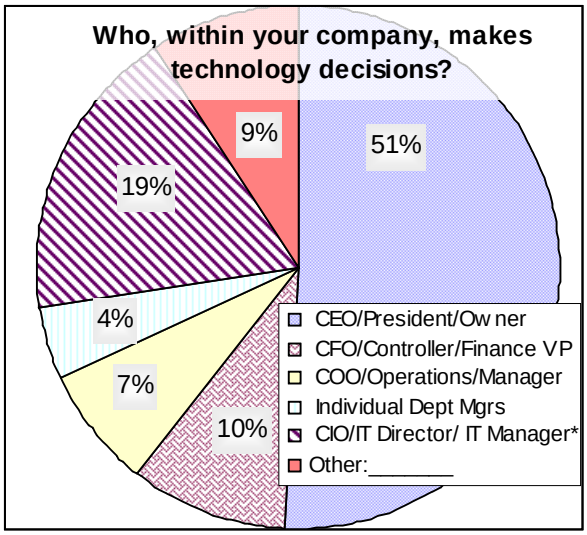

Figure 6. Decision-making Categories (not mutually exclusive)

The index was then converted to a binomial variable of a "More Effective" user of Internet technology and a "Less Effective" user of Internet technology (i.e. used technology less and/or less effectively).

Converting the data in this way provided us with a clear demarcation in order to conduct the analysis using relatively weak non-parametric chi-square test. Our decision to utilize this test of significance came from the understanding that the required assumptions of more powerful statistical test would not be met with our underlying data. Influential in our choice of tests was our decision to establish bivariate variables rather than utilizing the relatively inexact categories of Technology Use (Savvy, Blossoming, Base, Unversed) which were based on questions not specifically designed for the purpose. My thinking was that if the data showed significance with this relatively weak statistical test, the findings would be more general than other possible ways of analyzing the data, making our choice the more conservative one. Subsequent, more directed, research methodology could then be used to investigate a refined hypothesis as a follow up to this one. Therefore, this non-parametric test is most appropriate.

ANALYSIS

Clearly, the answer to the first question proposed is that the CEO/President/Owner is the technology decision maker in most companies, followed by a distant second of the CIO. It should be noted that between the two years, the CIO gained ground. When taken alone the first year, the CIO made the technology decision only 11% of the time.

The next step was to analyze whether group decision making made a difference on the use of new technologies such as the Internet. Initially, I broke out all existing combinations of group decision-making in order to do the analysis on each group, but the frequency for some of them were 3 or less, and I determined the breakouts were unsuitable for statistical analysis. In order to maintain necessary requirement of mutually exclusive comprehensive categories for the chi-square statistical test, as well as a large enough grouping size for each cell, I created two categories out of all the "combined" decision-making responses; with the CIO and without the CIO. I found that Role within the Organization of the IT Decision-maker is both statistically and meaningfully significant as can be seen in Figure 7.

Decision-Maker Role in Organization	*Percentage: Less Internet Use*	*Percentage: More Internet Use*	*Less Internet Use*	*More Internet Use*	*Expected Less Internet*	*Expected More Internet*	*Total*
CEO	81%	19%	224	54	207	71	278
CIO	60%	40%	55	36	68	23	91
CFO	74%	26%	25	9	25	9	34
COO	71%	29%	25	10	26	9	35
Department Mgr	67%	33%	12	6	13	5	18
Joint With CIO	64%	36%	18	10	21	7	28
Joint Without CIO	74%	26%	64	22	64	22	86
Other	79%	21%	11	3	10	4	14
N			434	150	434	150	584
	Chi-square =		16.29	Significant (p < .02) at df = 7			

Figure 7. Chi-square Analysis

Once significance was found, it is appropriate for us to view the categories without the requirement of mutually exclusive categories in order to see any patterns on the technology use based upon the Decision-maker Role. The non-exclusive groupings of the different roles involved in the decisions are reported in Figure 8.

