Implementation in a world of workstations and networks

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Abstract

This paper explores the relevance of research on implementation and user acceptance given the pervasiveness of technology in modern organizations. The paper presents the results of applying an extended model of technology acceptance to the use of broker workstations. We argue that implementation success is important in obtaining a return from the firm’s investment in technology. Data are collected at two points in time to assess user acceptance of the workstations. The results provide some support for the models and the unanticipated finding that perceptions of system quality and system ease of use decreased over time. The paper suggests that a combination of research methodologies may be appropriate for assessing user acceptance of the complex technology typically found in today’s firms. © 2000 Elsevier Science B.V. All rights reserved.

Keywords: Implementation; Technology acceptance model; Workstations; Task-technology fit

1. Introduction

The pace of change and user adoption increases with each technological innovation. It took 5 years for personal computers to become a major factor in business. Once the Internet could be used for profit, the number of service providers and users grew exponentially. With such rapid change and widespread adoption, does the organization need to be concerned with acceptance and implementation issues that have characterized earlier technology innovations? Are users finally ready to adopt technology without some of the implementation problems witnessed in the past?

This paper addresses two questions: (1) is implementation research relevant in today’s high-technology business environment; and (2) how well do models of implementation predict user acceptance of technology?

Interest in the implementation of technology began in the 1960s and 70s as many information systems failed to achieve their potential [10]. There has been a continuing stream of research on implementation, and more recently, the acceptance of technology [3,16]. With large numbers of people having computer-based workstations on their desks, and some organizations having more computers than employees, is implementation still relevant?

1.1. Implementation research

Implementation research seeks to determine what motivates people to use and accept technology. Is this an interesting and relevant question today? In the era before networked computing, managers frequently complained that they did not receive a return from their investment in technology. It seemed that many senior managers were unaware of their firm’s
technology initiatives. With the exponential growth of the Internet, the impact of technology stocks on the market, and the frequent articles about information technology, electronic commerce and the Web, it is hard to believe that any U.S. executive lacks awareness of the pervasiveness of today's technology. Does this awareness translate into acceptance and use? Can research on implementation help answer this question?

Past research on implementation has been categorized as falling into 'factor' and 'process' studies [11,17]. The setting for this research generally involved mainframe or minicomputers with batch and on-line applications; there are few studies involving PCs, and only one that we are aware of includes networked, multifunctional workstations [13]. Factor studies are variance research; the investigator develops a model, instruments to measure the value of variables in the model, collects data and analyzes it using statistical techniques like correlation and regression analysis. The name comes from the analysis in which the variance in one variable or construct is correlated with the variance in another. Process research focuses on the actual process, generally over time, of implementing a system. This researcher is generally looking for a combination of events and actions that are necessary for success. The process researcher is likely to be a participant observer of the development process and adopt a qualitative design.

Researchers who favor factor studies site the rigor of the research designs and the fact that they generally collect data from a large number of users. Statistical techniques make it possible to generalize to other settings, though the vast majority of factor studies is cross-sectional. Process researchers argue that implementation occurs over time and that one has to observe the process to understand all of its nuances. Most studies, whatever their approach, assume that system use is voluntary, or that the researchers can distinguish voluntary from required use. Requiring one to use a system reduces variance in use and makes it difficult to adopt usage as a dependent variable measuring implementation success.

2. The contemporary environment

The IT environment today is characterized by networked, multifunctional workstations. The use of some functions may be mandatory, for example, a stock broker may only be able to obtain a real-time quote through his or her workstation. However, workstation usage also may have a highly voluntary component; the stock broker chooses whether to use analytic functions or not. The actual usage of a workstation is very hard to monitor when the device is turned on all day on the user's desk. While a program could count keystrokes and identify functions being used, the results may be misleading. A broker may have stock tickers running across the screen all day. Is the broker looking at it or is it background?

In this environment with everyone having a workstation, why should management be concerned about implementation? First, current information technology represent a very large investment, more so than systems in earlier eras. The Department of Commerce has estimated that 45% of capital investment in the U.S. is for information technology. A few years ago NationsBank had a $500 million software budget and an overall IT expenditure of $1.9 billion a year. When it and Bank of America merged, the combined bank had an initial annual technology budget of $4 billion.

