

Understanding Technology Acceptance: Phase IV Research Protocol for Predicting the Acceptance of Technologies

Technical Report HFA-TR-09-06
Atlanta, GA: Georgia Institute of Technology
School of Psychology – Human Factors and Aging Laboratory
2009

KOERT VAN ITTERSUM¹
WENDY A. ROGERS²
LEONARD J. PARSONS¹
ARTHUR D. FISK²

¹*COLLEGE OF MANAGEMENT*
²*SCHOOL OF PSYCHOLOGY*



Requests for more information may be sent to Koert van Ittersum
(koert.vanittersum@mgt.gatech.edu) or Wendy A. Rogers (wendy@gatech.edu)

Table of Contents

Executive Summary	3
Implementation Protocol	4
Step 1 Define the technology	7
Step 2 Describe the target market(s)	8
Step 3 Select the survey method	9
Step 4 Determine the sample size	10
Step 5 Design & pre-test the survey	11
Step 6 Send out the survey	13
Step 7 Enter & organize the data	14
Step 8 Estimate the model	15
Step 9 Interpret the results	19
Step 10 Implement the results	20
General Conclusion	21
References	23
Appendix A Template for Survey Generator (Total Model)	25
Appendix B Template for Survey Generator (Predictive Model)	31
Appendix C Which Statements and Questions Measure Which Part of the Model?	35
Appendix D Instructions for Survey Generator	38

Executive Summary

The general objectives of Phase IV of the Technology Acceptance Project were to: (1) obtain insights into the external predictive validity of our model; (2) obtain insights into the reasons why decision makers decided to accept or decided not to accept a new technology; (3) develop a *Technology-Introduction Plan* for *Deere & Company*'s introduction of new technologies in the market place, (4) develop software allowing for easy customization of scales used to measure technology and user characteristics that influence the acceptance of technologies, (5) facilitate a broader transfer of the results of the Technology Acceptance Project throughout *Deere & Company*, and (6) develop a broader understanding of the mechanisms underlying the variables of the quantitative model that will guide development of communication strategies to influence the acceptance of technologies.

To facilitate a broader transfer of the results of the Technology Acceptance Project throughout *Deere & Company* (5), this report focuses on points (3) and (4). We present a research protocol describing in detail the steps that will need to be taken to apply the Georgia TechAccept Model. As part of this presentation, the software that was developed for easy customization of scales used to measure technology and user characteristics that influence the acceptance of technologies will be introduced.

Implementation Protocol

The main objective of this component of the project is to provide a detailed guideline that allows *Deere & Company* personnel to apply the *Georgia TechAccept Model* (see Figure 1). The Georgia TechAccept model has been developed to predict whether a specific target market will adopt a specific technology and to gain an understanding of the key motivations of the decision of whether to adopt. A key strength of the model is that it can be estimated without the need for actual sales data. Therefore, the model can be estimated prior to the market introduction of a new technology.

The model can be applied to incrementally new technologies as well as radical new technologies. Furthermore, it can be applied at different stages of new technology development and market introduction process. In the early stages, the application can help to gain a first insight into how receptive a target market is toward a technology and whether there are specific concerns that may next be addressed in the development process. Later in the development process, the model can be used to fine-tune the market introduction. After introduction, the model can be used for new markets or to assess intentions of the not-yet-adopted segment of the market. The basic implementation process does not depend on when this Georgia TechAccept Model is applied. However, it is important to note that the model was developed for and tested in the U.S. market. Future research may be necessary to determine how well the model performs in foreign markets.

Depending on the goals of the application of the model, it can be decided to estimate the entire model or only to estimate the predictive part of it. When the goal is to predict whether the target market will accept the technology and to assess what drives this decision, then only the predictive part of the model (boxed-in part of the model shown in Figure 1) needs to be

estimated. When the goal is to gain a more thorough understanding of the decision making process and learn about key variables that may be influenced via marketing, it is recommended to estimate the entire model. With this in mind, we provide a step-by-step implementation overview. Please note that in providing the implementation overview, we assume some basic understanding and skills with regards to collecting and analyzing primary data. We refer to Lehmann et al. (1998) and for instance Cohen et al., (2002) and Hair et al. (2010) for extensive and detailed information about conducting marketing research and data analyses, respectively.

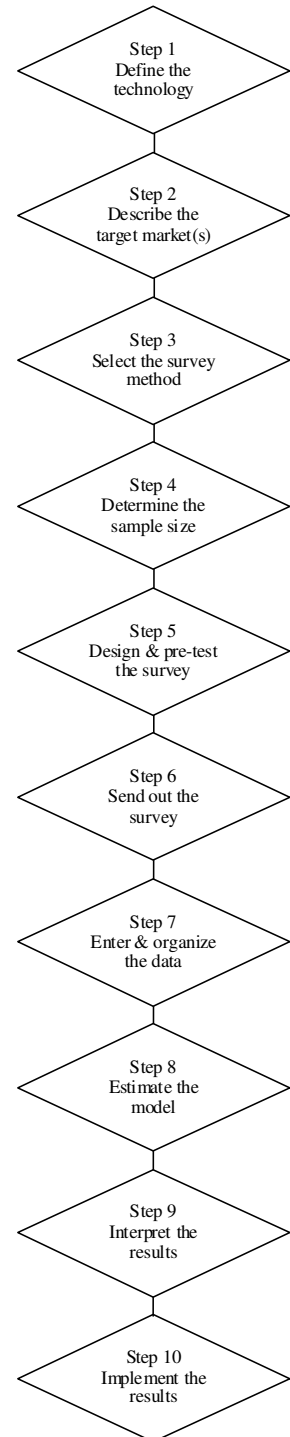
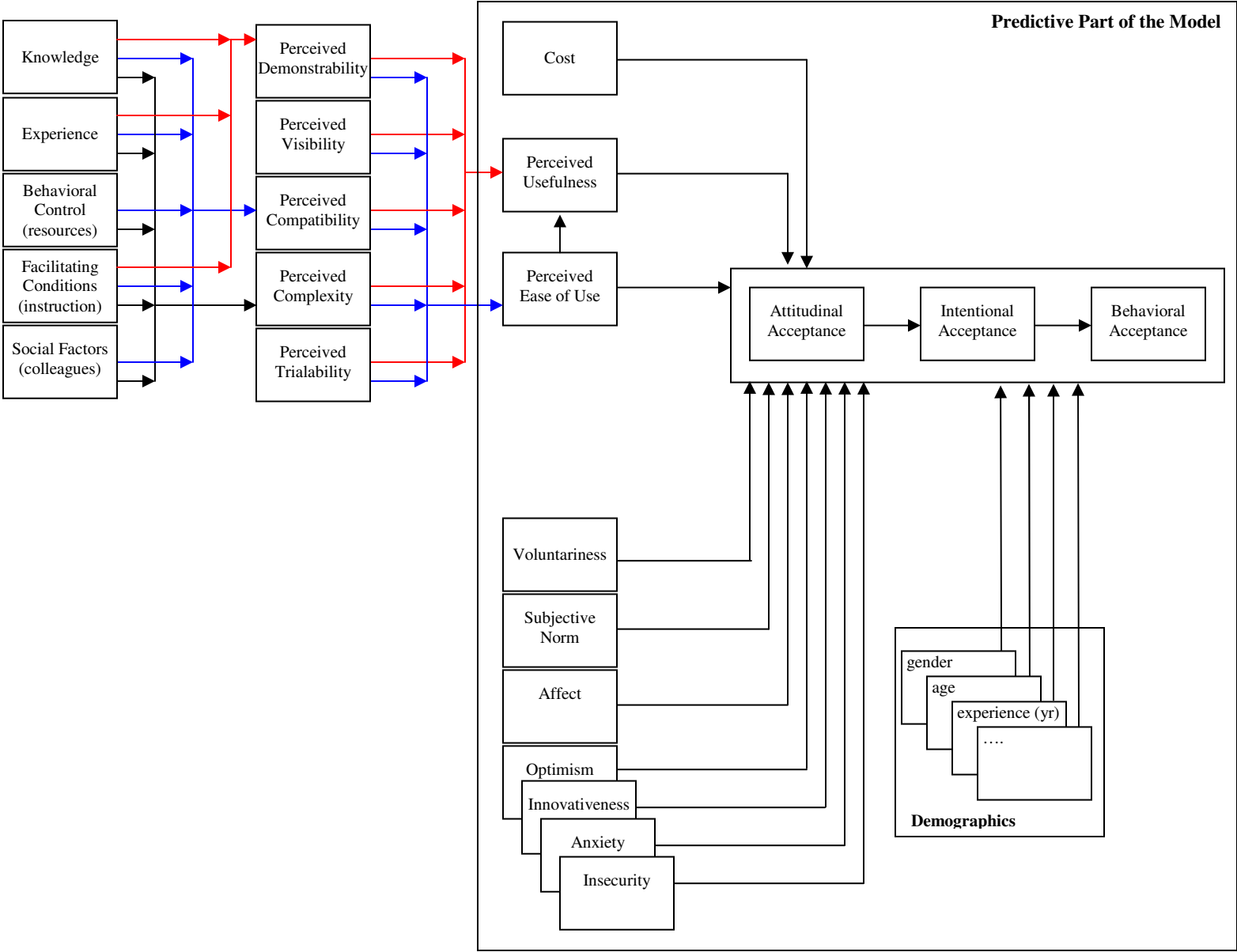