	CEO	CIO	CFO	COO	Depart. Mgr	Joint CEO-CIO	Joint CEO-CFO	Joint CEO-COO
Less Internet Use	78%	60%	78%	69%	70%	42%	79%	62%
More Internet Use	22%	40%	22%	31%	30%	58%	21%	38%
Less Internet Use	262	73	52	33	21	11	23	8
More Internet Use	75	49	15	15	9	15	6	5
	337	122	67	48	30	26	29	13

Figure 8. Decision-making Categories (not mutually exclusive)

Clearly, group decision-making had a positive impact on the use of new technologies. The graph (Figure 9) shows the details. **The 26 decision-making teams that included both the CEO and CIO had a proportionately higher frequency of "More Internet Use" rating**. (While only 3 organizations had only the CEO and CIO making the decision, 26 had the CEO and CIO among the decision-makers.) It is also interesting to note that when the CIO was included in the decision-making, but the CEO wasn't, the frequency of "More Internet Use" was impacted, but not as much.

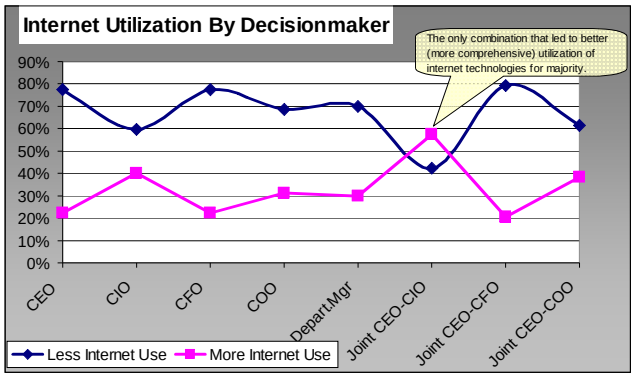

Figure 9. Common Categories of Decision-makers

A review of the correlation between the questions and the decision-maker also revealed some interesting points, though caution must be taken because the samples would not meet the assumption of normal distribution. Some correlations would be expected (such as the correlation between having a Web page and using a web developer, and the relationship between utilizing ecommerce and having filtered email). In some cases, however, a relationship turned up that is a bit surprising (Figure 10). If the CIO is among the decision-makers, it appears that the organization would be **less** likely to have a domain name (r = -.20). If the CEO is among the decision-makers, it appears that the organization is **more** likely to have a domain name (r = .18). Based upon my experience, I would propose that CIOs are more knowledgeable about Internet technologies – and therefore might have higher security concerns regarding maintaining a web site. Additionally, CIOs are often already enmeshed in legacy technology, and therefore are less likely to seek Internet solutions. CEOs, on the other hand, having less technology knowledge, are probably more likely to ignore potential security issues. Alternatively, they might simply be more fascinated with customer-focused technologies such as the Internet, and insist on utilizing that channel of customer contact and support regardless of the security risks.

Another interesting relationship was found between the CIO as the decision-maker and a higher percentage of people within the organization with email. Additionally, companies with a CIO are more likely to implement SPAM-filtering software and have increased connections to the Internet. In general, CIOs focus more on providing the majority of employees with useful technology. With satisfying existing users being a difficult job in and of itself, CIOs don't tend to focus on customer-facing technologies as much.

	Email	Web	Ecommerce	WebDevel	Connection	EmailFilter	Unfilteredspam	Filteredspam	CEO/President/Owner	CFO/Controller/Finance	COO/Operations/Manag	Individual Dept Mgrs	CIO/IT Director/ IT Mana	Other:_____	TechVal
Email	1														
Web	-0.2290965	1													
Ecommerce	-0.018933	0.08939307	1												
WebDevel	-0.0868935	0.30184404	0.07178809	1											
Connection	0.08876025	-0.1190814	-0.0231206	-0.0904261	1										
EmailFilter	-0.0636153	0.04530242	0.14334177	0.07995463	0.08051476	1									
Unfilteredspam	0.0288956	0.06716483	0.0031333	0.11263895	0.01124609	0.2957212	1								
Filteredspam	0.00672673	-0.030219	-0.1185812	0.01319761	-0.0056308	-0.473109	-0.0432978	1							
CEO/President/Owner	-0.0256171	0.18464496	0.01345754	0.03635219	0.03743059	0.01361604	0.07582217	0.01878552	1						
CFO/Controller/Finance	-0.0720651	-0.0666448	0.09827889	-0.1431437	0.04282119	0.01684008	-0.0356617	-0.0304119	-0.1050906	1					
COO/Operations/Manag	0.01271109	-0.0324318	0.0198757	0.003191	0.04606046	-0.0143234	0.02435557	-0.0093213	-0.1854912	-0.0294779	1				
Individual Dept Mgrs	-0.0235873	-0.098861	0.04697165	-0.0078695	-0.0390995	-0.0814049	-0.0269452	0.03810595	-0.0991006	0.03792654	-0.0131538	1			
CIO/IT Director/ IT Mana	0.1500508	-0.2089816	-0.0477871	-0.0226241	-0.0236154	-0.0692933	-0.0731407	-0.0255842	-0.378563	-0.0396054	-0.1077714	-0.0241777	1		
Other:_____	0.01259214	-0.012651	-0.0790733	0.00737718	-0.0628077	0.00611377	-0.027692	-0.0415546	-0.3535843	-0.0878083	-0.0614319	-0.079473	-0.1204104	1	
TechVal	-0.2250664	0.21931413	0.08195286	0.14005727	-0.0785438	0.06299159	0.07122705	-0.0279656	0.07158864	-0.0633105	-0.0050557	-0.0648087	-0.1607461	0.02373248	1

