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Dead Or Alive? The Development, Trajectory And Future Of Technology Adoption Research.

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Abstract:

Research on individual-level technology adoption is one of the most mature streams of information systems (IS) research. In this paper, we compare the progress in the area of technology adoption with two widely-researched streams in psychology and organizational behavior: theory of planned behavior and job satisfaction. In addition to gauging the progress in technology adoption research, this allows us to identify some fruitful areas for future research. Based on our comparison, we conclude that there has been excellent progress in technology adoption research. However, as a next step, we call for research focused on interventions, contingencies, and alternative theoretical perspectives (to the largely social psychology-based technology adoption research). Also, we believe it would be important to use the comparisons discussed here as a basis to develop a framework-driven set of future research directions to guide further work in this area.

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Introduction

Neither a conference trip nor a visit to a university goes by without us being asked about the state of technology adoption research or, more specifically, technology acceptance model (TAM) research. In different forums, including the *Decision Sciences International Conference* in Boston in 2004 and the *Gordon B. Davis Symposium* in Minneapolis in 2005, we have tried to address this question, and we are excited to have the opportunity to continue the dialog in the *Journal of the Association of Information Systems*. Our typical answer to the question, "Is technology adoption research is dead?" has been, "Yes and no." The answer is "yes" if the inquiry implies a continuation of replications with no substantive theoretical advance. Such a state is clearly undesirable in any area of research, and technology adoption research seems to see a lot of replication with minor "tweaking." This is perhaps due to the parsimony of TAM, the robustness of its scales, and the strong generalizability of the model. However, the "no" part of our typical response stems from the tremendous opportunities that are still available to make substantial theoretical advances using our current knowledge as the starting point. In this paper, we make the case that technology adoption research is, in fact, "dead" in its most common current form—replication and minor extensions—but there are opportunities for future advances.

In this analysis, we respond to those who [rightfully] question the future of this area. Specifically, we chart the course of the progress of technology adoption research over the past two decades or so. We compare this progress with that of research in two prominent areas of research in psychology and organizational behavior—specifically, the theory of planned behavior (TPB) and job satisfaction. The first area, TPB research, provides us with a basis to conduct a model-centric comparison given that much of technology adoption research has relied on TAM. The second focus area, job satisfaction research, provides us with a basis for an outcome-centric comparison. That is, just as job satisfaction is a key job outcome of interest, technology adoption and/or use is a key outcome of interest from the perspective of system success (see DeLone and McLean 1992, 2003). Our earlier review and synthesis provides an extensive and detailed discussion of technology adoption research and presents the unified theory of acceptance and use of technology (UTAUT; Venkatesh et al. 2003). It is not our intent to repeat such a review here; rather, we hope to catalog major milestones and the progress of technology adoption research and then draw comparisons with advances in TPB and job satisfaction research.

Progression of Technology Adoption Research

While individual-level technology adoption has been studied for well over two decades, it gained prominence with the introduction of TAM (Davis 1989; Davis et al. 1989), which integrated diverse theoretical perspectives and built on social psychology research and presented a parsimonious model of adoption and use. Much of the research on technology adoption prior to TAM examined user satisfaction and attitudes (see Davis et al. 1989 for a discussion). The initial TAM research included valid, reliable, and easy to administer scales for the key constructs. TAM was shown to be empirically superior to the more general theory of reasoned action (Ajzen and Fishbein 1980; Davis et al. 1989; Fishbein and Ajzen 1975). The two papers that introduced TAM (Davis 1989; Davis et al. 1989) are frequently cited in research both in IS and in other fields, with well over 1,000 citations, thus underscoring its impact on IS and beyond. Our goal here is not to revisit the development and evolution of TAM per se (see Lee et al. 2003), but to examine the evolution of the broader domain of technology adoption research as a whole. The sections that follow will trace the progression of the technology adoption research area from studies focusing on replication and generalizability of the original TAM to recent efforts at construct refinement and the search for alternate theoretical mechanisms that drive the adoption and use of technology in organizations.

Replication and Generalizability

One of the first steps in establishing the efficacy of a theoretical model is examining its generalizability across time, populations, and contexts (Shadish, Cook, and Campbell 2002). Many of the early replication and generalizability examinations focused on TAM. Although other models of technology adoption have also been studied (see Venkatesh et al. 2003), here, we focus particularly on the replications tied to TAM, as it provides the broadest range of contexts in which generalizability has been examined. In the case of TAM, there were several early attempts to test the model in new settings using new technologies. Overall, the model and the scales were robust, and the predicted relationships were found to hold in various tests—e.g., Adams, Nelson, and Todd (1992); Hendrickson, Massey, and Cronan (1993); Mathieson (1991); and Venkatesh and Davis (2000). TAM was tested among various types of information systems, including email (Karahanna and Straub 1999; Straub 1994), groupware (Lou, Luo, and Strong 2000), expert systems (Keil, Beranek, and Konsynski 1995), CASE tools (Dishaw and Strong 1999), voice mail (Karahanna and Limayem 2000), calculator

(Mathieson 1991), digital libraries (Hong et al. 2001), spreadsheets (Mathieson 1991; Venkatesh and Davis 1996), and e-health systems (Wilson and Lankton 2004).¹ TAM has also been tested in different countries such as the U.S. (e.g., Davis 1989; Venkatesh and Davis 2000), Japan (e.g., Straub 1994; Straub, Keil, and Brenner 1997) and Saudi Arabia (e.g., Abdulgader and Kozar 1995).

