

# Understanding Technology Acceptance: Phase IV – Testing the Predictive Validity

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## 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. This report presents the outcome of our efforts with regards to objectives (1) and (2). Efforts on the other objectives are reported separately.

The main conclusion with regard to objective 1 is that the external predictive validity is promising. For 2 out of 3 customers in a target market, the model correctly predicted whether they will adopt a technology. Furthermore, the model helped identify what the critical determinants were for customers' decision to adopt a specific technology. Based on the results of a follow-up survey that included open-ended questions on why customers decide whether they will adopt, we conclude that the core of the proposed *Georgia TechAccept Model* is valid. The perceived usefulness and perceived cost savings are among the most relevant factors influencing the final decision of whether to adopt a technology.

The qualitative results provided additional insights into the decision making process. That is, these data indicated why respondents did or did not perceive the technology to be useful to them personally and for their farm.

The Georgia TechAccept Model represents a useful tool for predicting and understanding customers' decision to accept new technologies. Furthermore, the qualitative results underscore the importance of conducting qualitative research that may pick up on nuances in the decision making process that may be difficult to quantify.

## Chapter 1 – Understanding Technology Acceptance

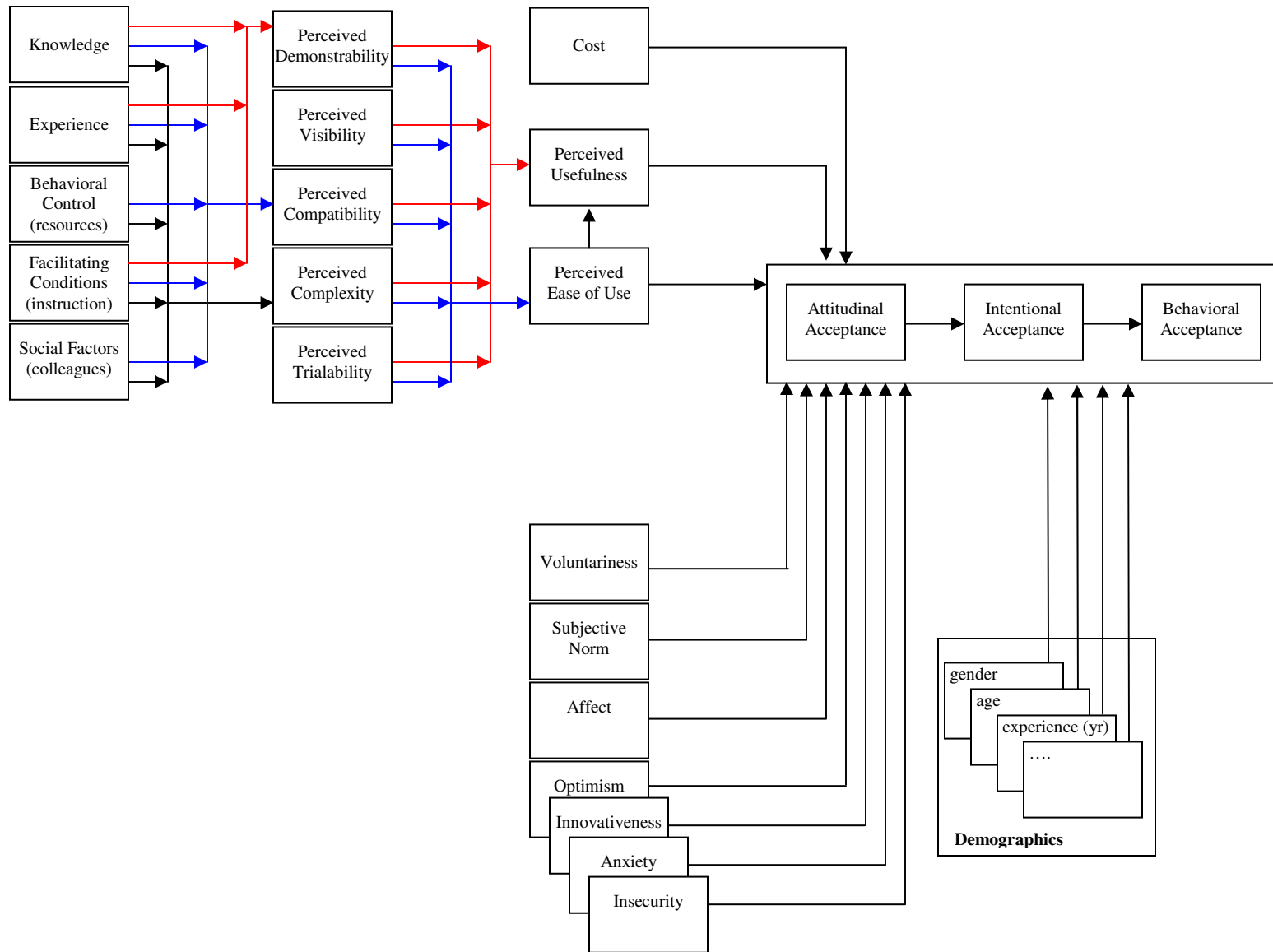
One of the most critical uncertainties associated with new-technology introductions is whether the target market will accept them. This uncertainty poses serious challenges for marketing managers planning a technology's production, pricing, distribution, and promotion. To reduce this uncertainty and to increase the success rate of new technology introductions, it is critical to understand and predict the market acceptance of new technologies. To accommodate this in the context of the customers and technologies of *Deere & Company*, we engaged in a four-year longitudinal research project, with the main objective to develop a model to better understand and predict technology acceptance. The application of this model would help improve the quality of the decision-making process and reduce uncertainty when considering new technologies for product development programs.