If management makes this kind of investment, it must believe the systems that result will be of value to the firm when users work with them. Systems like the DSS at Frito-Lay, communications-oriented technology at VeriFone, and groupware at a number of firms suggests that there is a large component of voluntary use for some of the functions found on a typical workstation. Successful implementation and user acceptance of this technology should be a question of great importance to senior management and to IT management in the firm. We feel that the answer to the first question in the paper is that implementation is an important issue in today's technological environment.

2.1. Models of implementation and acceptance

Early research on implementation can be characterized as empirically-driven. Factor researchers proposed descriptive models of implementation, including variables other researchers had found to be related to success, and usually adding new variables

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1 Comments by Hugh McColl, NationsBank's chairman at an NYU CEO Forum, 4 July 1997.
as well [12,17]. Process researchers often employed a model of the consultation process from the organization development literature as a framework for their observations and analysis. None of these models had a strong theoretical base.

Davis [4] proposed the technology acceptance model (TAM) for implementation research, which is based on the theory of reasoned action [5]. This model is a variance or factor model and it contains many of the variables in past implementation research. However, the model is more grounded in theory than the past descriptive models of implementation. Davis’ original model includes two perceptions, ease of use and usefulness. These perceptions predict attitudes toward using a system. Attitudes predict intentions to use, and intentions predict actual usage. In various tests of the model, Davis and others have recommended using a simplified version of the model in which the two perceptions predict either intentions or use, dropping attitudes, which have proven to be weak predictors of either intentions or usage. In most cases, researchers have been able to measure only intentions or usage, so one or the other has been the dependent variable.

Davis’ results supported his model (1989); several other studies also provide evidence for TAM. Davis, Bagozzi and Warshaw compared a model based on the theory of reasoned action with TAM and found mixed results for both models, though there was support for the perceptions and their positive relationship with intentions to use a system (1989). Mathieson [14] also compared TAM with the theory of planned behavior (TPB) and found that both models predicted intention to use well, but that TAM was slightly better from an empirical view.

Taylor and Todd [20] looked at TAM and the TPB in a longitudinal study of a resource center; they concluded that a decomposed TPB provided more insights than TAM, though TAM received support from their data. In another study [21], these same authors found that TAM, modified to include subjective norms and perceived behavioral control, performed well in predicting acceptance for various users. Straub et al. [18] used TAM to compare self-report and computer monitored voice mail usage in a field setting. Szajna [19] found that a revised TAM, dropping attitudes from the model and making a slight change for pre versus post-implementation, predicted usage. She recommended adding an experience component as an extension of the model and suggested that measures of actual usage may work better than self-report measures, at least when looking at the acceptance of e-mail.

TAM has primarily been tested in experimental or quasi-experimental studies with students as the subjects rather than in the field with business professionals. The technology involved has generally included a single application or a few packages like a word processor and presentation application. There is one study of broker workstations running many applications simultaneously using TAM in a cross-sectional design [13]. However, for the most part, there has been little research on implementation and acceptance featuring modern technology.

2.2. Extending TAM

Researchers have tested TAM in laboratory settings more often than the field. We believe that the greater richness and complexity of a field setting requires consideration of more variables than are included in TAM. What theoretical justification is there for making additions to TAM, and what variables might we use to extend the model to be used in field studies of modern technology? Davis has indicated that a class of ‘external’ variables influences perceived usefulness and perceived ease of use. He sees additional variables acting through these perceptions to influence usage. Past research on implementation [12], especially related to technology acceptance by brokers [11] also offers guidelines for extending the model.

This reasoning suggests that the following variables might be added to TAM in a field setting involving stock brokers using a multifunctional workstation, as shown in Fig. 1: social norms; broker strategy; perceived system quality; broker performance.

2.2.1. Broker strategy

While the tasks of all brokers are similar, there are different ways to approach the job (Lucas, 1979). A broker may feel she can best succeed by doing research for her clients to encourage them to trade. This broker would be likely to use the features of a workstation that provided access to research information. Another strategy is to develop social ties; most of the time of a broker following this strategy would be spent at meals, visiting clients and at social functions.
The workstation would be less relevant for this broker. The broker’s strategy affects the degree to which the technology is relevant, and should be a determinant of perceptions of the workstation. The inclusion of broker strategy is consistent with the ideas expressed in the task-technology fit literature [7].