Predictive Validity

Following an examination of generalizability of the various models, one of the logical next steps was to establish their predictive validity. The early tests of predictive validity examined intention (Davis et al. 1989; Mathieson 1991), self-reported use (Davis et al. 1989), choice (Szajna 1994), and actual use (Straub, Limayem, and Karahanna 1995; Venkatesh and Morris 2000) as dependent variables. Despite some concerns about intention models not predicting actual behavior (Straub et al. 1995), other research has found support for the predictive validity in IS use contexts (see Venkatesh et al. 2003) and other behaviors (e.g., Albarracin, Johnson, Fishbein, and Muellerleile 2001; Sheppard, Hartwick, and Warshaw 1988).

Competing Models

While TAM sparked much interest in technology adoption and has been the dominant model, there have been several competing models presented in the literature. TAM was presented as an adaptation of the more general social psychology theory of reasoned action (see Ajzen and Fishbein 1980; Fishbein and Ajzen 1975). Several other competing models [to TAM] emerged with roots in psychology, sociology, and IS (see Venkatesh et al. 2003 for a review). Initially, in order to benchmark TAM, Davis et al. (1989) compared it to the theory of reasoned action. Drawing upon the theoretical roots in Triandis' (1977) work on interpersonal behavior, Thompson, Higgins, and Howell (1991) proposed a model of PC utilization. Moore and Benbasat (1991), drawing upon innovation diffusion theory (IDT; Rogers 1995),² introduced various characteristics that would influence technology adoption. The predictive validity of IDT was examined by Agarwal and Prasad (1998). In addition to examining TAM and TPB, Taylor and Todd (1995a, 1995b) introduced a decomposed theory of planned behavior that aimed to preserve the generality of TPB [by using the core constructs of attitude, subjective norm, and perceived behavioral control] and TAM [by using beliefs tailored to the technology adoption context] but added richness by incorporating a more comprehensive set of beliefs. Other competing models that evolved have adapted the widely-employed social cognitive theory from psychology (Compeau and Higgins 1995a, 1995b).

There have been several model comparison studies (e.g., Davis et al. 1989; Mathieson 1991; Plouffe, Hulland, and Vandenbosch 2001; Taylor and Todd 1995a). The findings from those studies are discussed at some length in Venkatesh et al. (2003). In that paper, we also conducted a fairly exhaustive comparison of eight different models and their extensions. The findings revealed that TAM and its extensions compared favorably to other models, partly due to the extensive attention it has received that has enabled fine tuning of various aspects of the model. In addition to the comparisons, there were attempts to integrate competing models, which we discuss in greater length later. Overall, the competing models have helped discover theoretical depth and identify new constructs, thus contributing to scientific progress in this stream.

Theory Base to Study Unique Problems

Once a model or stream becomes well-established within a given domain, it often serves as a basis for studies in other areas—i.e., a well-established model or construct can then be used as the key outcome of interest in examining an unanswered question in a different domain. The advantage of a model that is nearly law-like (DiMaggio 1995) is that certain parts of the nomological network can be taken for granted such that a deeper investigation of specific new research questions can be conducted. An obvious example is how well-established theories from psychology and organizational behavior have been used to study various IS problems—rather than being straight applications of those theories, this work has served to develop context-specific theories and knowledge. Similarly, TAM and other technology adoption models are important because they have served as a theory base to study several problems in IS and other fields. One example within the domain of technology adoption is the investigation of the role of trust and its impact on adoption (Gefen, Karahanna, and Straub 2003a, 2003b). Another example is the use of TAM constructs as outcome measures to compare training methods (Venkatesh 1999). The models and constructs have been used in areas outside the confines of technology adoption as well, including information adoption (Sussman and Siegal 2003), marketing (e.g., Dabholkar and Bagozzi 2002; Gentry and Calantone 2002; Yang and Peterson 2004), and advertising (e.g., Rogers and Chen 2002), to name only a few. In fact, the robust and law-like nature of these models (TAM in particular) has even resulted in these models being used as a basis for comparing analytical techniques—e.g., LISREL vs. PLS (Chin and Todd 1995). Although models

¹ Our review indicated that TAM has been applied to over 50 technologies/systems.

² The previous edition of the book was published in 1983 and cited in Moore and Benbasat (1991)

of technology adoption were originally developed to study technologies in organizations, they have evolved beyond the originally intended technologies to study adoption of a wide range of technology-related (broadly speaking) behaviors such as dairy farming (Flett, Alpass, Humphries, Massey, Morriss, and Long 2004) and green electricity use (Arkesteijn and Oerlemans 2005). Thus, technology adoption research has had a significant impact on the study of important problems both within and beyond IS.

Temporal Dynamics and Other Contingencies

Identifying boundary conditions and situational contingencies related to technology adoption models presents an important step on the road to scientific progress and maturity within a stream. Several important and interesting contingencies that affect key relationships [predicting intention to use a system or system use] have been studied. The earliest investigations were conducted by Davis himself in the original paper introducing TAM (Davis et al. 1989). Subsequent to that, several researchers have found temporal dynamics to play a variety of critical moderating roles—two examples are the declining importance of perceived ease of use and social influence with time (see Taylor and Todd 1995a; Karahanna, Straub, and Chervany 1999; Venkatesh and Davis 2000). In addition to important temporal dynamics, several other contingencies have been identified, including voluntariness (Hartwick and Barki 1994; Venkatesh and Davis 2000), gender (Gefen and Straub 1997; Venkatesh and Morris 2000; Venkatesh et al. 2000), and age (Morris and Venkatesh 2000). More recently, the moderating effects have been shown to be even more complex—i.e., with higher-order interaction terms being significant (Morris, Venkatesh, and Ackerman 2005; Venkatesh et al. 2003).