To accomplish this objective, we first conducted an extensive review of hundreds of academic articles published in marketing, information technology, and for instance agricultural economics. From this review, we determined those variables that are proposed to be critical to technology acceptance as well as the purported inter-relationships of those variables.

After we determined the critical variables of technology acceptance, we constructed a database of measures for each of the variables identified. To that end, we developed an operational definition (i.e., a measurable determination) for each of the variables. We then identified available metrics that have been validated in the research literature. The outcome of this process was a searchable program that enables *Deere & Company* to easily identify what measures are available, how reliable these measures are, and what questions need to be asked to measure the construct under consideration (the Scale E-Library available on JD Forum).

Next, we conducted a study involving over 200 participants to test and fine-tune the most appropriate variables for our model development in the context of *Deere* customers and technologies. The outcome of this study was further examined through a series of structured interviews with five to ten *Deere* customers enabling us to review the clarity of the measurement tools. Following this, we pretested the quantitative model, using the refined measures, to assess whether the model was comprehensive. We developed a questionnaire tool that was tested first with subject matter experts and then administered to approximately 470 *Deere* customers (in two studies). Based on the results of these tests, we refined the model, the end result of which is shown in Figure 1.1. Next we conducted a fourth study to test the predictive power of our technology acceptance model by predicting the market performance of a technology that was not yet introduced by *Deere & Company*. We discuss the details in Chapter 2.

Figure 1.1 Georgia TechAccept Model



## Chapter 2 – Predictive Validity Examined

### *Background*

In close collaboration with multiple divisions at *Deere & Company*, we selected Swath Control for Planters as the focal technology to test the quantitative model shown in Figure 1.1. To test the quantitative model for Swath Control Technology for Planters, in Phase III, we surveyed a random sample of 5,005 US corn growers with farms of 500+ acres during the summer of 2007. With a total of 579 participants responding, the final response rate was 11.8%. On average, the farmers' attitude towards the Swath Control Technology for Planters was favorable ( $M = 4.0$  on a scale 1=very unfavorable attitude, 5=very favorable attitude). This favorable attitude translated in a strong intention to accept this new technology –  $M = 3.4$  (which is significantly higher than the scale midpoint of 3, on a scale 1 to 5, with 5 representing a strong intention to accept this technology). When asked whether they will buy the Swath Control Technology for Planters, 64.4% indicated that they will buy. However, this percentage of 64.4% most likely was inflated because of the overrepresentation of larger farms in our sample. Larger farms are more likely to buy this type of the technology than smaller ones. When we corrected for the overrepresentation of larger farms in the sample, we found that the corrected self-reported acceptance rate was 59.5% - according to these self-reported behavioral measures; thus basically 60% percent of the target market planned to buy Swath Control.

The (internal) predictive validity of our model was high – the percentage of correctly predicted choices (yes/no acceptance) was 91.1%. This percentage means that the model is 91.1% accurate in predicting who is likely to accept (64.4%) and who is not likely to accept (35.6%). To examine the predictive validity more rigorously, we



examined the out-of-sample predictive validity by estimating our entire model based on a randomly selected 60% of our sample and using the outcome to predict the self-reported acceptance of the other 40% of prospective customers in our sample. The predictive validity of the model remained high. We found that, when we estimated our model for 60% of the sample and used the model estimates to predict the self-reported behavior of the other 40%, the percentage of correctly predicted choice (yes/no accept) was 88.3%. This means that we could ask a new sample of corn growers to only answer questions on the predictors (e.g., perceived costs, perceived usefulness, perceived ease of use), and without asking them if they would accept the technology we would still be able predict with an 88.3% accuracy whether these corn growers would state that they will or will not accept the Swath Control Technology for Planters. This suggested that our model has great predictive validity (for details, refer to the final research report of Phase III; Van Ittersum, Rogers, Capar, Park, Caine, O'Brien, Parsons, & Fisk, 2007b).

As noted in our reporting on Phase III, a more rigorous test of the predictive validity is to test the model predictions against actual behavior. To accomplish this, we collected behavioral data in Phase IV.

### ***Methodology***

To collect actual behavioral data, we re-contacted all participants of the survey in Phase III via phone during the spring of 2008 and again during the summer of 2009. The same procedure was used during both surveys.

We conducted these follow-up surveys via phone to maximize the response rate. Individuals were contacted during both daytime and evening hours Monday through Friday (9:00a.m. - 9:00 p.m.), and also on Sunday evenings (5:00 p.m. - 9:00 p.m.). The

Computer-Assisted Telephone Interviewing callback scheduler had an algorithm that automatically re-attempted a no-answer or answering machine the next day. If the initial no-answer or answering machine was attempted during evening hours, a notation would be made for that record to be called during the next day. Thus, all records were attempted over a variety of days and time periods to hit all time periods during the day in an attempt to reach the respondent. Records that encountered eight consecutive no-answer or answering machines over a variety of day/time periods were retired as unreachable. Busy signals were re-attempted 15 minutes after the initial busy. Another busy signal resulted in a callback set for the next day. We then tried those over a variety of day/time periods.