Figure 1. Georgia TechAccept Model



Step 1. Define the technology

An important first step is to develop a clear description of the technology and its potential benefits. Such a definition will be critical to obtaining valid responses from the target market; the individuals being surveyed must clearly understand what the technology entails. We recommend providing the target market with an objective description of the technology and refraining from “overselling” the technology. Here is an example of a technology description that we used in one of our studies:

Swath control technology for planters is a technology that uses GPS while planting seeds for row crops to minimize planting overlap and gaps. It automatically engages/disengages individual or groups of planter row units to minimize overlap and gaps, based on where you are in the field relative to where you have already planted.

This description can be extended to lay out more specific benefits of the technology. Other key points can be added as well such as the *John Deere* brand name and logo, price information, or for instance maintenance requirements. Furthermore, the technology may be visualized using pictures and, depending on the survey method, using a 3-D virtual representation or for instance video. Ultimately, when possible, one could consider having members of the target market interact with the actual technology before filling out the survey. The main objective is to provide the target market with a realistic understanding of the technology and its capabilities.

Step 2. Describe the target market(s)

Besides describing the technology, it will be critical to come up with a clear definition of the target market or target markets. In this context, it is important to know who the technology is intended for. This specification will enable selection of a representative sample of respondents from the target market. If this is done correctly, it will be possible to draw valid inferences about the target market's response to the technology based on the results of the respondents in the sample.

Here is an example of a technology description that we used when studying the acceptance of Swath Control for Planters:

“Farm operators who grow 500 acres of corn or more”

To predict the market acceptance of a specific technology for two or more target markets, separate data will need to be collected for each target market. Vice versa, when the goal is to predict acceptance of two technologies by one single target market, separate data will need to be collected for each technology.

Step 3. Select the survey method

For the quantitative part of the research, the Georgia TechAccept team has always collected data using a paper-and-pencil approach that involved sending a hard-copy of the survey to members of the target market. This approach was largely driven by the contact information available – postal mail addresses only.

After the target market has been defined (see Step 2), it will be important in future projects to determine whether and what kind of contact information is available. If only postal mail addresses are available, we recommend using a paper-and-pencil approach. If email addresses are available, electronically surveying the target market may be a preferred method. It is cheaper and faster. A potential downside is that this approach may bias the results if not all members of a target market have email or online abilities. This could be resolved by some mixture of paper-and-pencil and electronic surveying.

A third option that may be considered is developing a panel – a group of members of a target market that agrees to participate in research on a regular basis (for some form of compensation). This may be especially effective for large, relative homogenous target markets that are targeted with new technologies on a regular basis (e.g., farmers).

We advice against conducting a telephonic survey to collect the data to predict technology acceptance. The nature of the statements and the number of responses to be collected make a telephonic survey impractical.

Step 4. Determine the sample size

To be able to infer conclusions about the entire target market based on the results of a group of respondents it is essential that a representative group of people from the target is approached with the request to participate. This may involve drawing a complete random sample of members from the target market, or for instance using other more advanced sampling methods (e.g., stratified sampling). The Georgia TechAccept team used SPSS to draw a complete random sample of a pre-specified size from their list of addresses of U.S. farmers (consisting of *Deere* customers and non-customers) who grow 500 acres of corn or more annually.

In past surveys, the Georgia TechAccept team sent out about 3,000 to 5,000 surveys for a response rate of about 10%. Larger samples may be preferable for drawing firm conclusions about the entire target market. As a point of reference, to draw conclusions with a confidence level of 95% and a confidence interval of 5%, a total sample of approximately 400 respondents is sufficient (irrespective of the size of the total target market). To increase the confidence level and/or reduce the confidence interval, more respondents are desirable.

The response rate may be increased by increasing the incentive provided, although it is not certain if and how much of a difference this would make. The Georgia TechAccept team would typically make fifty \$20-gift cards or twenty \$50-gift cards available but it is not clear if the incentive was the reason that people participated. Other strategies may be applied. Also note that the final survey instrument is shorter than the one used in developing the model. Shorter surveys tend to yield higher response rates than longer ones.

Step 5. Design & pre-test the survey

Next, the questionnaire needs to be developed. To facilitate this process, the Georgia TechAccept team developed a software tool that allows for easy customization of scales used to measure technology and user characteristics that influence the acceptance of technologies. More specifically, we created two Word versions of the questionnaire; one questionnaire can be used when the objectives are to predict technology acceptance and gain an understanding of what drives decision makers' to accept new technology (complete model shown in Figure 1) (see Appendix A). The other (shorter) questionnaire can be used when the main objective is to predict technology acceptance (see Appendix B). Both versions are created using the mailing macros in Word. Detailed information on how to customize both questionnaires is provided in Appendices, A, B, C, and D. Note that some questions measure technology-independent personality characteristics (e.g., innovativeness) that will not change depending on the technology (question 5 in the survey). If the same respondents will be contacted on multiple occasions (e.g., because they are part of a panel), it could be considered to measure these characteristics once (together with for instance demographic information) and store that information for each respondent (so they do not have to provide that information each time they participate in research).

Both questionnaires contain all relevant questions (irrespective of the stage of the technology introduction process), which have been selected based on extensive background research and tests, detailed information of which can be found in various research reports (e.g., Van Ittersum et al., 2008). Once the basic survey instrument is finished, the researcher may consider adding questions that have proven themselves useful in the past for predicting technology acceptance in a specific target market. As one

case in point, after a discussion with *Deere* experts on the Swath Control Technology for Planters, questions regarding the shape of fields and expansion strategies were added to the basic survey instrument as these questions proved to be valuable predictors of technology acceptance. Furthermore, the Georgia TechAccept team always added one final open-ended question to the survey that asked the respondents to describe any factors that you will consider in deciding (not) to buy the technology under consideration.

In adding questions, it will be important to trade-off the value that will be obtained from adding these questions to the extra time it will take the respondent to finish the survey. The two basic survey instruments take an estimates 10 and 5 minutes respectively. As indicated, the length of the survey negatively influences the response rate.

After a careful in-house check, it is recommended to share the survey instrument with a few members from the target market to find out if they understand the technology description (see Step 1), the questions and statements, and feel if something may be missing. This will also allow for determining how much time it will take respondents to fill out the entire survey. After this pre-testing of the survey instrument, the final version can be developed.

Step 6. Send out the survey

Next, send out the survey instrument to the randomly selected sample of members from the target market. To increase the response rate, it may help to send a pre-notification letter prior to sending the survey.

Together with the survey, the Georgia TechAccept team always added a cover letter that explained the objective(s) of the survey (knowledge generation in case of the Georgia TechAccept team; helping improve customer satisfaction may be an argument used by *Deere & Company*), a description of the incentive and how participants will be able to get it, where to send the questionnaire, and what to do in case of questions (make a phone number available). The Georgia TechAccept team would give the respondents about four to six weeks to return their survey (in pre-paid and pre-labeled envelopes that were included in the package). After the second and fourth week, reminder notes were sent to those who had not yet responded. In a case where the response rate remains too small, additional surveys may be sent out to a second randomly drawn sample from the target population.