Antecedents and Interventions

Common criticisms of TAM are also its key strengths: simplicity and parsimony (see Lee et al. 2003). While some other models—e.g., the model of PC utilization (Thompson et al. 1991) and innovation diffusion theory (Agarwal and Prasad 1998; Moore and Benbasat 1991)—are richer and incorporate a range of attributes, the empirical evidence has typically weighed in favor of TAM and its derivatives, with constructs tied to performance expectancy being the strongest predictors of intention (see Venkatesh et al. 2003). Despite this predictive ability, there is not enough systematic practical guidance about how managers, designers, and trainers could enhance adoption and use by influencing perceptions. In response to calls for research in this area, the antecedents to key constructs were identified—determinants of perceived usefulness (Venkatesh and Davis 2000); determinants of perceived ease of use (Venkatesh 2000); and, similarly, psychological origins of perceived usefulness and perceived ease of use were presented in Karahanna and Straub (1999). The antecedents helped deepen our understanding of the cognitive underpinnings of the key predictors of technology adoption and use. Beyond the determinants of key constructs that could provide a basis for interventions, training-related interventions were also examined (Olfman and Mandviwalla 1994; Venkatesh 1999; Venkatesh and Speier 1999). More recently, Koufaris (2002) and Gefen et al. (2003a, 2003b) have studied the role of trust in technology adoption, thus incorporating a construct with significant scientific and practical implications (see McKnight, Choudhury, and Kacmar 1998) into the context of technology use behaviors. Overall, the study of key antecedents and various interventions are key indicators of scientific progress and practical applicability of technology adoption research as it deepens our understanding of the phenomenon and provides levers for managerial action.

Construct Refinement and Alternative Mechanisms

There have been several interesting recent developments surrounding the refinement of existing constructs within technology adoption research. For example, using an expectation confirmation approach, Bhattacharjee (2001) introduced an alternative model grounded in expectations vs. experiences (see also Bhattacharjee and Premkumar 2004; Szajna and Scamell 1993)—however, research in this area is still emerging. Challenging the role of intention as the key predictor of system use and drawing from psychology research on the topic of habit, recent research has suggested the role of habit as a predictor of continued use (Morris et al. 2005; Venkatesh et al. 2000). Jasperson, Carter, and Zmud (2005) have also made the case to conceptualize use in a richer manner and study post-adoptive use. Overall, this suggests that while there has been some progress in refining the conceptualization of key constructs and identifying alternative mechanisms that drive use, the trend toward a more fundamental paradigm shift and enriching of the underlying mechanisms is still at an early stage of development and holds much promise.

Synthesis

As noted earlier, Taylor and Todd (1995a) integrated TPB with more IS-specific constructs, drawn from other technology adoption research, as determinants of the general predictors of TPB. Venkatesh et al. (2003) presents a recent synthesis of well over a decade of research. In that paper: (1) we reviewed eight different models of technology adoption and use and discussed various contingencies studied in prior literature; (2) we presented a summary of prior model comparison studies; (3) building on the prior literature, we presented a conceptual and empirical synthesis of the different models and described a unified theory of acceptance and use of technology (UTAUT); and (4) we presented directions for future research, some of

which we expound upon later in this paper. There have also been a number of meta-analyses of technology adoption research (e.g., Mahmood, Hall, and Leonard 2001; Premkumar 2003) that have appeared more than a decade following Davis' original work. More narrative reviews and pointers to key future research directions are presented in Gefen and Straub (2000), Lee et al. (2003), and Legris, Ingham, and Collette (2003). Overall, the several syntheses cited here reflect that this domain of research has reached a level of maturity that calls for an assessment of what is known and a need to identify fruitful directions for future research.

Summary

Table 1 summarizes the major milestones and key citations in technology adoption research. Clearly, TAM has had a significant influence on the IS field. Beyond replication and generalizability, much of the progress to date has centered around competing models with techno-centric predictors. However, research challenging the basic tenets of intention theories has been somewhat limited. Research on the determinants and interventions is now starting to emerge, although much of the research on interventions is tied to training.