Once we spoke with someone at the farm, we continued to call that record until there was a final disposition (e.g. completion, refusal, ineligible, etc.), so there was no limit to the number of times such a record would be called.

Callbacks indicated that we spoke to someone at the farm and were asked to callback at another time. Usually, those left at callback status at the conclusion of the study were instances where we simply were not able to get to the person – even though we continued setting callbacks, the person was never available to speak with us.

Regarding “no eligible respondent,” this could occur for a number of reasons, but generally the person whose name was reported as having completed the survey previously was no longer working at the farm. We had a contact name for the record, but were told that that person did not work there anymore, or that they did not know who that person was. Thus it was not a case where the person simply was not there. If that were the case, the respondent would be logged as “respondent never available” or end with a callback. In the outset of the call, we explained that someone at the farm had completed a mail survey

earlier and that we would like to speak with that person. If nobody could be identified that had completed the mail survey, then that would also be coded no eligible respondent.

Overall, the outcome was that 221 farmers agreed to participate (which represented a response rate of approximately 65%) in the survey shown in Appendix A. The main objectives of the survey were to assess respondents' actual behavior with respect to the adoption of the Swath Technology for Planters, and to assess the key influencers and reasons for adopting or not-adopting the technology. In reporting the results of the predictive accuracy, we focus on predicting the behavior at the end of the two years. We examined whether differences existed between predicting behavior for the first year and the first two years, but did not find any. Thus for readability purposes, we focus on the entire two year time frame.

### ***Results***

The results we report focus on the 185 farmers for whom we know whether they adopted the technology. Of these, fifty-four percent (N=103) indicated they adopted the Swath Control Technology for Planters. However, of these, 38 already owned Swath Control Technology prior to our Phase III survey. To test the external predictive validity of our model, we focused on the 65 farmers who at the time of the Phase III survey did not yet own Swath Control Technology as well as all farmers who indicated in the follow-up survey that they did not own Swath Control technology. In combination with some missing values, this left a total sample of 142 observations. Of these, 45% (N=64) claimed to have adopted the technology. Table 2.1 cross tabulates farmers' behavioral intention (yes/no), assessed during the Phase III survey, against their actual adoption behavior, established during the first follow-up survey.

Of the 95 farmers who in the Phase III survey indicated that they would adopt the Swath Control Technology, 53.7% (N=51) actually ended up purchasing the technology between the Phase III survey and the second Phase IV follow-up survey. About 45% of them did not adopt the technology during the time frame.

Of the 47 farmers who informed us during the Phase III survey that they would not adopt the technology, 13 farmers (27.7%) actually adopted the technology anyway. To date, the majority of non-intenders have indeed not adopted the technology. In the next chapter we examine in more detail respondents' motivations for their decisions. Here we focus more specifically on the predictive validity of our model. How well did our model predict the actual behavior of these 142 respondents?

*Table 2.1. Raw data: Did Participants Follow-Through on Their Intentions to Adopt the Swath Control Technology for Planters?*

		Self-reported Intention to Adopt (Phase III)		
		No	Yes	Total
Actual Behavior (Phase IV)	Did not buy	72.3% (n=34)	46.3% (n=44)	54.9% (n=78)
	Did buy	27.7% (n=13)	53.7% (n=51)	45.1% (n=64)
Total		100.0% (n=47)	100.0% (n=95)	100.0% (n=142)

To test the predictive accuracy, we estimated our model for all Phase III participants with exception of the 142 respondents of the follow-up survey (N=400, 73.1% of the sample). The outcome was next used to predict the ACTUAL behavior of the 142 farmers who did participate in the follow up survey. Tables 2.2 show the results. The results represent an out-of-sample test of the predictive validity.

Overall, we found that the predictive validity was 64.7% ((N=25 + N=50)/N=116). This means that we could ask a new sample of corn growers to only answer questions on the predictors (e.g., perceived costs, perceived usefulness, perceived ease of use), and, without asking them if they would accept the technology, we would still be able to predict with a 64.7% accuracy whether these corn growers will or will not accept the Swath Control Technology for Planters during the first 24 months of technology availability. So, for almost 2 out of 3 growers we would be able to correctly predict if s/he will adopt the technology during the first 24 months of availability.

*Table 2.2. Out-of-Sample Predictive Validity of Georgia TechAccept Model Based on the Estimation of the Model for Those Phase III Respondents Who Did Not Respond in Phase IV*

		Predicted		
		Intention to adopt		
		No	Yes	Total
Actual Behavior (Phase IV)	Did not buy	89.3% (n=25)	43.2% (n=38)	54.3% (n=63)
	Did buy	10.7% (n=3)	56.8% (n=50)	45.7% (n=53)
Total		100.0% (n=28)	100.0% (n=88)	100.0% (n=116)

### Chapter 3 – Insights from Adopters, Intenders, and Non-Adopters of Swath Control Technology for Planters

Besides reporting adoption behavior, the participants in the two follow-up studies were asked a series of questions to determine the motivations of adopters and non-adopters. Since time may change motivations (e.g., due to various societal circumstances), we present the results of these responses for the first and the second survey separately. The first survey finished roughly 12 months after the introduction and the second survey approximately 24 months. It is relevant to note that in between the first and second survey, the state of the economy declined, and this may have an influence on the results, as will be discussed.