Step 7. Enter & organize the data

Depending on the survey method selected, next, the data need to be entered in a useable format. This can be done in Excel or SPSS. The Georgia TechAccept team used SPSS to enter and analyze the data. If data are collected online, this stage will predominantly consist of organizing the data to ensure suitability for analyses.

	qid	q1.1	q1.2	q1.3	q1.4	q1.5	q1.6	q2.1	q2.2	q2.3	q2.4
22	24	2	18	.	.	.	3 word of mouth	5	1	5	3
23	25	1	.	.	.	.	.	5	1	1	1
24	26	2	5	2	.	.	.	5	1	1	1
25	27	2	24	2	.	.	.	5	1	1	1
26	28	2	24	1	.	.	.	5	1	1	1
27	29	1	.	.	.	.	.	4	1	2	2
28	30	1	.	.	.	.	.	5	1	3	2
29	31	2	24	1	.	.	.	5	3	2	1
30	32	2	16	2	.	.	.	5	1	2	1
31	33	2	24	2	.	.	.	4	4	4	2
32	34	2	4	1	.	.	.	5	1	2	1
33	35	2	18	.	.	.	3 John Deere dealer	5	2	4	4
34	36	1	.	.	.	.	.	5	1	3	3
35	38	2	6	2	.	.	.	5	1	1	1
36	40	2	12	1	2	.	.	5	1	5	5
37	41	1	.	.	.	.	.	5	1	1	1
38	42	2	18	.	3	.	.	5	1	1	1
39	43	2	10	2	.	.	.	5	1	5	3
40	45	2	24	1	.	.	.	5	4	5	4
41	46	2	12	2	.	.	.	5	2	4	4
42	47	2	4	.	3	.	.	1	1	1	1
43	48	2	6	.	.	.	3 owner	5	1	1	1
44	49	2	24	1	.	.	3 JD Dealer	5	1	1	1

If qualitative data are collected via the open-ended questions, the complete open-ended responses should be entered. By entering the complete responses (as opposed to entering a summary or categorization labels), the qualitative response can be coded and analyzed properly (Taylor and Bogdan 1998).

	q34.2	q34.3	MEMBER	q35
1	.	.	.00	
2	.	.	.00	
3	2	3	3.00	Any to lessen stress.
4	2	3	3.00	If the cost is reasonable I would consider it. It is not a high priority for me.
5	.	.	.00	
6	.	.	.00	Cost is #1 thing. Tight budget must pay for itself. Does not have to be fancy, just accurate
7	2	3	3.00	
8	2	.	2.00	Cost, Tech Support, Functionality
9	.	3	1.00	Cost
10	.	.	1.00	
11	2	3	2.00	Cost for the technology is the factor that decides if I use it. We plant a lot of angle rows, a
12	.	.	.00	
13	2	3	3.00	
14	.	.	.00	Cost, reliable, cannot afford any down time. easy to use. We just purchased Gs2 this year
15	.	3	2.00	Swath control on planters is dependant on our ability to buy or rent strip till equipment to i
16	2	3	2.00	Cost, service availability.
17	.	.	1.00	It would have to be priced right.
18	.	3	1.00	Ease of use, tech support at dealer, cost us return, fit our existing equipment.
19	2	3	3.00	
20	.	.	3 2.00	
21	.	.	.00	Most of it is economics. As the technology gets less expensive, we might be tempted to c
22	.	.	1.00	Cost vs Benefits. Ease of use and operator fatigue is not a factor.
23	2	3	3.00	

Step 8. Estimate the model

Once the data have been entered, the data analyses can start. First, check for missing values, and decide what to do with them. Respondents with missing values may be dropped or values for the missing data points may be inferred based on responses that are provided.

Next, calculate the averages for the multi-item constructs. Appendix C demonstrates which specific statements in the survey instrument correspond to which specific construct.

	ATT	INTENT	BEHINT	USEF	EOU	COST	var	var	va
1	4.7	5.0	2.0	5.0	4.0	-1.0			
2	5.0	5.0	2.0	5.0	3.3	-1.5			
3	5.0	5.0	2.0	5.0	3.7	.6			
4	4.0	2.0	1.0	3.8	2.7	1.1			
5	3.0	2.0	1.0	3.0	1.3	1.6			
6	1.0	5.0	2.0	5.0	5.0	-1.6			
7	4.0	5.0	2.0	4.0	3.3	1.1			
8	3.7	4.0	2.0	4.3	4.0	.6			
9	5.0	4.5	2.0	3.8	4.3	.0			
10	5.0	5.0	2.0	5.0	4.3	-1.0			
11	4.7	5.0	2.0	4.0	5.0	-1.0			
12	3.0	1.0	1.0	.	.	.			
13	4.4	4.0	2.0	4.0	3.7	1.1			
14	3.0	1.0	1.0	2.3	4.0	1.1			
15	5.0	3.5	2.0	2.5	4.3	1.1			
16	5.0	4.0	2.0	4.5	5.0	.1			
17	3.0	3.0	1.0	4.5	3.7	1.6			
18	4.0	4.0	2.0	4.3	4.0	.0			
19	4.0	3.0	2.0	3.5	5.0	-2.0			
20	4.0	3.0	1.0	3.8	4.0	-.5			
21	2.7	1.0	1.0	4.0	4.0	1.1			
22	3.4	3.0	2.0	4.5	4.7	1.6			
23	1.0	1.0	1.0	1.5	1.0	1.6			

Next, the entire model or only the predictive part of the model can be estimated. First, we will discuss estimating the predictive part of the model. To estimate the predictive part of the model, the Georgia TechAccept team used (binary) logistic regression analyses.

	INTENT	BEHINT
1	5.0	2.0
2	5.0	2.0
3	5.0	2.0
4	2.0	1.0
5	2.0	1.0
6	5.0	2.0
7	5.0	2.0
8	4.0	2.0

To estimate the predictive part of the model, regress the behavioral acceptance question (will you buy this technology? Yes/No) on the various independent variables shown in Table 1 (note, these correspond with the information presented in Appendix C). In the data file, these variables are represented by the averages the researcher calculated before.

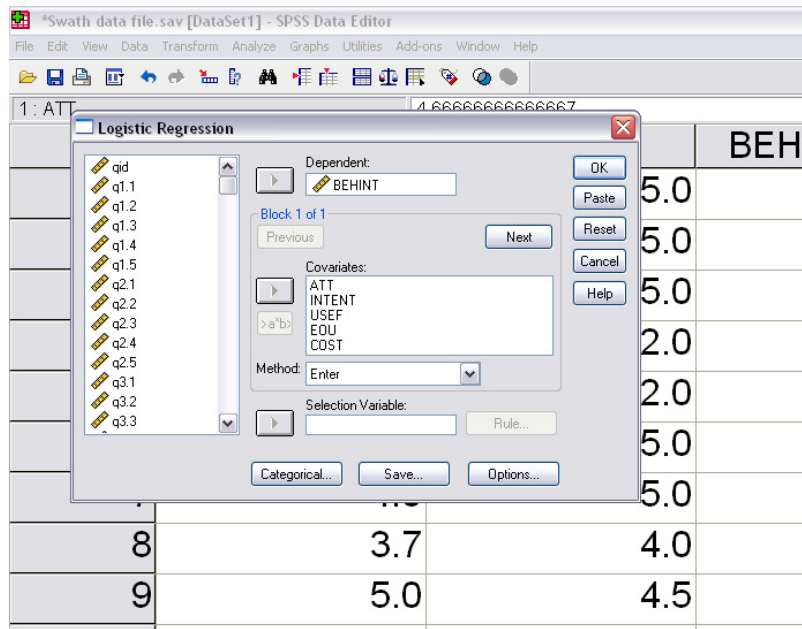


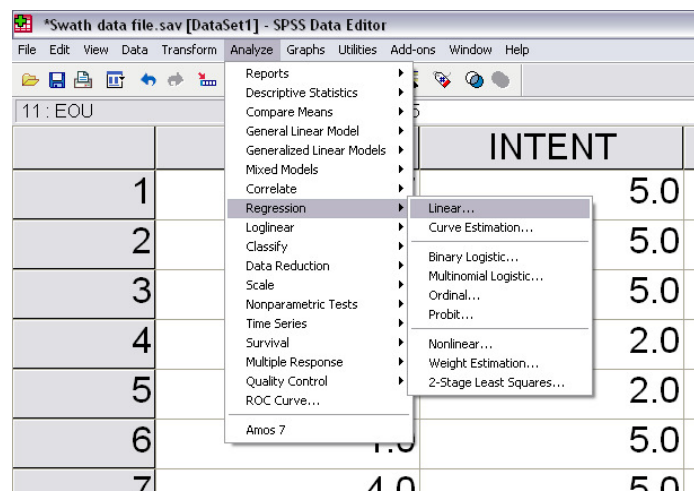
Table 1. These variables are needed to estimate the predictive part of the model using Logistic Regression Analysis

Dependent Variable	
Behavioral Acceptance	
(Will you buy this technology? [1] yes [2] no)	
Independent Variables	
Attitudinal Acceptance	.49*
Intentional Acceptance	3.46***
Perceived Usefulness	.50*
Ease of Use	.10
Cost	.53
User Characteristics	
Voluntariness	-.26
General Anxiety	-.33
Optimism	.12
Innovativeness	.06
Insecurity	.20
Social Force	.19
Affect	-.08
Gender	-2.03
Age	-.02
Years of Experience	.01
Farm Size (acres)	.000

The outcomes of the logistic regression analyses are parameter estimates that reflect the impact of each individual independent variable (left column in Table 1) in predicting the acceptance of the technology.