Table 1. Summary of Progress of Technology Adoption Research	
Major Areas of Progress	Representative Examples and Key Cites
Influential models	<i>Technology Acceptance Model</i> : Davis (1989); Davis et al. (1989) <i>Theory of Planned Behavior</i> : Ajzen (1985, 1991); Mathieson (1991); Taylor and Todd (1995a, 1995b) <i>Innovation Diffusion Theory</i> : Agarwal and Prasad (1998) Moore and Benbasat (1991)
Replication and generalizability	<i>Population</i> : Adams et al. (1992); Hendrickson et al. (1993); Mathieson (1991) <i>Countries</i> : Japan—Straub et al. (1997); Saudi Arabia—Abdulgader and Kozar (1995) <i>Technologies</i> : Email—Karahanna and Straub (1999); Calculator—Mathieson (1991); Spreadsheet—Mathieson (1991) and Venkatesh and Davis (1996); Organizational systems—Venkatesh et al. (2003)
Predictive validity	<i>Actual use</i> : Straub et al. (1995); Venkatesh and Morris (2000); Venkatesh et al. (2003) <i>Choice</i> : Szajna (1994) <i>Intention</i> : Davis et al. (1989); Mathieson (1991) <i>Self-reported use</i> : Davis et al. (1989)
Competing models	<i>Decomposed theory of planned behavior</i> : Taylor and Todd (1995a, 1995b) <i>Innovation diffusion theory</i> : Moore and Benbasat (1991) <i>Social cognitive theory</i> : Compeau and Higgins (1995a, 1995b) <i>Triandis' model</i> : Thompson et al. (1991)
Theory base to study unique problems	<i>Advertising</i> : Rogers and Chen (2002) <i>Dairy farming</i> : Flett et al. (2004) <i>Green electricity</i> : Arkesteijn and Oerlemans (2005) <i>Information adoption</i> : Sussman and Seigal (2003) <i>Marketing</i> : Dabholkar and Bagozzi (2002) <i>Trust</i> : Gefen et al. (2003a, 2003b)
Temporal dynamics and other contingencies	<i>Age</i> : Morris and Venkatesh (2000) <i>Gender</i> : Gefen and Straub (1997); Venkatesh and Morris (2000) <i>Higher-order interactions</i> : Morris et al. (2005) <i>Temporal dynamics</i> : Karahanna et al. (1999); Taylor and Todd (1995a); Venkatesh and Davis (2000) <i>Voluntariness</i> : Hartwick and Barki (1994); Venkatesh and Davis (2000)
Determinants and other interventions	<i>Determinants of usefulness and ease of use</i> : Karahanna and Straub (1999); Venkatesh (2000); Venkatesh and Davis (2000) <i>Training interventions</i> : Olfman and Mandviwalla (1994); Venkatesh (1999); Venkatesh and Speier (1999)
Construct refinement and alternative mechanisms	<i>Expectation-disconfirmation</i> : Bhattacharjee (2001); Bhattacharjee and Premkumar (2004) <i>Habit</i> : Morris et al. (2005) <i>Post-adoption</i> : Jasperson et al. (2005)
Synthesis	Gefen and Straub (2000); Lee et al. (2003); Legris et al. (2003); Venkatesh et al. (2003)

Progression Of Research In Two Dominant Streams

As a young field, IS has wrestled with its identity and assessment of scientific progress (e.g., Benbasat and Zmud 2003; Whinston and Geng 2004). The frequent pronouncements of technology adoption research being a “dead” area are likely based on a feeling of lack of progress, stagnation, and/or a feeling that all relevant questions have already been answered. As with technology adoption in IS research, there are several dominant, mature streams of research in psychology and organizational behavior. In light of the discussion of technology adoption research, it is worth examining the trajectory of influential and mature research streams in other fields to understand whether research in *those* areas is still deemed important to pursue, and how the development and progression of those streams might be used to gauge the relative scientific progress and future of technology adoption research. We believe that tracing the development of these streams can be enlightening and can lend additional insights into potential meaningful next steps in technology adoption.

To conduct our analysis, we chose two different research streams from different reference disciplines: *theory of planned behavior* (TPB; Ajzen 1985) from psychology and *job satisfaction* (e.g., Judge and Larsen 2001; Judge, Heller, and Mount 2002) from organizational behavior. Both are dominant individual-level behavioral streams (and TPB is one that has even been applied to study technology adoption itself). Examining the progression of these streams can help us see parallels between them and, in light of the respective trajectories, may help us identify potential new areas for technology adoption research. Comparing the progress in technology adoption research with the progress in these two streams will also give us the opportunity to make two related yet distinct comparisons:

1. *Model-centric comparison*: A comparison of TAM and technology adoption models with TPB will allow us to examine more directly the impact, trajectory, and life of *theoretical models* in different fields—e.g., TAM vs. TPB; and
2. *Outcome-centric comparison*: A comparison of technology adoption research with job satisfaction research will allow us to examine the nomological network and evolution of research around a *critical outcome*—adoption/use vs. job satisfaction.

Theory of Planned Behavior

Ajzen (1985; 1991) introduced and summarized early findings related to TPB. The section that follows will highlight key milestones in the development of TPB and its trajectory over time. It is interesting to note that the trajectory of TPB is remarkably similar to technology adoption models, TAM in particular. Given that TPB is a general model of human behavior, while TAM and other technology adoption models focus on a specific behavior, there are bound to be differences in specific types of studies and areas of applications of each. However, our analysis shows that the key milestones in TPB to date are actually quite similar to those of TAM and related models. This consistency is particularly noteworthy when the nature of the contribution of technology adoption articles published in the premier IS journals is compared with TPB articles published in premier journals in psychology, organizational behavior, and other fields.

Like technology adoption research, many of the early studies of TPB focused on *replication and generalizability* to other type of behaviors. Paralleling technology adoption research, studies next assessed the *predictive validity* of TPB across a diverse range of different behaviors that not only illustrated the application of TPB, but also helped establish its predictive validity beyond simple replication studies. Having established the generalizability and predictive validity of TPB, researchers began to develop competing theoretical perspectives to provide either greater richness or context-specific models of different behavior (e.g., Taylor and Todd’s (1995a, 1995b) extension of TPB to technology adoption is illustrative of this line of research). As the robustness of TPB as a general model of human behavior became more established, researchers used it as a foundational *theory base to study unique problems* in psychology and other areas. Just as TAM became a foundation for studying training behaviors or online consumer behavior, TPB became an anchor for studying ethical decision making, smoking, and other problems.