During the first survey, we asked 162 respondents whether they owned the technology. 42.0% of the respondents said they currently owned the technology. We asked those that still did not own the technology whether they intended to buy it. 27.1% of total respondents said they intended to adopt the technology, whereas the remaining 30.9% had no intention to adopt. During the second survey, which took place two years after the introduction, we surveyed 158 respondents with the same questions. While the percentage of adoption had not changed much, the number of participants with an intention to adopt increased from 27.1% to 32.9%, about 6%. Table 3.1 shows the adoption status of the Swath Control Technology for Planters among all the respondents of both surveys.

*Table 3.1. Adoption Status of the Swath Control Technology for Planters*

Adoption Status	Survey 1		Survey 2	
	Number of Respondents	Percentage (%)	Number of Respondents	Percentage (%)
Adopter	68	42.0	67	42.4
Intends to adopt	44	27.1	52	32.9
Has no intent to adopt	50	30.9	39	24.7
<b>Total</b>	<b>162</b>	<b>100</b>	<b>158</b>	<b>100</b>

*Note.* Survey 1 was administered in 2008, 1 year after the introduction of the technology. Survey 2 was administered in 2009, 2 years after the introduction of the technology.

## ADOPTERS

Farmers who adopted the Swath Control Technology for Planters reported ownership of 14 brands of the technology. Table 3.2 shows these brands and the percentages of the frequencies these brands were mentioned. Among owners of the Swath Control Technology for Planters, 48.7% reportedly owned the John Deere brand a year after introduction. This percentage is the same two years after introduction. Trimble and AG Leader are the next most frequently owned brands, one and two years after introduction, respectively. It is interesting to note that the market share of Trimble seems to decrease, whereas AgLeader is gaining some share. Also, new brands have appeared on the market. Table 3.2 present the brands reportedly owned by the adopters of the Swath Control Technology for Planters and the frequencies (in terms of percentages) for each brand, one and two years after introduction.

*Table 3.2. Brands Owned by Farmers*

<b>Brand</b>	<b>Percentage (%)</b>	
	<b>Survey 1 (N=41)</b>	<b>Survey 2 (N=61)</b>
John Deere	48.7	45.9
Trimble	21.9	9.8
Ag Leader	12.2	18.0
Easy Steer	4.9	0.0
Outback	2.4	3.3
AutoFarm	2.4	3.3
True Comp	2.4	4.9
Caterpillar	2.4	0.0
Rinex	2.4	0.0
Case IH	0.0	4.9
Kinze	0.0	4.9
RTK	0.0	1.6
Beeline	0.0	1.6
Omnistar	0.0	1.6
<b>Total</b>	100.0	100.0

*Note. Survey 1 was administered in 2008, 1 year after the introduction of the technology. Survey 2 was administered in 2009, 2 years after the introduction of the technology. The brand question was inadvertently not included for some respondents in Survey 1.*

More than half of the respondents who already adopted Swath Control Technology for Planters, adopted it in the last two years (2007-2008). Table 3.3 shows the cumulative percentages of adoption times in terms of percentages.

*Table 3.3. Adoption Times*

<b>Year</b>	<b>Cumulative Percent</b>	
	<b>Survey 1 (N=67)</b>	<b>Survey 2 (N=62)</b>
2000	1.5	0.0
2001	0.0	0.0
2002	4.5	1.6
2003	0.0	0.0
2004	10.4	0.0
2005	25.4	6.4
2006	41.8	12.9
2007	68.7	35.5
2008	100.0	82.3
2009		100.0

*Note. Survey 1 was administered in 2008, 1 year after the introduction of the technology. Survey 2 was administered in 2009, 2 years after the introduction of the technology.*



To understand the decision making process of the farmers in adopting the Swath Control Technology for Planters, we asked the participants who already owned the technology the reasons they bought it. Table 3.4 shows the primary reasons stated by the farmers to adopt the technology.

*Table 3.4. Primary Reasons for Adoption*

<b>Reason</b>	<b>Percent</b>	
	<b>Survey 1 (76 comments)</b>	<b>Survey 2 (62 comments)</b>
Efficiency/Precision	44.7	38.1
General Usefulness	18.4	6.3
Save Seed	15.8	15.9
Save Money	10.5	15.9
Ease of Use	6.7	11.1
Save Fuel	2.6	1.6
Replacement Time	1.3	1.6
Other	0	9.5*
<b>Total</b>	100.0	100.0

*Note. Survey 1 was administered in 2008, 1 year after the introduction of the technology. Survey 2 was administered in 2009, 2 years after the introduction of the technology. Some participants provide multiple primary reasons.*

*\*Half of the other comments were that “it came with the tractor.”*

The most important reasons mentioned can be classified as “perceived usefulness”. About 60% of the stated reasons for adoption of the Swath Control Technology for Planters belonged to this category. Almost half the comments provided referred to general efficiency and precision benefits. Furthermore, 20% of the comments actually stated that the technology was “useful” (without going into more details). Cost savings were mentioned as the second most relevant reason for adopting the technology. Almost 30% of the comments specified financial benefits associated with this technology (save seed, save money, save fuel). The results of survey 2 yielded similar results, although the

ease of use was mentioned more frequently. While in survey 1 ease of use represented 5% of the comments, that share increased to over 10% in the second survey.

To better understand the influential factors in farmer’s decision making processes in adopting the Swath Control Technology for Planters, we asked the participants who indicated they owned the technology who or what influenced their decision to purchase it.