2.2.2. System quality

The quality of a system is related to whether a user can accomplish his or her tasks with a workstation. A system that omits important functions or which offers irrelevant services will not satisfy the user’s needs. System quality is a variable that IS managers should be able to influence through design and operating practices.

2.2.3. Performance

There is some evidence that technology may best fit the needs of the high performing user, or in some instances, the needs of a poorly performing worker [10]. If the system supports the worker in solving problems, its use should be associated with high levels of performance. For example, a broker might use the workstation with a client to develop recommendations on stocks to buy and sell. On the other hand, a person with poor performance may use an information system to diagnose problems and develop a strategy for improving performance. This broker might use analytic tools provided by a workstation to understand better the performance of different client portfolios.

2.2.4. Social norms

The theory of reasoned action includes social norms in predicting behavior. “According to our theory, the more a person perceives that others who are important to him think he should perform a behavior, the more he will intend to do so [6], p. 57.” Participants are not subject to the influence of senior management in a laboratory setting, and may not perceive much influence from their peers. It should be noted that in one empirical study of participation, Hartwick and Barki [8] incorporated social norms and found only weak associations with other variables. In the current study, we hope to show that norms are important in a field setting in which TAM provides part of the underlying research model.

2.3. The research model

The model in Fig. 1 follows the guidelines of Davis and Fishbein and Azjen. In particular, two external variables are hypothesized to influence perceived usefulness and perceived ease of use, strategy and system quality. Why are we interested in predicting these perceptions? The items in the scales for perceived ease of use and perceived usefulness are difficult to influence directly, for example, a typical item in these scales is ‘the workstation enhances my effectiveness’. If one believes in the causal implications of TAM, then a way to increase acceptance is to improve the user’s perceptions of ease of use and usefulness. We believe that broker strategy and system quality influence these two perceptions.

As described above, individual brokers have different approaches to their tasks; technology which fits a broker’s tasks should be perceived as more useful and easier to use than technology which exhibits a poor fit. A broker whose strategy
is supported and reinforced by the workstation should have favorable perceptions of it. The broker for whom the workstation is largely irrelevant is likely to have no or possibly unfavorable perceptions of the technology.

System quality is a rating of how easy it is to retrieve data using the workstation, its response time, accuracy, etc. It could be argued that these items are perceptions just as are ease of use and usefulness. However, management does control some of the characteristics of the technology which lead to these perceptions. Assuming causal linkages, management might be able to influence perceptions of ease of use and usefulness, and then user acceptance, by increasing the quality of the workstation’s features, for example, by improving response times.

Following the logic of Fishbein and Azjen, we have added social norms to the TAM as a direct influence on usage. Employees in a company setting are influenced by superiors, colleagues and clients. While norms may be relatively unimportant in research involving students, they are likely to have a significant influence on technology acceptance in an organization like a brokerage firm.

Based on earlier findings on performance [10], the research model hypothesizes a positive relationship between usage and performance when the workstation supports the successful broker. If a broker with low performance uses the system to help find problems, one would find a negative relationship between use and performance.

The research model in Fig. 1 extends TAM to fit the setting of an ongoing firm. It includes two external variables of broker strategy and system quality. We feel these variables influence perceived ease of use and perceived usefulness, and that they are important in designing technology. For example, the broker strategy variable suggests to designers that they consider the fit between the user’s task and the technology. Designers and managers have some control over the quality of a system, and the model proposes that quality affects acceptance through its influence on perceptions. The inclusion of social norms is important in a work environment where a variety of actors create norms that influence potential users. Finally, past research has shown that system usage, one measure of acceptance, is related to user performance.