Besides the parameter estimates, for each individual it can be estimated whether he or she will adopt the technology. By aggregating these individual predictions, insights into the aggregate level acceptance of the technology can be obtained.

To estimate the explanatory part of the model, multiple regression analyses have to be conducted. We used OLS regression analyses (see Tables 2-A and 2-B).



Again, the labels of the independent variables presented in Tables 2-A and 2-B correspond with the information presented in Appendix C.

Table 2-A. These variables are needed to estimate the first layer of descriptive part of the model using OLS Regression Analysis (see Figure 1)

Independent Variables	Dependent Variables	
	Perceived Usefulness	Perceived Ease of Use
Ease of Use	.133***	
Complexity	.026	-.341***
Compatibility	.610***	.253***
Trialability	.099**	.070*
Observability/Visibility	.086***	.124***
Result Demonstrability	.188***	.197***

Table 2-B. These variables are needed to estimate the second layer of descriptive part of the model using OLS Regression Analysis (see Figure 1)

Independent Variables	Dependent Variables		
	Perceived Compatibility	Perceived Complexity	Results Demonstrability
Social Support	.291***	-.850*	
Facilitating Conditions	.349***	-.157***	.368***
Behavioral Control	.306***	-.305***	
Knowledge	.118**	-.074*	.225***
Experience	-.420	.058	-.051

OLS regression analyses produce parameter estimates for the relationship between each individual variable and the dependent variable examined. For instance, while the perceived complexity of the technology does not influence the perceived usefulness, it does negatively influence the perceived ease of use (see Table 2-A).

As the size of the parameters depends on how they are measured, we recommend focusing on the standardized regression coefficient, which allow comparison of the parameter estimates.

Step 9. Interpret the results

Next, the estimation results can be interpreted. First, it can be inspected what share of the respondents is predicted to adopt the technology (based on the described predictions, see Step 8). Next, based on inspecting the estimated parameters, it can be determined what the most critical variables are in the decision to adopt the technology. Based on that information, the researcher can examine the average scores on those critical variables. That is, the researcher can assess how well the technology is performing on those most critical variables, which in turn provides great pointers for either adjusting the technology or altering perceptions by providing the target market with the right information. An inspection of the descriptive part of the estimation results will provide insights into what kind of information may be needed to alter perceptions of those critical variables. Some examples have been provided in the previous sections.

Step 10. Implement the Results

Based on the interpretation of the results, and depending on the stage of the new technology development and/or marketing process, different actions can be undertaken. For instance, in the early stages of the development process, changes in the technology design can be made. For instance, should the results reveal that the target market is reluctant to adopt a technology because they perceive it will be difficult to use, appropriate changes may have to be made (and tested). Alternatively, when the technology development process is over, additional attention may be given to basic instructions and manuals that are provided with the technology. Prior to launch, the results may yield insights into how to communicate the benefits of the technology via advertising. If the perceived usefulness is the most critical variable in the decision to adopt, it should be highlighted in advertising campaigns. If incorrect concerns about the compatibility of a technology hinder adoption, corrective communication measures may go a long way. The model thus feeds into the development of technologies, instructions, communications, as well as the marketing of technologies.

General Conclusion

As discussed in the introduction, the Georgia TechAccept Model is a new helpful tool that can help reduce the uncertainty associated with the introduction of new technologies by *Deere & Company*. The model can predict how receptive the target market is and it helps explain how the target market decides whether or not to adopt a new technology. Compared to for instance the Bass model, another tool used at *Deere & Company*, the Georgia TechAccept Model is beneficial as it can be used at early stages of the new technology development and marketing process. Unlike the Bass model, no sales data are required to make accurate predictions about the marketing acceptance of a new technology. Given that the Bass model performs best when sales data are available, we believe that the Bass model may be used to complement the Georgia TechAccept Model after the technology has been introduced, to gain an understanding of the aggregate level diffusion of the technology in time, something that the Georgia TechAccept model at this point in time can not do. Recent insights do suggest though that the model may be extended by collecting so called Cumulative Timed Intentions (Van Ittersum and Feinberg 2009) such that insights about the diffusion of new technologies may be obtained even prior to launch. Cumulative timed intentions reflect the expected cumulative likelihood that someone will have purchased a technology at several points in the future (e.g., within 1 month, 6 months from now, etc.), conditional on their not having already adopted (see Van Ittersum and Feinberg 2009 for details).

We also would like to stress that while the model has been shown to be robust across technologies, it has not been tested in foreign markets. Specific cultural differences may affect the performance of the model. Also, the country-of-origin of technologies may affect the acceptance. Furthermore, most of the scales used to test our

model have been develop in the U.S. and they may not perform equally well in foreign markets. Additional research on the extendibility of the model to foreign markets is recommended.

To date, the Georgia TechAccept team always analyzed the data within a target market across individuals. Based on feedback received from *Deere & Company* we would like to mention that it may be fruitful to examine whether different segments are present within a given target market. As one simple example, it could be examined if the decision making process for operators of larger farms is different than the decision making process for operators of smaller farms.

Finally, we recommend that the model results collected throughout *Deere* for different technologies be centrally stored and shared. Patterns in the effects of key variables for predicting technology acceptance across markets and technologies may yield valuable insights that allow for drawing more generalizable conclusions.

In sum, we believe the Georgia TechAccept Model has great potential for reducing uncertainty when developing and introducing new technologies. We hope that the current report will facilitate the acceptance of the Georgia TechAccept Model by *Deere & Company*.

References

- Cohen, Patricia, Jacob Cohen, Stephen G. West, & Leona S. Aiken (2002). *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences* (3rd ed.). Erlbaum.
- Hair Jr., Joseph F., William C. Black, Barry J. Babin, and Rolph E. Anderson (2010), *Multivariate Data Analyses*, 7th edition, Prentice Hall.
- Lehmann, Donald R., Sunil Gupta, and Joel H. Steckel (1998), *Marketing Research*, Addison Wesley.
- Taylor, Steven J., Robert Bogdan (1998), *Introduction to Qualitative Research Methods: A Guidebook and Resource*. (3rd ed.). NJ, US: John Wiley & Sons Inc.
- Van Ittersum, Koert, and Fred Feinberg (forthcoming), "[Cumulative Timed Intent: A New Predictive Tool for Technology Adoption](#)," *Journal of Marketing Research*.
- Van Ittersum, K., Rogers, W. A., Capar, M., Caine, K. E., O'Brien, M. A., Parsons, L. J., & Fisk, A. D. (2006). *Understanding technology acceptance: Phase I – literature review and qualitative model development* (HFA-TR-0602). Atlanta, GA: Georgia Institute of Technology, School of Psychology, Human Factors and Aging Laboratory.
- Van Ittersum, K., Rogers, W. A., Capar, M., Park, S., O'Brien, M. A., Caine, K. E., Parsons, L. J., & Fisk, A. D. (2006). *Understanding technology acceptance: Phase II – Identifying and validating metrics and preliminary testing of a quantitative model* (HFA-TR-0604). Atlanta, GA: Georgia Institute of Technology, School of Psychology, Human Factors and Aging Laboratory.
- Van Ittersum, K., Rogers, W. A., Capar, M., Park, S., Caine, K. E., O'Brien, M. A., Parsons, L. J., & Fisk, A. D. (2007). *Understanding technology acceptance: Phase II (Part 2) – Refining the quantitative model* (HFA-TR-0704). Atlanta, GA: Georgia Institute of Technology, School of Psychology, Human Factors and Aging Laboratory.

Van Ittersum, Koert, Wendy Rogers, Muge Capar, Sung Park, Kelly E. Caine, Marita O'Brien, Leonard J. Parsons, and Arthur D. Fisk (2008), *Understanding Technology Acceptance: Phase 3 (Part 1) – Quantitative Modeling*, Technical Report HFA-TR-0705, Atlanta, GA: Georgia Institute of Technology, School of Psychology, Human Factors and Aging Laboratory.

Rogers, Wendy, Arthur D. Fisk, Kelly E. Caine, Michelle Kwasny, Bart Wilkison, Andrew Mayer, and Van Ittersum, Koert (2008), *Understanding Technology Acceptance: Phase 3 (Part 2) – Communication Studies*, Technical Report HFA-TR-0706, Atlanta, GA: Georgia Institute of Technology, School of Psychology, Human Factors and Aging Laboratory.

Appendix A
Template for Survey Generator (Total Model)

«PRODUCT_TITLE_ALLCAPS» QUESTIONNAIRE

What do we mean by «product_title»?