As Table 3.5 shows, many influential factors were stated by the respondents as to whom or what influenced them in their decision to buy the Swath Control Technology for Planters. Among these, the most frequently stated reason was the dealer, specifically the *Deere & Company* dealers. Besides the dealer, other individuals (either working on the farm, or for instance neighboring farmers) played an important role in the final decision making. Respondents sometimes reiterated the importance of the usefulness and savings in the final decision.

*Table 3.5. Who/what influenced the adopters in their decision*

Source of Influence	Percent		Description
	Survey 1 (N=69 comments)	Survey 2 (N=67 comments)	
A Dealer	34.8	28.4	Salesman, Dealer (Deere, Caterpillar, Trimble, Case IH, AG Leader; Deere most frequent)
Another person	14.5	13.4	Neighbors
Advertisements	13.0	13.4	Farm magazines, Brochures
Another Farmer	4.4	13.4	Other farmers, known for > 20 yrs
Someone at my farm	5.8	7.5	My son
Usefulness	8.7	4.5	
Savings	8.7	13.4	
Some other reason	10.1	6.0	Past experiences, I just wanted it
<b>Total</b>	100.0	100.0	

*Note. Survey 1 was administered in 2008, 1 year after the introduction of the technology. Survey 2 was administered in 2009, 2 years after the introduction of the technology. Some participants provide multiple influences.*

## FARMERS WITH AN INTENTION TO ADOPT

We asked the respondents who did not own the Swath Control Technology for Planters whether they intended to purchase it sometime in the future. An interesting pattern can be seen when comparing the results one year after introduction and two years after introduction. One year after introduction, 40.7% of the respondents were not sure what brand to purchase; however, this percentage dropped to 16.7% two years after the introduction. More importantly, *Deere & Company* seemed to benefit the most, seeing its share of mind increase from 37.0% to 64.6%. The share of AG Leader dropped a little from 18.5% to 10.4%. Table 3.6 shows the brand preferences of the participants.

*Table 3.6. The brand they intend to adopt*

Brand	Percent	
	Survey 1 (N=25)	Survey 2 (N=48)
John Deere	37.0	64.6
Ag Leader	18.5	10.4
Trimble	3.7	2.1
Case IH	0.0	2.1
Kinze	0.0	4.2
Not sure	40.7	16.7
<b>Total</b>	100.0	100.0

*Note. Survey 1 was administered in 2008, 1 year after the introduction of the technology. Survey 2 was administered in 2009, 2 years after the introduction of the technology. The brand question was inadvertently not included for some respondents in Survey 1.*

We asked those who intended to adopt the Swath Control Technology for Planters when they planned to purchase it. In comparing the responses from a year after the introduction (survey 1) to those two years after the introduction (survey 2), it becomes clear, that while the overall intent to adopt may not have changed, the timing of adoption seems to have been postponed. While a year after the introduction, almost 3 out of 4

intenders planned to adopt by 2009, two years after the adoption this percentage dropped to one out of five. The economy is most likely to blame.

*Table 3.7. When they intend to adopt*

Year	Cumulative Percent	
	Survey 1 (N=30)	Survey 2 (N=28)
2008	13.3	3.6
2009	73.3	21.4
2010	93.3	46.4
2011	96.7	75.0
2012	100.0	92.9
2013		100.0

*Note.* Survey 1 was administered in 2008, 1 year after the introduction of the technology. Survey 2 was administered in 2009, 2 years after the introduction of the technology. For Survey 2 many respondents did not provide an answer to this question.

When asked “Why will you be making the purchase at this time?” the respondents stated a broad range of reasons which we grouped under different categories. Table 3.8 shows these categories and their frequencies (in terms of percentages).

*Table 3.8. Primary reasons for why they intend to adopt the technology in the future*

Reason	Percent	
	Survey 1 (N=43)	Survey 2 (N=52)
Replacement Time	34.6	23.1
Efficiency/Precision	25.6	15.4
Save Money	11.7	36.6
General Usefulness	9.4	9.6
Save Seed	7.0	3.8
Save Fuel	0	0
Ease of Use	7.0	1.9
Other	4.7	9.6
<b>Total</b>	<b>100.0</b>	<b>100.0</b>

*Note.* Survey 1 was administered in 2008, 1 year after the introduction of the technology. Survey 2 was administered in 2009, 2 years after the introduction of the technology.

It is notable that the replacement time (34.5%) was an important reason for respondent to decide why they intend to adopt the technology in the future. Besides the timing, the perceived usefulness of the technology (“efficiency/precision” and “general usefulness”) and the cost savings (“save money,” “save seed”) were important additional reasons to adopt in the future.

The responses suggest that the state of the economy has influenced the decision of when to adopt the technology. One year after the introduction, replacement time (34.6%) was a dominating reason; however two years post-introduction cost savings were more critical (40.4%). Stated differently, during economic down turn, the decision to adopt is driven more by cost savings.

To better understand the influential forces on their decision to adopt, we asked the participants with an intention to adopt who or what influenced them in their decision to purchase the Swath Control Technology for Planters. These sources of influence and the frequencies (in terms of percentages) in which they were stated is presented in Table 3.9.