3. The study

We collected data in the fall of 1993 and again in the fall of 1995 to test the model in Fig. 1 from the institutional brokerage group of a major stock brokerage firm. The 1993 data (time 1) was collected within 6 months of the installation of a new workstation for all brokers in the group. The workstation provided a number of functions including the ability to obtain stock quotations, to communicate via e-mail, and to analyze securities data. We developed a survey instrument based on past research, and three research assistants administered the survey in a 20–30 minute phone interview. A total of 41 out of 59 brokers in four locations completed the interviews. Two years later (time 2) we again collected data from the brokers who had responded at time 1. We were surprised to find that only 25 brokers from the original 41 remained in their same position at the time 2 survey; this is a high mortality rate, particularly for a job described as being very attractive with low turnover.

3.1. Data and variables

Table 1 provides the definition of the data included in the study. We used scales from past research or new scales which we developed after interviewing brokerage firm managers and brokers. Because brokers’ time is very valuable, the length of the phone call was limited. Therefore, we dropped some items from past scales in order to fit interview time constraints. The individual items in the scales may be found in the Appendix A.

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The four strategy variables came from these interviews and are single-item questions. There was virtually no correlation among the strategies and we consider them to be independent of each other. The system quality scale of five items is based on a number of past studies [12]. The reliability of these scales is in the 0.6–0.75 range, which is somewhat lower than the scale reliabilities in similar studies in the past.

Perceived usefulness and ease of use have been adapted from Davis’ scales used in his studies of TAM [3]. We developed an instrument to measure social norms based on Ref. [5] and pretested it on a group of MBA students. Based on these results, we constructed the individual items for social norms shown in the
Appendix A; a scale of these items forms the variable, Norms, in the analysis.

Intent is measured by a three-item scale asking about the user’s intentions to use features that were planned for the system in 1993. We did not include intent in 1995 because the workstation had been in use for so long at this point. Usage is a two-item self-report measure. Because it is difficult to observe usage, and because monitoring usage may not be very accurate, we used the self-report measure.

The brokerage firm provided a listing of revenues by account by broker. We compiled these data into broker sales revenue for 1992 and 1993. Unfortunately, the firm changed its performance reporting system between time 1 and time 2, so that we were unable to obtain comparable performance data for the 1995 survey (We also could not restate the 1992 and 1993 data to fit the new performance measurement algorithm.). In the analysis, we use the natural log of sales to provide a better statistical distribution.

3.2. Results time 1

Following the practice of the majority of past studies of TAM, we used regression analysis to analyze the results (The limited size of the data set prevented us from using path analysis or structural equation modeling.). Each of the equations is in standardized form without the intercept and with beta weights for coefficients; the beta weight represents the change in the dependent variable in standard deviation units from a change of one standard deviation unit in the independent variable. Eqs. (1) and (2) present the results of predicting perceived usefulness and perceived ease of use with the four broker strategy variables and system quality. In these equations, we had too many independent variables for the number of observations, so we used a stepwise algorithm to select independent variables to enter. System quality is a predictor of both perceptions. A strategy of meeting with the client is negatively related to perceived ease of use; the broker who follows a strategy of meeting with clients finds the workstation less easy to use than his or her colleagues. It is likely that the workstation provides less support for meeting with clients than for other broker strategies; it is not easy to use or easily available in a client setting. It is also possible that brokers who prefer to meet with clients are more oriented toward social contact than working with technology.

PERUSE = 0.49 SYSQUAL \[ R^2 = 0.22 \]

\[
F = 11.72^{***} \quad n = 39 \quad *p \leq 0.10, **p \leq 0.05, \quad ***p \leq 0.01
\]

PEREOU = −0.36 STGMEET + 0.34 SYSQUAL \[ R^2 = 0.25 \]

\[
F = 7.30^{***} \quad n = 39
\]
Eq. (3) predicts usage for the original TAM. Here only perceived usefulness is significant, and the two variables explain 15% of the variance in usage. The relationships posited in TAM are supported by the data, but the results are weak.

\[
\text{\text{USAGE\text{\_TAM}}} = 0.31 \text{ PERUSE} + 0.21 \text{ PEREOU} \\
R^2 = 0.15 \quad F = 4.50^{**} \quad n = 39
\]  

(3)