With the core theory established across a wide domain of interesting theoretical contexts, understanding the *temporal dynamics and other contingencies* became increasingly important. Some of these contingencies focused on the specific domain being studied (e.g., gender in the prevalence of hypertension), while others were more general in nature (e.g., personal factors). As evidence of the increasing importance of these contingencies, meta-analyses of various moderators associated with TPB emerged (e.g., Notani 1998). Continuing with the trajectory of TPB research, often as part of a review and synthesis of TPB, studies explicated a set of *determinants and other interventions* for the core beliefs in TPB (attitude, subjective norm, and perceived behavioral control) with an eye toward providing more concrete managerial guidance about what factors could be leveraged in organizations to change behavior. Finally, having reached a point of relative maturity, recent developments in TPB have been centered around *refining the core constructs and identifying alternate mechanisms* that can be used to predict behavior. In particular, trying to better understand the nature and makeup of

perceived behavioral control has garnered a great deal of attention in the research literature as have debates between Ajzen and others who have challenged some of the tenets of TPB. These refinements and intellectual debates have helped advance our understanding of human behavior. We discuss the various foci of prior TPB research in detail next.

Replication and Generalizability

Much like researchers studying TAM, following the introduction of TPB, researchers focused on the *replication* and *generalizability* of TPB by applying TPB to various behaviors. While the application of TPB to different behaviors has been nearly never-ending, there were some early efforts focused on theory testing, replication, and an examination of generalizability that were published in premier journals: for example, weight loss (Schifter and Ajzen 1985) and goal-directed behaviors (Ajzen and Madden 1986). Of course, since then, across a variety of journals, studies of several behaviors, including health behaviors (e.g., Conner and Sparks 1996), have been published. This is consistent with the early replication studies on TAM being published in *MIS Quarterly* (Adams et al. 1992; Hendrickson et al. 1993) and *Information Systems Research* (Mathieson 1991). As we will discuss later, the range of behaviors studied have been synthesized in narrative and meta-analytic reviews. TPB has also been tested for generalizability via cross-cultural studies (e.g., Godin et al. 1996; Hanson 1999).

Predictive Validity

In quite the same way that the predictive validity of TAM was assessed in IS research, the *predictive validity* of TPB was assessed in empirical studies published in a wide variety of journals in many academic disciplines on a broad array of *behaviors* such as household recycling of newspapers, health-related behaviors (e.g., weight loss), negotiation, consumer behavior, composting, and rehabilitation, among others (e.g., Armitage and Conner 2001b; Boldero 1995; Blanchard et al. 2002; Bennett and Bozionelos 2000; East 1996; Fishbein and Ajzen 2005; Fortin 2000; Godin et al. 1996; Hobbis and Sutton 2005; Notani 1998; Shapiro and Watson 2000). Some of these studies were relatively simple applications of TPB but were nonetheless important steps in establishing the predictive validity of TPB beyond the initial wave of replication studies.

Competing Models

Like research in technology adoption where alternatives to TAM evolved, *competing theoretical perspectives* to TPB emerged with the goal of providing greater richness and/or a different lens to study behavior (e.g., Bagozzi and Kimmel 1995). Triandis' (1977) work is also an important competing social psychology theory that presents a general model of human behavior and has received some attention in psychology and other fields. Perhaps since TPB was a more general model of human behavior, some of the challengers to TPB were more context-specific models of specific target behaviors—e.g., volunteer motivation (e.g., Harrison 1995) and technology adoption (Taylor and Todd 1995a). Many studies compared different competing models (e.g., Bagozzi and Kimmel 1995; Bish, Sutton, and Golombok 2000; Hunter, Grunfeld, and Ramirez 2003; Leone, Perugini, and Ercolani 1999; Netemeyer, Andrews, and Durvasula 1993; Quine et al. 1998).

Theory Base to Study Unique Problems

As the robustness of TPB was established beyond doubt, it became a springboard for the study of important and interesting problems in various domains. This is akin to TAM serving as the starting point for the study of key problems such as training and online consumer behavior (e.g., Gefen et al. 2003b; Koufaris 2002; Venkatesh 1999). The key difference between applications of TPB to study specific behaviors and, more interesting, significant theoretical contributions was the extent to which the behavior being studied was important *and also* the extent to which TPB served as the basis for substantive theoretical development. The list of important behaviors studied building on TPB is extensive—e.g., ethical decision making (Flannery and May 2000), adherence to speed limits (Elliott, Armitage, and Baughan 2003), smoking cessation (Bennett and Clayworthy 1999), and employee adoption of technology (Venkatesh et al. 2000). These, and several other studies, served as a way to extend the core ideas in TPB and/or enhance the understanding of the target behavior.

Temporal Dynamics and Other Contingencies

Ajzen's work contributed to the understanding of some of the temporal dynamics (see Doll and Ajzen 1992). There were several other investigations of the role of time and the stability and relative importance of predictors (e.g., Conner et al. 2000; Sheeran and Abraham 2003). Some of the contingencies have been tied to the specific domain of investigation such as gender in technology (Venkatesh et al. 2000), among others (see Armitage et al. 2002; Conner and McMillan 1999; Conner et al. 2003; Conner et al. 2000; Maio and Olson 1995; Morris and Venkatesh 2000; Taylor et al. 2001), but they have the potential for applicability in other behavioral domains. In addition to context-specific contingencies, there have been general contingencies identified such as type of person (Sideridis 2001). In fact, Notani (1998) presented a meta-analysis of the various moderators of relationships tied to perceived behavioral control.