*Table 3.9. Who/what influenced the adopters in their decision*

<b>Source of Influence</b>	<b>Percent</b>		<b>Description</b>
	<b>Survey 1 (N=42)</b>	<b>Survey 2 (N=52)</b>	
A Dealer	19.0	19.2	Dealer (Deere most frequently mentioned)
Advertisements	19.0	23.1	Farm magazines and internet
Another Farmer	14.3	11.5	Neighbor and other farmers (known > 20 yrs)
Someone at my farm	2.5	1.9	Myself, my wife
Another person	0.0	9.6	My son
Usefulness	19.0	5.8	
Ease of use	4.8	1.9	
Savings	11.9	13.5	
Some other reason	9.5	13.5	Existing Swath products
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	

*Note. Survey 1 was administered in 2008, 1 year after the introduction of the technology. Survey 2 was administered in 2009, 2 years after the introduction of the technology.*

According to these results, the most frequently stated sources of influence were a dealer and advertisements. The differences between one and two years after introduction were minimal, although advertisements may have become more important (which in turn may be driven by more advertising on part of *Deere* and competing companies). Besides these personal influences, respondents reiterated the usefulness and cost savings as important reasons to adopt the technology in the future. Other reasons respondents stated include already having Swath products on.

## FARMERS WITH NO INTENTION TO ADOPT

One year after the introduction of the technology, 30.9% of our participants had no intent to adopt. Two years after introduction, this percentage dropped to 24.7% (see Table 3.1.). We asked these respondents why they did not plan to buy the technology in the future. Table 3.10 presents the primary reasons they stated for not adopting.

*Table 3.10. Primary reasons for having no intent to adopt the technology*

Reason	Percent	
	Survey 1 (51 comments)	Survey 2 (38 comments)
No need	35.3	28.9
Cost issues	27.5	26.3
Farm Characteristics	13.7	23.7
Age	9.8	2.6
Don't Want	5.9	0
Not easy to use	3.9	5.3
Equipment issues	3.9	2.6
Other	0	10.6*
<b>Total</b>	100.0	100.0

*Note.* Survey 1 was administered in 2008, 1 year after the introduction of the technology. Survey 2 was administered in 2009, 2 years after the introduction of the technology. Some participants provide multiple primary reasons.

*\*These comments related to lack of knowledge about the product.*

The differences between one and two years after introduction were minor. Many respondents who decided not to purchase the Swath Control Technology for Planters declared that they did not need the technology (> 45%). The reasons they gave for not needing it varied from size and shape of the farm to the farmer being about to retire. Over 25% of the reasons dealt with financial issues: the price of the technology was considered to be high or they believed it was not financially beneficial for them to use this technology.

We asked the non-adopters with no intention to adopt the technology in the future who or what influenced them in their decision. All of those who responded provided “another reason” than the four pre-specified categories (dealer, advertisements, another farmer, and

someone at my farm). To better understand who or what influenced the farmers in their decision not to adopt the Swath Control Technology for Planters, we examined the reasons provided under “some other reason” category closely. Table 3.11 shows the categories that emerged from this inspection.

*Table 3.11. Other Reasons that influenced farmers in their decision not to adopt the Swath Control Technology for Planters*

<b>Other Source of Influence</b>	<b>Percent</b>	
	<b>Survey 1 (N=39 comments)</b>	<b>Survey 2 (N=35 comments)</b>
No need	23.1	25.0
Personal Choice	20.5	5.6
Cost	15.4	19.4
Farm Characteristics	10.2	13.9
Age	10.2	5.6
Don't want	10.2	11.1
Equipment Issue	7.7	5.6
Not easy to Use	2.6	2.8
Other	0	11.1*
<b>Total</b>	<b>100.0</b>	<b>100.0</b>

*Note. Survey 1 was administered in 2008, 1 year after the introduction of the technology. Survey 2 was administered in 2009, 2 years after the introduction of the technology. Some participants provide multiple primary reasons.*

*\*Most of these relate to lack of knowledge.*

The most frequently reported reason for not adopting the technology was that the non-adopters did not feel a need for the technology – the technology lacked sufficient usefulness. Another relevant factor was the costs of adopting the technology were perceived as too high – the benefits did not justify the investment. Many of the other reasons mentioned tend to relate to the first two described. For instance, for someone close to retirement, investing in this technology may not be cost-effective. Some farmers basically said that they did not want to technology.



## SUMMARY: INTENTIONS VERSUS BEHAVIORS

Finally, we examined the motivations for farmers who followed through on their intentions to adopt or not to adopt Swath Control Technology for Planters, and those who did not. The results are summarized in Table 3.12.

*Table 3.12. Motivations to Follow Through on Intention to Adopt as Expressed in Phase III*

		Self-reported Intention to Adopt (Phase III)	
		No	Yes
Actual Behavior (Phase IV)	Did not buy	...has no intention to buy	<ul style="list-style-type: none"> <li>-no need for it</li> <li>- not cost effective</li> <li>- age/retirement</li> <li>- too expensive</li> <li>- don't want it</li> </ul>
	Did not buy	...but has intention to buy	<ul style="list-style-type: none"> <li>- will adopt when replacing current planter</li> <li>- wait for improved version</li> <li>- price will drop</li> </ul>
	Did buy		<ul style="list-style-type: none"> <li>- report dealer as important influencer</li> <li>- lower cost</li> <li>- higher accuracy</li> <li>- efficient (compared to markers)</li> <li>- less effort</li> </ul>

As Table 3.12 demonstrates, the most important reasons for farmers who did not and still do not have an intention to adopt Swath Control Technology are that they do not feel they need it, perceive it will not be cost effective, they are close to retirement, they perceive it to be too expensive, or they simply do not want it.