Eq. (4) predicts usage for the extended model of Fig. 1; it adds social norms and the log of 1992 sales. Only the log of 1992 sales is significant statistically, and at the 0.10 level; higher performers use the system more. The four variables in this equation are weakly dominated by sales. The results explain a little more of the variance than Eq. (3), 20 versus 15%.

\[
\text{USAGE} = 0.14 \text{ NORMS} + 0.25 \text{ PERUSE} \\
+ 0.16 \text{ PEREOU} + 0.29 \text{ LNSALES92} \\
R^2 = 0.20 \quad F = 3.34^{**} \quad n = 39
\]  

(4)

Eqs. (5) and (6) repeat the analysis above for intentions to use the system rather than self-reported usage. In Eq. (5) for the original TAM, we see the same pattern as Eq. (3); perceived usefulness is significant and both perceptions are positively related to Intent. The amount of variance explained is only 7%, which means the model does not shed much light on intentions.

\[
\text{\text{INTENT\text{\_TAM}}} = 0.31 \text{ PERUSE} + 0.07 \text{ PEREOU} \\
R^2 = 0.07 \quad F = 2.34 \quad n = 38
\]  

(5)

Eq. (6) predicts intentions to use the system for the extended model. Social norms are the dominant independent variable; they are significant at the 0.05 level. Norms do not enter into reports of current usage, but they are associated with future intentions. Norms may play more of a role in shaping future behavior than current work practices.

\[
\text{\text{INTENT}} = 0.44 \text{ NORMS} + 0.7 \text{ PERUSE} \\
+ 0.01 \text{ PEREOU} - 0.05 \text{ LNSALES92} \\
R^2 = 1.5 \quad F = 2.58^{*} \quad n = 36
\]  

(6)

Eq. (7) predicts 1993 performance as a function of 1992 performance and usage of the workstation. Both variables are positively related to 1993 performance, and workstation usage is surprisingly significant (Frequently, lagged performance dominates other variables in predicting current performance.).

\[
\text{LNSALES93} = 0.87 \text{ LNSALES92} + 0.16 \text{ USAGE} \\
R^2 = 0.86 \quad F = 124.66^{***} \quad n = 41
\]  

(7)

3.3. Results time 2

Table 2 presents the results of a matched samples t-test of the 25 `survivors’ for the variables we were able to measure at both time 1 and time 2. All results but two are remarkably similar and changed little in the 2-year period between surveys. The consistent values hold in spite of the high sample mortality rate of 39% from time 1 to time 2.

User ratings of systems quality declined significantly as did perceptions of ease of use. Company management indicated that they were making continual improvements and upgrades to the system, which should have resulted in improvements in quality. It is possible that at time 1, brokers rated the new system favorably in comparison to the old system it had just replaced. By time 2 the old system was long forgotten and the relevant reference system was the broker workstation, itself. Management may find that providing the newest technology raises user expectations and that users do not remain satisfied long with current technology. Professionals have colleagues in other organizations and may use their systems as a point of comparison. Software vendors do their best to obsolete their products with new releases and versions in order to maintain sales. We may find that users expect the same improvements from internal, proprietary systems.

4. Discussion

Considering the first question raised in the paper, is implementation research relevant today, we believe that the implementation of information technology and its acceptance is even more important today than in the past. Organizations rely on technology
to operate their businesses, provide reservoirs of knowledge and organizational intelligence, and structure their firms. Organizations are rapidly adopting workstation and network technology platforms. Management has to be concerned with the acceptance of this technology if it is to obtain a return from the firm’s investment in IT.

The second question in our research was how well models of implementation predict acceptance in today’s workstation and networked environment. The answer to this question is mixed. TAM performs well in quasi-experimental research on students. In this field setting, its variables tend to be dominated by other variables like social norms and performance. However, this dominance is not strong, and neither TAM in its original or extended versions explains a large amount of variance in workstation use.

Our results, however, have to be treated with caution due to the limitations of the sample size. Testing models like TAM in a field study is difficult because one needs to locate a significant number of users who work with the same system. As we learned, a longitudinal study is also very difficult due to subject mortality, even with a job that is believed to have low turnover.