Determinants and Other Interventions

In TPB, the determinants are typically the five to seven modal beliefs each that are determinants of attitude, subjective norm, and perceived behavioral control, respectively, within the specific domain/behavior. These beliefs are potential interventions which if/when influenced or manipulated could affect the target behavior. In addition to the modal beliefs being domain-specific, TPB suggests that various external variables can influence the modal beliefs. Such external variables can also serve as leverage points. Many papers, particularly the ones that provide reviews and syntheses, provide a discussion of the relevant prior literature that relate to beliefs and interventions that can influence behaviors such as condom use, exercising, organ donation, etc. (e.g., Albarracin et al. 2001; Armitage and Conner 2001b; Bennett and Bozionelos 2000; Blanchard et al. 2002; Blue 1995; Brug et al. 1995; Conner and Armitage 1998; Fishbein and Ajzen 2005; Godin 1993; Hagger, Chatzisarantis, and Biddle 2002; Hausenblas, Carron, and Mack 1997; Hobbis and Sutton 2005; Montoya, Atkinson, and Trevino 2000; Sutton 1998).

Construct Refinement and Alternative Mechanisms

Some recent developments in the prediction of behavior in general (and TPB in particular) include construct refinement and identification of alternative mechanisms to predict behavior. For example, there has been work on the refinement of the perceived behavioral control construct—in particular, there has been an emphasis on separating it into internal and external dimensions, with empirical evidence confirming this bi-dimensionality via low inter-item correlations among measures of control based on the original conceptualization of the construct (see Beale and Manstead 1991; Chan and Fishbein 1993; Sparks 1994; Sparks et al. 1997; Terry 1991, 1993, 1994; Terry and O'Leary 1995). Other research dissecting various TPB constructs includes Rhodes and Courneya (2003).

There have been several challenges to some of the fundamental tenets of TPB. As a result, several alternative perspectives have emerged that extend beyond just competing models within the same paradigm of thought. Specifically, challenges to the tenets of TPB have proposed alternatives to intention as a driver of behavior. Researchers have suggested behavioral expectation as a potential better predictor of behavior (e.g., Warshaw and Davis 1985). In the case of routinized behavior, some have suggested that habit, and not intention, may be the most important driver of behavior (e.g., Conner and Armitage 1998; Elliott et al. 2003; Orbell, Blair, Sherlock, and Conner 2001; Ouellette and Wood 1998). This intellectual debate has continued with Ajzen (2002) disagreeing with the conceptualization and role of habit in predicting human behavior (see also Ajzen and Fishbein 2000). There have been other constructs that have been suggested to refine the predictions and mechanisms outlined in TPB—e.g., desires (Perugini and Bagozzi 2001), implementation intention (Orbell, Hodgkins, and Sheeran 1997), goal-directed behaviors (Leone et al. 2004), and self-identity (Sparks 2000). In sum, researchers have continued to refine and advance our understanding of human behavior by identifying subtle nuances and mechanisms.

Synthesis

There have been several reviews and meta-analytic studies of TPB (e.g., Albarracin et al. 2001; Armitage and Conner 2001a; Bennett and Bozionelos 2000; Blue 1995; Conner and Armitage 1998; Fishbein and Ajzen 2005; Godin 1993; Hagger et al. 2002; Hausenblas et al. 1997; Hobbis and Sutton 2005; Montoya et al. 2000; Sutton 1998). Often the reviews and meta-analyses relate to specific behaviors, which is to be expected given that TPB has served as a base for extensive theory development in a variety of domains. Some of these syntheses challenged the tenets of TPB and have fed into some of the next steps in building and extending TPB.

Summary

Table 2 summarizes the major milestones and key citations in TPB research. The model-centric comparison between TPB and technology adoption models (with a particular emphasis on TAM) suggests that while TPB has been more widely applied, the stages of evolution have been similar. Substantial progress has been made in TPB, especially in studying interventions and going beyond the basic tenets to consider alternative theoretical mechanisms, both of which should be considered in future work on technology adoption.

Table 2. Summary of Progress of Theory of Planned Behavior Research

Major Areas of Progress	Representative Examples and Key Cites
Influential model	For the purpose of the model-centric comparison— <i>Theory of Planned Behavior</i> : Ajzen (1985, 1991)
Replication and generalizability	<i>Cross-cultural examinations</i> : Godin et al. (1996); Hanson (1999) <i>Goal-directed behaviors</i> : Ajzen and Madden (1986) <i>Health behaviors</i> : Connor and Sparks (1996) <i>Weight loss</i> : Schifter and Ajzen (1985)
Predictive validity	<i>Blood donation</i> : Armitage and Conner (2001b) <i>Consumer behavior</i> : East (1996); Fortin (2000); Notani (1998) <i>Household cycling of newspapers</i> : Boldero (1995) <i>Negotiation</i> : Shapiro and Watson (2000) <i>Rehabilitation</i> : Blanchard, Courneya, Rodgers, Daub, and Knapik (2002); Godin et al. (1996)
Competing models	<i>Health models</i> : Quine, Rutter, and Arnold (1998) <i>Triandis' model</i> : Triandis (1977) <i>Volunteer motivation</i> : Harrison (1995)
Theory base to study unique problems	<i>Adherence to speed limits</i> : Elliott et al. (2003) <i>Ethical decision making</i> : Flannery and May (2000) <i>Smoking cessation behavior</i> : Bennett and Clatworthy (1999) <i>Technology adoption</i> : Taylor and Todd (1995a, 1995b); Venkatesh et al. (2000)
Temporal dynamics and other contingencies	<i>Age</i> : Armitage, Norman, and Conner (2002) <i>Gender</i> : Armitage et al. (2002); Taylor, Bagozzi, and Gaiher (2001) <i>Temporal dynamics</i> : Doll and Ajzen (1992); Conner, Sheeran, Norman, and Armitage (2000); Sheeran and Abraham (2003)
Determinants and other interventions	<i>Cognitive behavioral therapy interventions</i> : Fishbein and Ajzen (2005) <i>Determinants of blood donation behavior</i> : Armitage and Conner (2001b) <i>Determinants of condom use</i> : Albarracin et al. (2001) <i>Determinants of exercise intention</i> : Blanchard et al. (2002) <i>Determinants of vegetable consumption</i> : Brug, Lechner, and Devries (1995)
Construct refinement and alternative mechanisms	<i>Behavioral expectation</i> : Warshaw and Davis (1985) <i>Dimensionality of PBC</i> : Chan and Fishbein (1993) <i>Habit</i> : Ouellette and Wood (1998) <i>Refinement of PBC</i> : Terry (1991, 1993) <i>Role of self-identity</i> : Sparks (2000)
Synthesis	Albarracin et al. (2001); Armitage and Conner (2001a); Fishbein and Ajzen (2005)