Then there are the farmers who had an intention during Phase III who still have not adopted the technology, even though they still intend to. The most mentioned reason for this “delay” was that they are waiting for the moment when they will replace their

planters. A few farmers indicated that they expect the usability to improve in new generations of the technology and that the price will drop somewhat.

Finally, farmers who intended and adopted the technology indicated a mixture of reasons to adopt the technology. Lower costs, efficiency, more accuracy, and less effort were among the most often mentioned motivations. These motivations are in line with key antecedents in our predictive model.

## Chapter 4 – General Summary

The results presented in this report conclude a four-year research endeavor aimed at developing a model to better understand and predict technology acceptance to help improve the quality of the decision-making process and reduce the uncertainty when considering new technologies for product development programs.

The building-blocks of this research are presented in:

- 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, Research Report for Deere & Company, Georgia Institute of Technology, Atlanta, Georgia, USA, 52 pages.
- 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, Research Report for Deere & Company, Georgia Institute of Technology, Atlanta, Georgia, USA, 42 pages.

The results presented in this report demonstrate that the external predictive validity is promising. For 2 out of 3 customers in a target market, the model correctly predicts whether they will adopt a technology. The model also helps identify what the critical determinants are for customers' decision to adopt a specific technology. And,

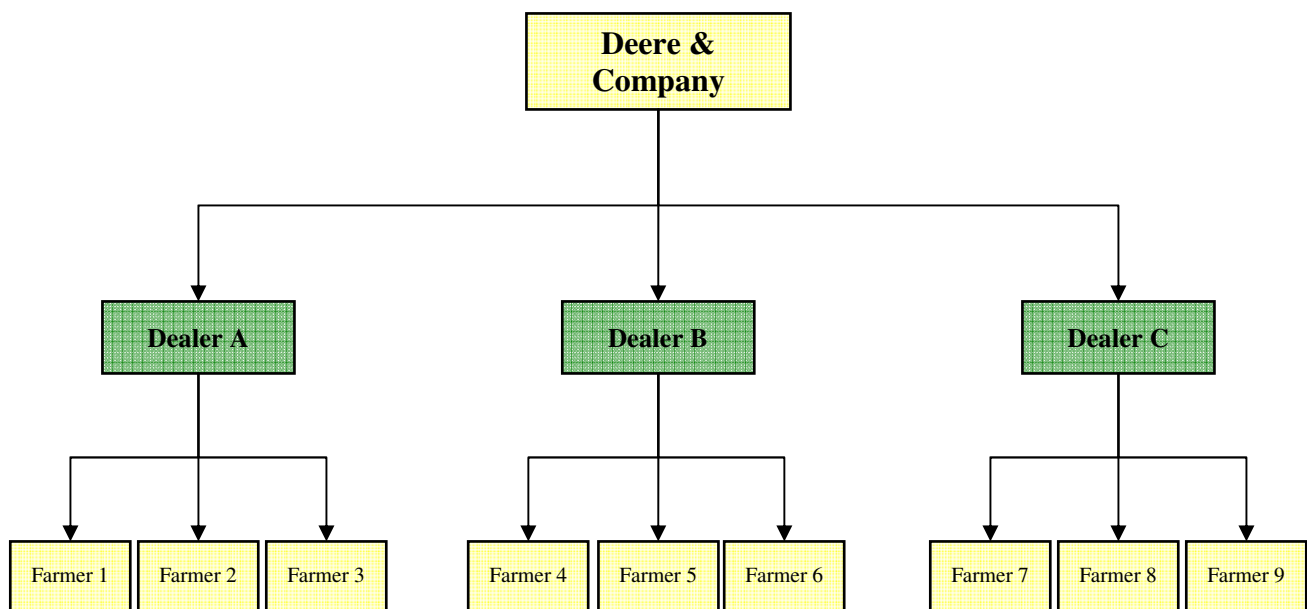
based on the results of a follow-up survey that included open-ended questions on why customers decide whether they will adopt, we conclude that the core of the proposed *Georgia TechAccept Model* is valid. More generally, we conclude that the Georgia TechAccept Model represents a useful tool for predicting and understanding customers' decision to accept new technologies. For detailed guidance on the application of the model, we refer to

Van Ittersum, Koert, Wendy Rogers, Leonard J. Parsons, and Arthur D. Fisk (2009), *Understanding Technology Acceptance: Phase IV – Research Protocol for Predicting the Acceptance of Technologies*, Technical Report HFA-TR-09-06, Research Report for Deere & Company, Georgia Institute of Technology, Atlanta, Georgia, USA.

## Chapter 5 – Future Research

*Deere & Company* dealers play a prominent role in end-customer adoption of new technologies. Despite the importance of the upstream channel members in the adoption process of new technologies, most research on the adoption of new technologies focuses on the adoption by end-customers (e.g., farmers). Limited attention is paid to the role of important upstream channel members, such as dealers. While one non-adopting end-customer may be considered a loss, a non-adopting dealer serving hundreds of end-customers may have far more severe consequences for the success of new technologies and ultimately the performance of *Deere & Company* (see Figure 5-1). It is therefore important to gain a better understanding of the role of the dealers in the adoption process of end-customers. To this end, we propose to study dealers in more detail.