«Product Title caps» is (*survey provider includes own description here*)

1. Please indicate what your attitude is towards «product_title», by circling the appropriate responses.

Bad	1	2	3	4	5	Good
Unfavorable	1	2	3	4	5	Favorable
Negative	1	2	3	4	5	Positive

2. Please indicate what your intention is to buy «product_title».

No intention	1	2	3	4	5	Strong intention
Unlikely	1	2	3	4	5	Likely

3. Will you buy «product_title»?

No

Yes

4. Please indicate for each statement about «product_title» to what extent you agree with it or feel it applies to you by circling the appropriate response.

	Strongly Disagree			Strongly Agree		
1) Use of «product_title» can increase the effectiveness of performing tasks and activities	1	2	3	4	5	
2) I would be concerned about «object1» performance when using «product_title»	1	2	3	4	5	
3) Using «product_title» will increase my productivity	1	2	3	4	5	
4) It would cost a lot to use «product_title»	1	2	3	4	5	
5) Learning to operate «product_title» would be easy for me	1	2	3	4	5	
6) I will not be required to use «product_title»	1	2	3	4	5	
7) I would find «product_title» easy to use	1	2	3	4	5	
8) Using «product_title» would take too much time from my normal activities	1	2	3	4	5	
9) I have seen «product_title» on many «location_of_use_of_product»s	1	2	3	4	5	
10) Using «product_title» would involve too much time «action1»	1	2	3	4	5	
11) Using «product_title» would be compatible with all aspects of my work	1	2	3	4	5	
12) I believe I could communicate to others the consequences of using «product_title»	1	2	3	4	5	
13) Using «product_title» would fit into my work	1	2	3	4	5	
14) The use of «product_title» would be voluntary	1	2	3	4	5	
15) I could use «product_title» on a trial basis to see what it can do	1	2	3	4	5	
16) Using «product_title» would improve the quality of my work	1	2	3	4	5	
17) I have had opportunities to try out «product_title»	1	2	3	4	5	
18) I will have no difficulty telling others about the results of using «product_title»	1	2	3	4	5	
19) The results of using «product_title» are apparent to me	1	2	3	4	5	
20) Using «product_title» will fit well with the way I like to work	1	2	3	4	5	
21) I would have difficulty explaining why using «product_title» may or may not be beneficial	1	2	3	4	5	
22) Working with «product_title» would be so complicated, it would be difficult to understand what is going on	1	2	3	4	5	
23) «Product_title_firstcap» is not visible on my «location_of_use_of_product»	1	2	3	4	5	
24) It would be easy for me to become skilful at using «product_title»	1	2	3	4	5	
25) Although it might be helpful, using «product_title» is certainly not compulsory in my job	1	2	3	4	5	
26) If I use «product_title», I increase the quality of output	1	2	3	4	5	
27) There are financial barriers to me using «product_title»	1	2	3	4	5	
28) It is easy to try out «product_title» without a big commitment	1	2	3	4	5	

5. The following statements are about your general thoughts and feelings regarding technology. Please indicate for each statement to what extent you agree with it.

	Strongly Disagree			Strongly Agree	
	1	2	3	4	5
1) I prefer to use the most advanced technology available	1	2	3	4	5
2) There is no such thing as a manual for a high-tech product or service that is written in plain language	1	2	3	4	5
3) Technology makes me more efficient in my occupation	1	2	3	4	5
4) I can usually figure out new high-tech products and services without help from others	1	2	3	4	5
5) I do not consider it safe to do any kind of financial business online	1	2	3	4	5
6) I find I have fewer problems than other people in making new technology work for me	1	2	3	4	5
7) Technical support lines are not helpful because they don't explain things in terms I understand	1	2	3	4	5
8) I like computer programs that allow me to tailor things to fit my own needs	1	2	3	4	5
9) When I get technical support from a provider of a high-tech product or service, I sometimes feel as if I am being taken advantage of by someone who knows more than I do	1	2	3	4	5
10) I do not consider it safe giving out a credit card number over a computer	1	2	3	4	5
11) I enjoy the challenge of figuring out high-tech gadgets	1	2	3	4	5
12) I worry that information I send over the internet will be seen by other people	1	2	3	4	5

6. The following statements are about your thoughts about «product_title», relative to «object1»s without this technology. Please indicate for each statement to what extent you agree with it or feel it applies to you by circling the appropriate response.

	Strongly Disagree			Strongly Agree	
	1	2	3	4	5
1) I have a lot of knowledge about «product_title»	1	2	3	4	5
2) My colleagues will be very supportive of the use of «product_title» for my job	1	2	3	4	5
3) I am very familiar with «product_title»	1	2	3	4	5
4) I think that people who influence my behavior think that I should use «product_title»	1	2	3	4	5
5) My colleagues will be helpful in the use of «product_title»	1	2	3	4	5
6) We have the knowledge necessary to use «product_title»	1	2	3	4	5
7) In general, my colleagues will support the use of «product_title»	1	2	3	4	5
8) I do not have much experience using «product_title»	1	2	3	4	5
9) I have the resources necessary to use «product_title»	1	2	3	4	5
10) Specialized instruction concerning «product_title» will be available to me	1	2	3	4	5
11) In light of the resources, opportunities, and knowledge required to use «product_title», it would be easy for me to use «product_title»	1	2	3	4	5
12) I think that people who are important to me think that I should use «product_title»	1	2	3	4	5
13) Assistance will be available to deal with system difficulties	1	2	3	4	5

7. The following statements are about your feelings about «product_title», relative to «object1»s without this technology. Please indicate for each statement to what extent you agree with it or feel it applies to you by circling the appropriate response.

	Strongly Disagree			Strongly Agree	
	1	2	3	4	5
1) I would think using «product_title» is pleasant	1	2	3	4	5
2) I would find working with «product_title» to be fun	1	2	3	4	5
3) I would like working with «product_title»	1	2	3	4	5

Please answer the following questions about yourself:

8. How many years have you been working in «industry_of_work»? _____ years

9. Please describe your educational history. Check as many as needed and please describe your major.

Level of education

Major

- No formal education
- Less than high school graduate
- High school graduate/GED
- Vocational training
- Some college/Associate's degree
- Bachelor's degree (BA, BS)
- Master's degree (or other post-graduate training)
- Doctoral degree (PhD, MD, EdD, DDS, JD, etc.)

10. What is your gender? Female Male

11. What is your age? _____ years

12. Please describe any factors that you will consider in deciding (not) to buy «product_title».

.....

.....

Thank you for your participation!!

Appendix B
Template for Survey Generator (Predictive Model)

«PRODUCT_TITLE_ALLCAPS» QUESTIONNAIRE

What do we mean by «product_title»?

«Product Title caps» is (*survey provider includes own description here*)

1. Please indicate what your attitude is towards «product_title», by circling the appropriate responses.

Bad	1	2	3	4	5	Good
Unfavorable	1	2	3	4	5	Favorable
Negative	1	2	3	4	5	Positive

2. Please indicate what your intention is to buy «product_title».

No intention	1	2	3	4	5	Strong intention
Unlikely	1	2	3	4	5	Likely

3. Will you buy «product_title»?

No

Yes

4. Please indicate for each statement about «product_title» to what extent you agree with it or feel it applies to you by circling the appropriate response.

	Strongly Disagree			Strongly Agree	
1) Use of «product_title» can increase the effectiveness of performing tasks and activities	1	2	3	4	5
2) I would be concerned about «object1» performance when using «product_title»	1	2	3	4	5
3) Using «product_title» will increase my productivity	1	2	3	4	5
4) It would cost a lot to use «product_title»	1	2	3	4	5
5) Learning to operate «product_title» would be easy for me	1	2	3	4	5
6) I will not be required to use «product_title»	1	2	3	4	5
7) I would find «product_title» easy to use	1	2	3	4	5
14) The use of «product_title» would be voluntary	1	2	3	4	5
16) Using «product_title» would improve the quality of my work	1	2	3	4	5
24) It would be easy for me to become skilful at using «product_title»	1	2	3	4	5
25) Although it might be helpful, using «product_title» is certainly not compulsory in my job	1	2	3	4	5
26) If I use «product_title», I increase the quality of output	1	2	3	4	5
27) There are financial barriers to me using «product_title»	1	2	3	4	5

5. The following statements are about your general thoughts and feelings regarding technology. Please indicate for each statement to what extent you agree with it.