Shaded with solid border would show significance at the .01 level
Shaded with solid border would show significance at the .05 level
Caution must be made in generalizing these findings as the assumptions of homodasticity and normal distribution have not been established

Figure 10. Regression Analysis of Factors

Our final question related to the perceived value of technology by the decision-maker. The question is shown in Figure 11.

```
        TechVal: Has technology brought value
to your company?
         Much value
         Some value
         No value
```

Figure 11. Perception of Technology Value Question

The chi-square analysis (Figure 12) depicted, as expected, an extremely strong relationship between the perceived value of technology and the Use of Internet technologies. Only one of the decision-makers who responded "No Value" when asked about technology was rated with "More Internet Use". The majority of decision-makers who did not see value in technology did not utilize the Internet as much. Of course, the fact that only 5% of the sample answered "No Value" makes it difficult to determine definitively if the technology use was actually a factor, or if the excessive score is a result of the small sample size in the single cell.

	Much Value %	***Some Value %***	***No Value %***	*Much Value*	*Some Value*	*No Value*	***Total***
Less Internet Use	63%	31%	6%	272	136	26	434
More Internet Use	81%	19%	1%	121	28	1	150
	67%	28%	5%	393	164	27	584
Chi-square = 166, strongly significant (13.81 is value at p > .001)							

Figure 12. Chi-square analysis of Perceived Technology Value

A graph (Figure 13) of the perceived value illustrates.

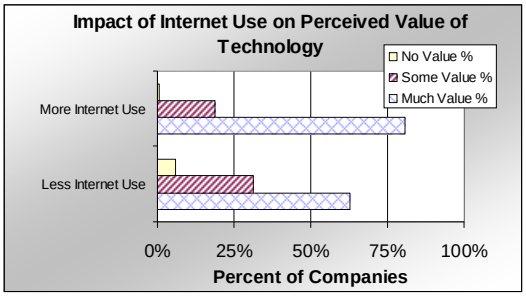

Figure 13. Graph of Perceived Value Responses

Organizations that use internet technology more value technology more. Causality, of course, cannot be determined as the iterative process of valuing technology and therefore using it more or using more and therefore valuing more cannot be separated. However – given this strong relationship, we can probably say that when the CIO is involved in the decision-making, technology is both used more, and valued more. It would be equally correct to say that when technology is perceived as more valuable, there is more likely to be someone more technology knowledgeable (like a CIO) in the decision-making process.

Further study is needed to determine the proportion of influence the information technology decision-maker role has on the use of technologies and the perception of the value of information technologies. Another fertile avenue of study may be to determine if changing the decision-making process in an organization affects the use or perceived value of information technology.

PRACTICAL IMPLICATIONS

Obviously, the most important practical implication is that both the CIO and the CEO should be involved in any technology decision. Currently, the CEO makes the decision, alone, the majority of time. If only one or the other makes the decision, optimum technology use does not appear be reached. The CEO tends to focus on customer-related technology such as web domains, while the CIO tends to focus on infrastructure and email. Both are needed for optimum use of information technology.

We don't know which is the chicken and which is the egg, more information technology use or perceived value of technology. However, it is clear that using new technologies such as the internet corresponds to a higher perceived value of technology.

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Christine J Rhoads is a professor in the College of Business at Kutztown University of Pennsylvania. She received her D.Ed. in Educational Technology from Lehigh University (with a minor in Business Administration), and her M.Ed. in Educational Psychology and Instruction Design. Her research interests include Information Technology, practical implications of decision making, database design, and executive education