Job Satisfaction

Unlike the review of technology adoption or TPB, which focused on a *theoretical model*, our review of job satisfaction research focused on a stream of research that was based on an *outcome* of interest. As a result, this review was more difficult, if only because of the sheer volume of research that has focused on this single construct. Searches of various databases produced more than 5,000 articles related to job satisfaction. In order to keep the scope manageable and to examine the major trends in the study of job satisfaction, we primarily focused on five premier journals: *Academy of Management Journal* (AMJ), *Academy of Management Review* (AMR), *Organizational Behavior and Human Decision Processes* (OBHDP), *Journal of Applied Psychology* (JAP), and *Personnel Psychology* (PPsyc). AMJ and AMR are leading journals in the field of management, which have over the years published some of the most significant theoretical contributions in the field. OBHDP is a journal with a more micro-level focus and a keen interest in organizational behavior phenomena where job satisfaction is generally a focus construct. JAP is a psychology journal where applied phenomena, related to employee behavior and reactions, have received a great deal of attention. Finally, PPsyc is focused on human resources with an obvious interest in employee reactions such as job satisfaction. Beyond these five journals, other leading journals such as *Journal of Personality and Social Psychology*, *Psychological Bulletin*, *Journal of Organizational Behavior*, and *Journal of Management*, among others, were also examined for articles that had a significant impact on subsequent research or interesting, unique empirical studies. Most of these journals are noted as the “upper-echelon” journals in the management field (Conlon, Morgeson, McNamara, Wiseman, and Skilton 2006). Beyond keeping the scope of our review

manageable given our purpose, concentrating on the major/mainstream journals also allowed us to capture the most significant theoretical advances in understanding job satisfaction.

As with TPB, the discussion that follows focuses on the general direction and trajectory of job satisfaction research at a very high level. Job satisfaction has also been studied for a much longer period of time compared to work on TPB; thus, beyond the initial steps in the stream, given space considerations, our review emphasizes work done over the last three decades.

As one might expect, there have been many *different models* of job satisfaction, each incorporating various sets of predictors. Early research focused on individual-centric predictors, including demographic and personality factors, and some of this work continues to the present day. Other classes of job satisfaction models have focused on job characteristics, leadership style and leader-member exchange. Furthermore, contemporary research has moved beyond simple linear models to those proposing more complex relationships captured using polynomial response surface modeling. Thus, in comparison with technology adoption models, those examining job satisfaction have incorporated a much richer, more diverse theoretical base.

Virtually all of the influential models of job satisfaction have been tested across multiple studies in an attempt to *replicate, add generalizability, and identify contingencies*. Paralleling the technology adoption and TPB research streams, once job satisfaction was established as a pivotal construct, researchers then began using it as a *theory base to study other unique problems* (e.g., voting, organizational change, and dysfunctional behavior).

Many interventions have been identified in job satisfaction research, providing evidence that this stream of research has, in fact, made significant progress in providing useful guidance to practitioners to identify and act on issues surrounding job satisfaction in the workplace. Such actions are much more extensive than those in the technology adoption literature, which, as previously mentioned, are largely limited to training interventions. Extending job satisfaction even further, other researchers have moved away from using job satisfaction as a dependent variable and have shifted their focus to the use of job satisfaction as an independent variable that might be used to understand *other outcomes of interest*. In so doing, they have helped create broad nomological networks surrounding job satisfaction as a core phenomenon in organizational life. Finally, given the depth and breadth of job satisfaction research, there are many *reviews and syntheses* of the area, including meta-analyses. In fact, given the extensive research on job satisfaction, there are reviews of research on specific dyadic relationships to and from job satisfaction—e.g., personality and job satisfaction. This suggests substantial progress in identifying and understanding the subtleties of job satisfaction and its interplay with other important variables.

Job satisfaction has been studied for much longer than either technology adoption or TPB, going back to the 1960s and earlier. The conceptualization and measurement of the construct received much attention in the early days and, unless otherwise relevant, we do not delve into those details, as the conceptualization and measurement have been well-established for a long time now. The scientific progress in understanding job satisfaction has been quite significant, which is understandable given how long the construct has been studied. But, like TPB, the substantial progress in job satisfaction helps provide the mature area of individual-level technology adoption with a number of pointers for future research. In the present analysis it was difficult to organize the articles in the same “categories” as technology adoption and TPB research, as articles often spanned multiple categories. Given the interweaving of themes, we organized our review of the job satisfaction literature into the following: models of job satisfaction; replication, generalizability, and contingencies; theory base to study unique problems; interventions; outcomes; and synthesis.