	Strongly Disagree			Strongly Agree	
1) I prefer to use the most advanced technology available	1	2	3	4	5
2) There is no such thing as a manual for a high-tech product or service that is written in plain language	1	2	3	4	5
3) Technology makes me more efficient in my occupation	1	2	3	4	5
4) I can usually figure out new high-tech products and services without help from others	1	2	3	4	5
5) I do not consider it safe to do any kind of financial business online	1	2	3	4	5
6) I find I have fewer problems than other people in making new technology work for me	1	2	3	4	5
7) Technical support lines are not helpful because they don't explain things in terms I understand	1	2	3	4	5
8) I like computer programs that allow me to tailor things to fit my own needs	1	2	3	4	5
9) When I get technical support from a provider of a high-tech product or service, I sometimes feel as if I am being taken advantage of by someone who knows more than I do	1	2	3	4	5
10) I do not consider it safe giving out a credit card number over a computer	1	2	3	4	5
11) I enjoy the challenge of figuring out high-tech gadgets	1	2	3	4	5
12) I worry that information I send over the internet will be seen by other people	1	2	3	4	5

6. The following statements are about your thoughts about «product_title», relative to «object1»s without this technology. Please indicate for each statement to what extent you agree with it or feel it applies to you by circling the appropriate response.

	Strongly Disagree			Strongly Agree		
4) I think that people who influence my behavior think that I should use «product_title»	1	2	3	4	5	
12) I think that people who are important to me think that I should use «product_title»	1	2	3	4	5	

7. The following statements are about your feelings about «product_title», relative to «object1»s without this technology. Please indicate for each statement to what extent you agree with it or feel it applies to you by circling the appropriate response.

	Strongly Disagree			Strongly Agree		
1) I would think using «product_title» is pleasant	1	2	3	4	5	
2) I would find working with «product_title» to be fun	1	2	3	4	5	
3) I would like working with «product_title»	1	2	3	4	5	

Please answer the following questions about yourself:

8. How many years have you been working in «industry_of_work»? _____ years

10. What is your gender? Female Male

11. What is your age? _____ years

Thank you for your participation!!

Appendix C

Which Statements and Questions Measure Which Part of the Model?

Table 1.

Dependent Var.	Items	Response Scale	Questions
Attitudinal Acceptance	Please indicate what your attitude is towards «product_title».	1=Bad, 5=Good 1=Unfavorable, 5=Favorable 1=Negative, 5=Positive	Q1
Intentional Acceptance	Please indicate what your intention is to buy «product_title».	1=No intention, 5=Strong intention 1=Unlikely, 5=Likely	Q2
Behavioral Acceptance	Will you buy «product_title»?	Yes-No	Q3

Table 2 Independent Variables

Construct	Items	Response Scale	Questions
Technology Characteristics			
Perceived Usefulness	Use of a «product_title» can increase the effectiveness of performing tasks and activities	1=Strongly Disagree, 5=Strongly Agree	Q4.1
	Using a «product_title» improves the quality of my work		Q4.16
	Using a «product_title» increases my productivity		Q4.3
	If I use a «product_title», I increase the quality of output		Q4.26
Ease of Use	Learning to operate a «product_title» would be easy for me	1=Strongly Disagree, 5=Strongly Agree	Q4.5
	It would be easy for me to become skilful at using a «product_title»		Q4.24
	I would find a «product_title» easy to use		Q4.7
Complexity	Using a «product_title» would take too much time from my normal activities	1=Strongly Disagree, 5=Strongly Agree	Q4.8
	Working with a «product_title» would be so complicated, it would be difficult to understand what is going on		Q4.22
	Using a «product_title» would involve too much time doing mechanical operations		Q4.10
Compatibility	Using a «product_title» is compatible with all aspects of my work	1=Strongly Disagree, 5=Strongly Agree	Q4.11
	Using a «product_title» fits well with the way I like to work		Q4.20
	Using a «product_title» fits into my work		Q4.13
Trialability	I can use a «product_title» on a trial basis to see what it can do	1=Strongly Disagree, 5=Strongly Agree	Q4.15
	It is easy to try out the «product_title» without a big commitment		Q4.28
	I have had opportunities to try out the «product_title»		Q4.17
Observability/Visibility	One sees «product_title» on many farms	1=Strongly Disagree, 5=Strongly Agree	Q4.9
	The «product_title» is not very visible on my farm		Q4.23
Result Demonstrability	I have no difficulty telling others about the results of using a «product_title»	1=Strongly Disagree, 5=Strongly Agree	Q4.18
	I believe I could communicate to others the consequences of using a «product_title»		Q4.12
	The results of using a «product_title» are apparent to me		Q4.19
	I would have difficulty explaining why using the «product_title» may or may not be beneficial		Q4.21
Voluntariness	The use of the «product_title» is voluntary	1=Strongly Disagree, 5=Strongly Agree	Q4.14
	I am not required to use the «product_title»		Q4.6
	Although it might be helpful, using a «product_title» is certainly not compulsory in my job		Q4.25
Perceived Financial Cost	It would cost a lot to use a «product_title»	1=Strongly Disagree, 5=Strongly Agree	Q4.4
	There are financial barriers to me using a «product_title»		Q4.27

Table 2. Independent Variables (-continued-)

User Characteristics			
Optimism	I prefer to use the most advanced technology available I like computer programs that allow me to tailor things to fit my own needs Technology makes me more efficient in my occupation	1=Strongly Disagree, 5=Strongly Agree	Q5.1 Q5.8 Q5.3
Technology Anxiety	Technical support lines are not helpful because they don't explain things in terms I understand There is no such thing as a manual for a high-tech product or service that is written in plain language When I get technical support from a provider of a high-tech product or service, I sometimes feel as if I am being taken advantage of by someone who knows more than I do	1=Strongly Disagree, 5=Strongly Agree	Q5.7 Q5.2 Q5.9
Innovativeness	I can usually figure out new high-tech products and services without help from others I enjoy the challenge of figuring out high-tech gadgets I find I have fewer problems than other people in making new technology work for me	1=Strongly Disagree, 5=Strongly Agree	Q5.4 Q5.11 Q5.6
Insecurity	I do not consider it safe giving out a credit card number over a computer I do not consider it safe to do any kind of financial business online I worry that information I send over the internet will be seen by other people	1=Strongly Disagree, 5=Strongly Agree	Q5.10 Q5.5 Q5.12
Knowledge	I have a lot of knowledge about «product_title» I am very familiar with «product_title»	1=Strongly Disagree, 5=Strongly Agree	Q6.1 Q6.3
Social Factors	My colleagues will be helpful in the use of a «product_title» My colleagues will be very supportive of the use of a «product_title» for my job In general, my colleagues will support the use of a «product_title»	1=Strongly Disagree, 5=Strongly Agree	Q6.5 Q6.2 Q6.7
Subjective Norm	I think that people who influence my behavior think that I should use a «product_title» I think that people who are important to me think that I should use a «product_title»	1=Strongly Disagree, 5=Strongly Agree	Q6.4 Q6.12
Behavioral Control	I have the resources necessary to use a «product_title» We have the knowledge necessary to use a «product_title» In light of the resources, opportunities, and knowledge required to use a «product_title», it would be easy for me to use a «product_title»	1=Strongly Disagree, 5=Strongly Agree	Q6.9 Q6.6 Q6.11
Experience	I do not have much experience using «product_title»	1=Strongly Disagree, 5=Strongly Agree	Q6.8
Facilitating Conditions	Specialized instruction concerning a «product_title» will be available to me Assistance will be available to deal with system difficulties	1=Strongly Disagree, 5=Strongly Agree	Q6.10 Q6.13
Affect	I would think using a «product_title» is pleasant I would find working with a «product_title» to be fun I would like working with a «product_title»	1=Strongly Disagree, 5=Strongly Agree	Q7.1 Q7.2 Q7.3

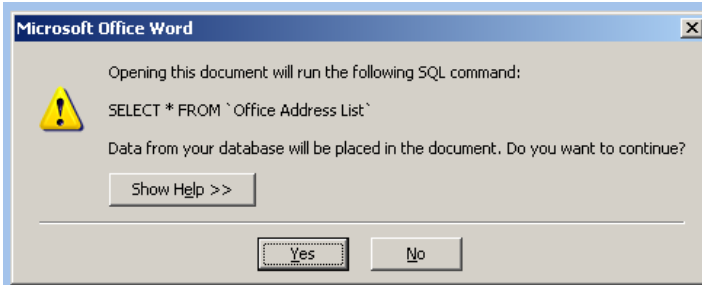
Appendix D

Instructions for Survey Generator

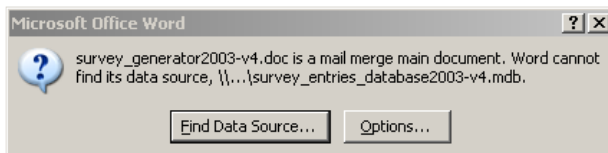
Word 2007 instructions (for Word 2003 instructions scroll down):

The two files you'll need are the survey generator template (.doc file) and the database of entries (.mdb file). These should work with both Microsoft Office 2007 and Office 2003.