The problem with field studies may be in separating mandatory from voluntary use; almost all models of implementation attempt to predict voluntary system usage. Mandatory use makes all of the other variables in a model moot. Some functions of the workstation have to be used in order to do one’s job. It is the broker’s only source of stock market quotations, for example. However, brokers have been getting these quotations from some kind of computer device for decades, and it is not clear that they even think about this function when evaluating the capabilities of the workstation.

Intentions to use the system refers to new features whose usage is voluntary; here social norms in the extended TAM are highly significant, suggesting that extending the model is important in a field setting. System quality is associated with perceived ease of use and perceived usefulness. If one believes the causal implications of the model, these results suggest that management should concentrate on the quality of the system and on establishing norms that favor system use in order to encourage acceptance.

While TAM and its extensions do not predict large amounts of variance in usage, they are relatively simple models that can be applied to predict accep-

<table>
<thead>
<tr>
<th>Variable name</th>
<th>Description</th>
<th>t2</th>
<th>z</th>
<th>Time 1 mean</th>
<th>Time 2 mean</th>
<th>Difference</th>
<th>t-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYSQUAL</td>
<td>System quality evaluated by five items</td>
<td>24</td>
<td>0.75</td>
<td>3.6</td>
<td>3.3</td>
<td>−0.3</td>
<td>−2.30**</td>
</tr>
<tr>
<td>STGMEET</td>
<td>Strategy: meet with clients</td>
<td>25</td>
<td>na</td>
<td>4.4</td>
<td>4.4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>STGMTCH</td>
<td>Strategy: find securities to match clients’ strategy</td>
<td>25</td>
<td>na</td>
<td>4.9</td>
<td>4.8</td>
<td>−0.1</td>
<td>−1.44</td>
</tr>
<tr>
<td>STGPORT</td>
<td>Strategy: broker acts as portfolio manager for clients</td>
<td>25</td>
<td>na</td>
<td>4.0</td>
<td>4.1</td>
<td>0.1</td>
<td>0.57</td>
</tr>
<tr>
<td>STGRES</td>
<td>Strategy: broker does research for clients</td>
<td>25</td>
<td>na</td>
<td>3.9</td>
<td>3.8</td>
<td>−0.1</td>
<td>0.57</td>
</tr>
<tr>
<td>PERUSE</td>
<td>Perceived usefulness based on two items</td>
<td>25</td>
<td>0.68</td>
<td>4.4</td>
<td>4.4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>PEREOU</td>
<td>Perceived ease of use based on three items</td>
<td>25</td>
<td>0.42a</td>
<td>3.9</td>
<td>3.5b</td>
<td>−0.4</td>
<td>−3.36**</td>
</tr>
<tr>
<td>NORMS</td>
<td>Support in using workstation from others, managers, senior managers and clients</td>
<td>24</td>
<td>0.75</td>
<td>3.8</td>
<td>3.7</td>
<td>−0.1</td>
<td>−0.94</td>
</tr>
<tr>
<td>USAGE</td>
<td>Use from two items</td>
<td>25</td>
<td>0.85</td>
<td>4.5</td>
<td>4.4</td>
<td>−0.1</td>
<td>−0.77</td>
</tr>
</tbody>
</table>

*The decrease in reliability from $t_1$ (0.63) to $t_2$ (0.42), for PEREOU is troubling. While some of the decrease might be attributed to a smaller sample size at time 2, reliabilities for other variables at time 2 did not show similar declines. The standard deviation for PEREOU is very similar for time 1 vs. time 2. The Pearson correlation for PEREOU at time 1 with PEREOU at time 2 is 0.63 which is a measure of test–retest reliability. This number is comparable to other time 1–2 correlations for individual variables. When we examined the items in the scale, we found that by eliminating ‘received sufficient training’ the $z$ rose to 0.7. Please see the discussion of time 2 results in the text for further information.

b Using the more reliable version of this scale, eliminating the item ‘received sufficient training’, results in a time 2 mean of 3.6, a difference of −0.3 and a $t$-value of 2.51**. PEREOU and SYSQUAL still remain the only two variables which are significantly different between time 1 and time 2, and both of them are less favorable in 1995 than 1993.
tance and to intervene if necessary. The variables in these models appear to be quite stable, and the changes from time 1 to time 2 suggest that they can be used in an ongoing evaluation of a system. For example, a firm implementing technology might track user acceptance after adding new functions to a system, offering advanced training courses, or releasing an entirely new version of the application. In periods of rapidly advancing technology, continued assessment of systems like the multifunctional workstation in the study are very important in taking advantage of technology investments.