Figure 5-1.  
Adoption channel for new products



## Appendix A

### Interview Protocol for Follow-Up Study on Swath Control Technology

Hello, my name is [NAME], and I'm calling from the University of Georgia in Athens. Last summer someone associated with this farm participated in a written survey conducted jointly with the Georgia Institute of Technology about Swath Control Technology for Planters. We would like to conduct a 3-minute follow-up interview with the person who completed the mail questionnaire last year. May I speak to the person who completed the mail questionnaire last year?

[INTERVIEWER: INTERVIEW PERSON WHO COMPLETED INTERVIEW LAST YEAR; ARRANGE CALLBACK AS APPROPRIATE].

[IN CASE A DIFFERENT PERSON COMPLETED INTERVIEW AND IS COMING TO THE PHONE, FIRST REINTRODUCE YOURSELF \* THEN MOVE ON, ELSE CONTINUE TO REMIND THE INDIVIDUAL ABOUT THE SWATH CONTROL TECHNOLOGY FOR PLANTERS \*\*]

\* Hello, my name is [NAME], and I'm calling from the University of Georgia in Athens. Last summer you participated in a written survey conducted jointly with the Georgia Institute of Technology about Swath Control Technology for Planters.

\*\* To remind you, Swath Control Technology for planters is a technology that uses GPS while planting seeds for row crops to minimize planting overlaps and gaps. It automatically engages and 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. We would like to conduct a 3-minute follow-up interview with you.

Before I start, I need to let you know that any information you provide for me will be kept strictly confidential and your participation is completely voluntary. You can skip any questions you don't want to answer, and you may discontinue participation at any time. Also, my supervisor may listen to part of the interview for quality control purposes.

Q1 – Do you currently own the Swath Control Technology for Planters?

1. Yes
2. No [SKIP TO Q5]

Q2a – What brand do you own?

Q2b – When did you purchase the Swath Control Technology for Planters?

[ENTER MONTH AND YEAR – MM/YYYY]

-- / ----

Q3a – Why did you purchase the Swath Control Technology for Planters?

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Q3b – Any other reasons?

Q4a – Who or what influenced you in your decision to purchase the Swath Control Technology for Planters (multiple answers allowed)?

1. Advertisements [SPECIFY WHICH ONE \_\_\_\_\_]
2. Another Farmer [SPECIFY HOW LONG YOU HAVE KNOWN HIM \_\_\_\_\_]
3. A Dealer [SPECIFY WHICH ONE \_\_\_\_\_]
4. Someone at my farm [SPECIFY WHO AND THEIR POSITION \_\_\_\_\_]
5. Some other reason [SPECIFY \_\_\_\_\_]

[INTERVIEWER: IF RESPONDENT GIVES MORE THAN ONE RESPONSE, [CONTINUE WITH Q4b, ELSE SKIP TO CLOSE]

Q4b – Of the answers you just provided, who or what influenced you THE MOST in your decision to purchase the Swath Control Technology for Planters (only one answer allowed)?

[SKIP TO CLOSE]

---

Q5 – Do you plan to purchase the Swath Control Technology for Planters sometime in the future?

1. Yes
2. No [SKIP TO Q9a]

Q6a – What brand do you plan to purchase?

Q6b – When do you plan to purchase the Swath Control Technology for Planters?

[ENTER MONTH AND YEAR – MM/YYYY]

-- / ----

Q7a – Why will you be making the purchase at this time?

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Q7b – Any other reasons?

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Q8a – Who or what influenced you in your decision to purchase the Swath Control Technology for Planters (multiple answers allowed)?

1. Advertisements [SPECIFY WHICH ONE \_\_\_\_\_]
2. Another Farmer [SPECIFY HOW LONG YOU HAVE KNOWN HIM \_\_\_\_\_]
3. A Dealer [SPECIFY WHICH ONE \_\_\_\_\_]
4. Someone at my farm [SPECIFY WHO AND THEIR POSITION \_\_\_\_\_]
5. Some other reason [SPECIFY \_\_\_\_\_]

[INTERVIEWER: IF RESPONDENT GIVES MORE THAN ONE RESPONSE, [CONTINUE WITH Q8b, ELSE SKIP TO CLOSE]

Q8b – Of the answers you just provided, who or what influenced you THE MOST in your decision to purchase the Swath Control Technology for Planters (only one answer allowed)?

[SKIP TO CLOSE]

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Q9a – Why not? (Why do you plan on not buying Swath Control technology for Planters in the future?)

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Q9b – Any other reasons?

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Q10a – Who or what influenced you in your decision NOT to purchase the Swath Control Technology for Planters (multiple answers allowed)?

1. Advertisements [SPECIFY WHICH ONE \_\_\_\_\_]
2. Another Farmer [SPECIFY HOW LONG YOU HAVE KNOWN HIM \_\_\_\_\_]
3. A Dealer [SPECIFY WHICH ONE \_\_\_\_\_]
4. Someone at my farm [SPECIFY WHO AND THEIR POSITION \_\_\_\_\_]
5. Some other reason [SPECIFY \_\_\_\_\_]

[INTERVIEWER: IF RESPONDENT GIVES MORE THAN ONE RESPONSE, [CONTINUE WITH Q10b, ELSE SKIP TO CLOSE]

Q10b – Of the answers you just provided, who or what influenced you THE MOST in your decision NOT to purchase the Swath Control Technology for Planters (only one answer allowed)?

[CLOSE]

Thank you very much for your help today, and have a nice day.