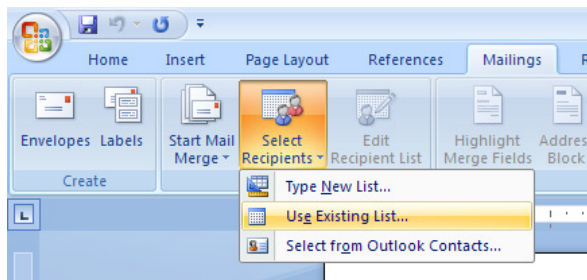
- 1) Open the .doc file which contains the survey template. In this case, survey_generator2003-v5.doc
- 2) Word will ask you if it's ok to run the following SQL command. Click **Yes**.



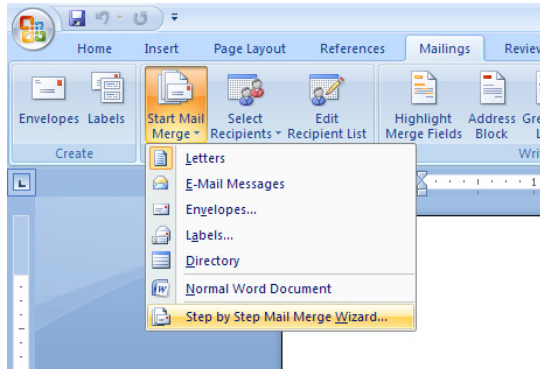
- 3) If an error message appears stating Word cannot find the data file, close any open dialogue boxes until you get to an option to **Find Data Source**. Select the directory the .mdb file is in or the new filename if it has been renamed. The name and location of the .mdb file is stored in the .doc file, so the survey template will need to be resaved once you locate your missing file.



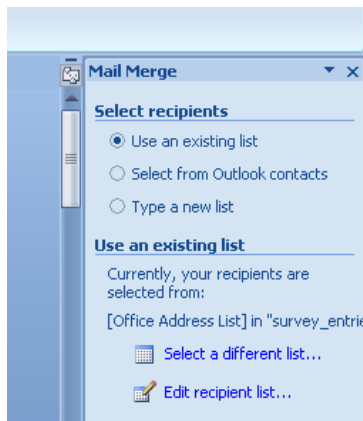
- 4) Alternatively once you open the .doc file you may choose to go to the **Mailings** tab and **Select Recipients -> Use Existing List** and select your .mdb data file from there.



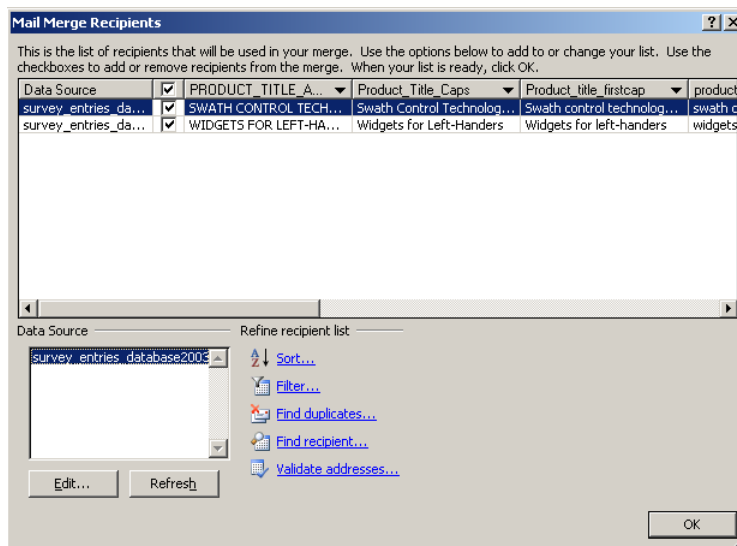
- 5) Once your document is open, select the **Mailings** tab, then **Start Mail Merge -> Step by Step Mail Merge Wizard**.



- 6) A side bar should appear indicating the Mail Merge Wizard. Select **Edit Recipient List**

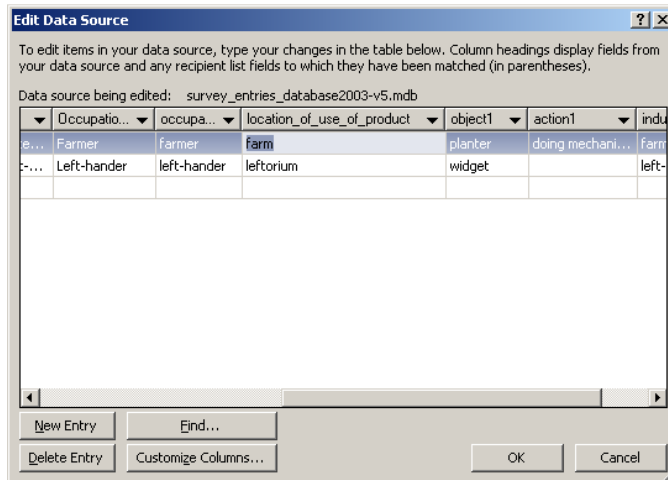


- 7) Select your .mdb file in **Data Source** at the bottom and click **Edit**



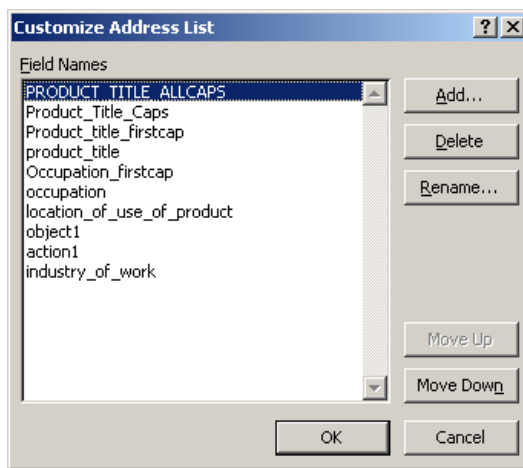
- 8) At the next window, click **New Entry**. This will create a new row. Each column in this window matches a field in the survey template highlighted in red. Each row will become a different version of the survey. Enter a value in each column to match what you would like to appear at this location in the final survey. For example, see Question 4.9,

I have seen «product_title» on many «location_of_use_of_product»s.



Keep in mind capitalization and whether the value needs to be plural or singular. In the example above, the “s” is included in the question so that the variable can remain singular and used elsewhere.

- 9) If a survey question needs to be further customized, select **Customize Columns** and **Add** a field of your own.



Then from the document toolbar ribbon at the top of the screen, select **Insert Merge Field** and choose your new field from where you want it to appear in your survey.. You will need to make sure values are filled in to populate this field once the final document is Merged.

- 10) Once your fields are filled in, click OK and save all changes to the .doc and .mdb file to continue. At the bottom of the Mail Merge sidebar, click **Next: Write Your Letter**. If you have any further edits to make to the document, make them now.
- 11) Click **Next: Preview your Letters**. The first row of fields in the recipient list should replace the text in red with your customized values. Scroll through the versions of the survey by clicking forward or backwards on the **Recipients** buttons. This is equivalent to selecting a row from the .mdb file.
- 12) Click Next: **Complete the Merge** to finalize the document. Review that all the fields you entered display correctly and match the formatting and grammar you intended. Final edits can be still be made at this time. At this point you can select the entire document (Ctrl-A) and change the font settings to remove the red highlighting. Save your final document to a filename separate from the original template. Alternatively, select all, copy, then paste-special into a new document in order

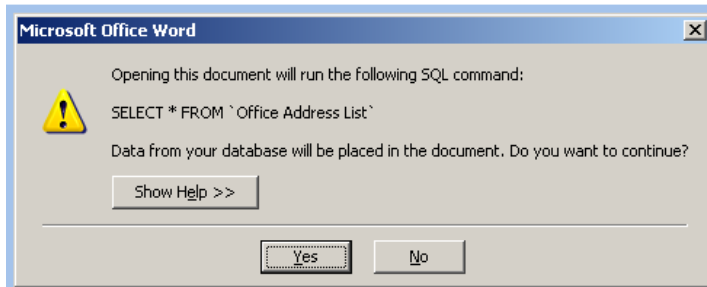
to paste purely as text which will eliminate the .doc file's need to link to the original database (.mdb) file. Save your new survey.

- 13) Save the original survey generator file to keep any edits made to the template and database file. Repeat the above process as needed.