5. Conclusions

The results of this study show that TAM and its extensions are weak predictors of the acceptance of a broker workstation. In future work, we recommend including the variables in these models because they have shown an association with acceptance in both laboratory and field studies. An important question is what other models and variables are needed to better explain the phenomenon of IT implementation and acceptance? Possibilities include ethnographic studies such as those by Barley [1] on roles and networks and Orlikowski [15], which offers a situated change perspective on organization change over time. Researchers might also want to examine managerial tasks related to adoption [2] and the role of technological champions in implementation [9].

Based on this study, we feel that variance models like TAM, combined with qualitative research, offer the best opportunity for understanding the implementation of modern information technology. These two approaches to research compliment each other and their combination will provide the most insights possible into the complexities of implementation in an environment of workstations, LANs, intranets and the Internet.

It may be necessary to develop variables to extend TAM in each setting. For example, there may be no analogy to broker strategy in a manufacturing company. Our suggestion is to look for important external variables, include social norms, and seek additional explanatory variables for technology acceptance in building models. Combining variance and ethnographic research designs should also contribute a great deal to our understanding of acceptance. The implementation and acceptance of information technology is and will remain a key determinant of the return the organization receives from its IT investments, and models of acceptance and implementation should lead to more successful IT initiatives.

Appendix A. Survey items

All responses are 1–5, strongly agree to strongly disagree.

STGMEET The successful broker has to spend considerable time meeting with clients
STGMTCH The successful broker finds stocks and opportunities that match the client’s strategy
STGPORT The successful broker functions as an unpaid portfolio manager
STGRES The successful broker spends significant time each day doing research for clients
SYSQUAL It is very easy to retrieve and organize data using the workstation
PERUSE Using the workstation improves my performance
PEREOU I find the workstation easy to use
NORMS Other institutional brokers whom I respect strongly support my using the Institutional Broker Workstation

The workstation’s response time is very fast
The workstation’s data is very accurate (the data are correct)
The workstation is very reliable (does not go down)
Using the workstation is much better than using the previous [system’s name]
Using the workstation enhances my effectiveness
I find the workstation easy to use
I have received sufficient training to use the workstation effectively
I find it easy to get the workstation to do what I want it to do

Other institutional brokers whom I respect strongly support my using the Institutional Broker Workstation
My immediate manager strongly supports my using the workstation [Firm’s name] senior management strongly supports my using the workstation
My most important clients strongly support my using the workstation

**INTENT**
I intend to make frequent use of electronic mail on the workstation
I intend to make frequent use of the office automation tools like spreadsheets and word processing on the workstation
I intend to make frequent use of the functions like data retrieval and transactions status reports on the workstation

**USAGE**
At the present time, I consider myself to be an extremely frequent user of the workstation
I currently use the workstation continuously throughout the day

References


Henry C. Lucas, Jr. has been on the faculty of the Stern School of Business at New York University. Beginning in August of 2000, he will be the Robert H. Smith Professor of Information Systems at the Robert H. Smith School of Business at the University of Maryland. Professor Lucas has written several books and articles about information systems, publishing articles in Management Science, Information Systems Research, MIS Quarterly and other journals. He is the editor-in-chief of the Association for Information Systems Electronic Journals.

Valerie Spitler is a candidate for the Ph.D. degree in the Information Systems Department at New York University’s Stern School of Business. In addition to research on implementation, she conducts research on individual use of information technologies in practice, using situated learning theory and interpretive research methods. She has been published in Decision Sciences, and in several conference proceedings, including the Proceedings of the International Federation for Information Processing, Working Group 8.2 and the MIS Quarterly workshop proceedings on new organizational roles of information technology in the Information Age. Ms. Spitler holds an M.B.A. from Insead (France) and a B.S. from the Wharton School and has worked for firms in financial services, software development and advertising.