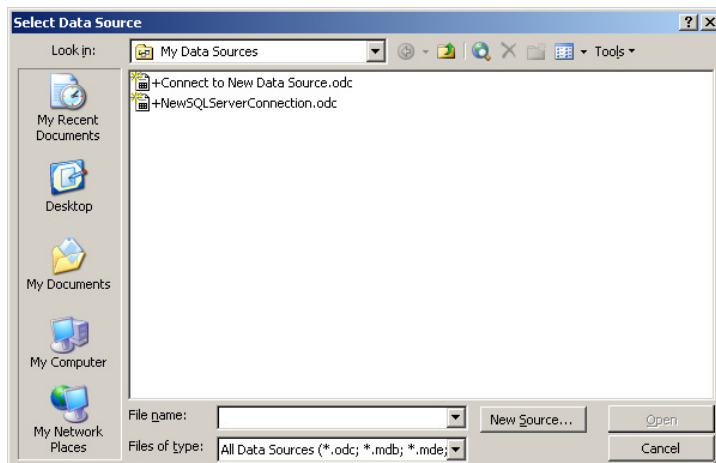
Word 2003 instructions:

The two files you'll need are the survey generator template (.doc file) and the database of entries (.mdb file). These should work with both Microsoft Office 2007 and Office 2003.

- 1) Open the .doc file which contains the survey template. In this case, survey_generator2003-v5.doc
- 2) Word will ask you if it's ok to run the following SQL command. Click **Yes**.

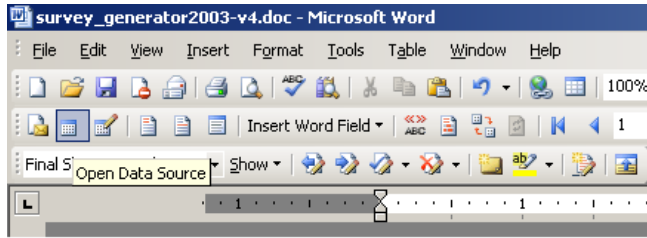


- 3) If an error message appears stating Word cannot find the data file, close any open dialogue boxes until you get to an option to **Select Data Source**. Select the directory the .mdb file is in or the new filename if it has been renamed. The name and location of the .mdb file is stored in the .doc file, so the survey template will need to be resaved once you locate your missing file.

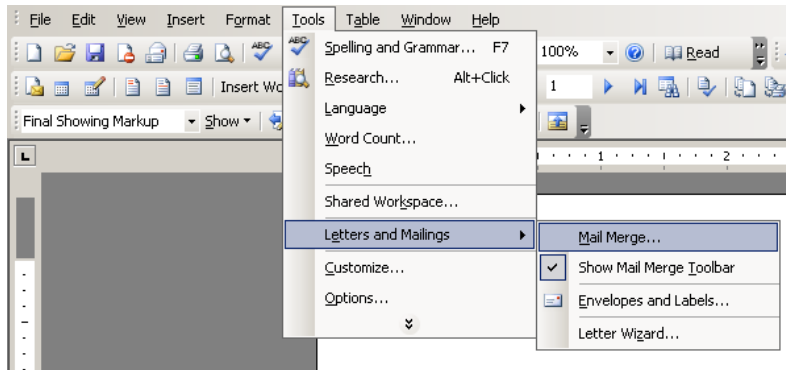


- 4) Alternatively once you open the .doc file you may choose to select the Data Source from the Mail Merge toolbar. This should launch automatically once the survey template is opened. If not, go to **View -> Toolbars** and select **Mail Merge**.

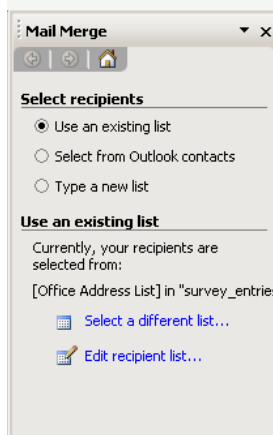
Select the **Open Data Source** icon below to bring up Windows Explorer as shown above and select the location of the .mdb file containing your recipients.



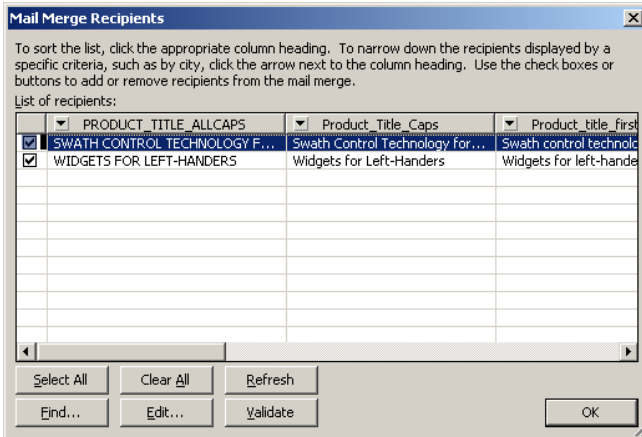
5) Once your document is open, select **Tools-> Letters and Mailings -> Mail Merge**.



6) A side bar should appear indicating the Mail Merge Wizard. Select **Edit Recipient List**

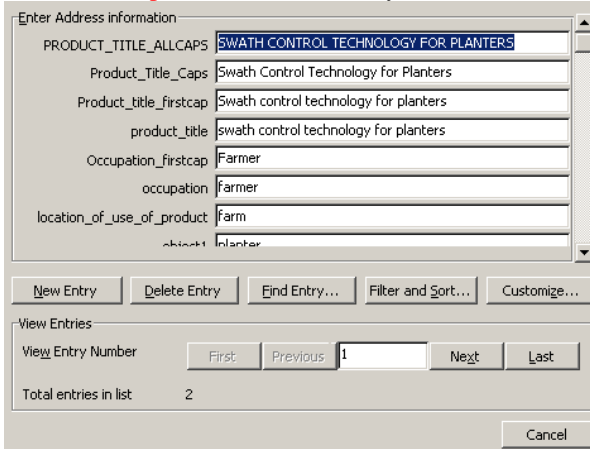


7) Select a row and click **Edit**



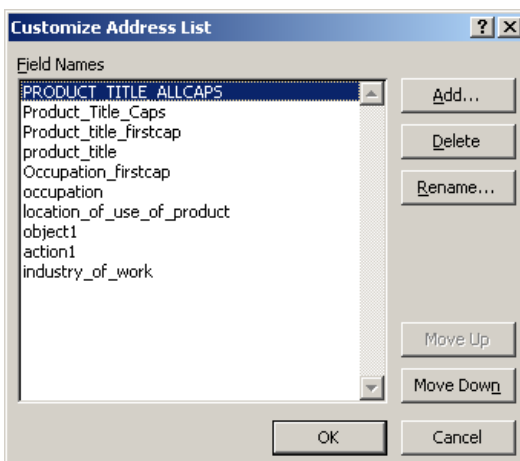
- 8) At the next window, click **New Entry**. This will create a new set of fields. Each cell in this window matches a field in the survey template highlighted in red. Each set of cells will become a different version of the survey. Enter a value in each cell to match what you would like to appear at this location in the final survey. For example, see Question 4.9,

I have seen «product_title» on many «location_of_use_of_product»s.

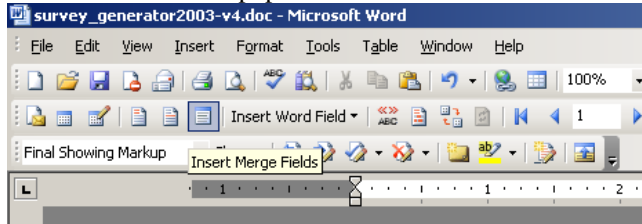


Keep in mind capitalization and whether the value needs to be plural or singular. In the example above, the “s” is included in the question so that the variable can remain singular and used elsewhere.

- 9) If a survey question needs to be further customized, select **Customize** and **Add** a field of your own.



Then from the Mail Merge toolbar at the top of the screen, select **Insert Merge Field** and choose your new field from where you want it to appear in your survey. You will need to make sure values are filled in to populate this field once the final document is Merged.



- 10) Once your fields are filled in, click OK and save all changes to the .doc file to continue. (The .mdb file should save automatically). At the bottom of the Mail Merge sidebar, click **Next: Write Your Letter**. If you have any further edits to make to the document, make them now.
- 11) Click **Next: Preview your Letters**. The first row of fields in the recipient list should replace the text in red with your customized values. Scroll through the versions of the survey by clicking forward or backwards on the **Recipients** buttons. This is equivalent to selecting a row from the .mdb file.
- 12) Click Next: **Complete the Merge** to finalize the document. Review that all the fields you entered display correctly and match the formatting and grammar you intended. Final edits can be still be made at this time. At this point you can select the entire document (Ctrl-A) and change the font settings to remove the red highlighting. Save your final document to a filename separate from the original template. Alternatively, select all, copy, then paste-special into a new document in order to paste purely as text which will eliminate the .doc file's need to link to the original database (.mdb) file. Save your new survey.
- 13) Repeat the above process as needed.