Models of Job Satisfaction

There have been many models, with a wide range of predictors. Some of the early research employed predictors that were individual-centric, such as demographic characteristics and personality (e.g., Adler 1980; Perone et al. 1979). The focus on personality and its ties to job satisfaction have continued to date (e.g., Ganzach 1998; Ilies and Judge 2003). In addition to the psychological characteristics of individuals, models on genetic influences and the heritability of job satisfaction have been proposed (e.g., Arvey et al. 1989; Bouchard et al. 1992; Cropanzano and James 1990; Ilies and Judge 2003). A different class of models is based on job characteristics (e.g., Hackman and Oldham 1975, 1980; Umstot et al. 1976). Beyond the job, researchers have also presented models that have focused on leadership style (Weed et al. 1976; Wood and Sobel 1970) and other supervisor behaviors (e.g., Petty and Bruning 1980). More contemporary thought has presented even more sophisticated models that are sensitive to the complex nature of interactions among individuals in the workplace by focusing on theories and constructs related to leader-member exchange (e.g., Janssen and Yperen 2004) and person-organization fit (e.g., Saks and Ashforth 1997). Models have also been responsive to important aspects receiving consideration in business practice, such as fairness (e.g., Janssen 2001). In addition to the various models predicting linear relationships, responding to Edward’s call for studies using polynomial response surface modeling (e.g., Edwards 1995), there have been models that have examined curvilinear relationships in the context of job satisfaction (e.g.,

Janssen 2001; Lambert, Edwards, and Cable 2003). Not surprisingly, just as in technology adoption research, there have also been numerous model comparison studies (e.g., see James and Tetrick 1986; Mathieu, Hofmann, and Farr 1993, for a couple of examples). Over the years, the models have evolved from being based on demographic characteristics to more sophisticated models of individuals, job, interactions, and business practices. Compared to technology adoption models, the models of job satisfaction are far richer and come from a much wider array of theoretical perspectives.

Replication, Generalizability, and Contingencies

Models of job satisfaction have been tested in several studies. Some models have received more attention than others—for example, the job characteristics model (Hackman and Oldham 1980) has received significant attention in the management and psychology literature, as well as in other fields. To some extent, contingencies have been woven more tightly in the replication and generalizability studies of job satisfaction models. In an effort to replicate and examine the generalizability of models of job satisfaction, there have been examinations of differences across occupations, rural vs. urban, organizational size, etc., which in turn have also represented important contingencies. Specifically, there have been studies of gender and/or age differences (e.g., Glenn et al. 1977; Kacmar and Ferris 1989; Varca et al. 1983), full-time vs. part-time (e.g., Eberhardt and Shani 1984), occupational differences (e.g., Ivancevich 1969), race and related cross-cultural differences (e.g., Jones et al. 1977; Kirkman and Shapiro 2001; Liu et al. 2004; Moch 1980), and value importance (e.g., Butler 1983), among others. Beyond the contingencies in relationships that predict job satisfaction, there have also been examinations of moderators of relationships from job satisfaction to other outcomes—e.g., performance as a moderator of the relationship between job satisfaction and turnover (e.g., Spencer and Steers 1981). Relative to technology adoption research that has primarily seen rather simplistic contingency variables, research on job satisfaction has examined a broad set of moderators, both for upstream predictors of job satisfaction and for downstream outcomes of job satisfaction.

Theory Base to Study Unique Problems

Job satisfaction has clearly been established as a pivotal construct in organizational behavior research, thus allowing researchers to study novel and important problems by using job satisfaction in a central role in newly-developed models of behavior. For example, job choice has been studied with a focus on job satisfaction as a key outcome (e.g., O'Reilly and Caldwell 1980). In addition, voting in union elections (Schriesheim 1978), newcomers' adjustment (Maier and Brunstein 2001), organizational change (Begley and Czajka 1993), drug use (Stein et al. 1993), and dysfunctional thought processes (Judge and Locke 1993) are a few examples of unique problems that have been studied, with job satisfaction playing a central role in those investigations. Technology-related problems studied include structuring of jobs (Brass 1985) and telecommuting (Golden and Viega 2005). Marketing research has examined sales performance and has included job satisfaction in the extended nomological network that has motivated those studies (e.g., Bluen et al. 1990; Speier and Venkatesh 2002). Even health outcomes have been studied in conjunction with job satisfaction (e.g., Howard et al. 1986). In sum, the range of problems studied with job satisfaction playing a key role is rich and varied, and such research has been able to leverage the maturity of job satisfaction research. Since models of job satisfaction are generally richer and more sophisticated relative to technology adoption models, the breadth of problems studied with job satisfaction in a central role is consequently also much greater.

Interventions

As noted earlier, research on the models of job satisfaction have often embedded in them a focus on interventions. Several different interventions have been examined for their effectiveness in influencing job satisfaction. Flexible working hours (e.g., Orpen 1981), goal setting (e.g., Latham and Yukl 1976), performance feedback (e.g., Kim and Hamner 1976), perceived organizational support (e.g., Eisenberger et al. 1997), mood (Brief et al. 1995), and socialization tactics (e.g., Maier and Brunstein 2001), among others, have been examined as potential interventions. The range of interventions is evidence that significant progress has been made in providing actionable guidance to practitioners, thus increasing the business relevance and applicability of the topic.

Outcomes

There have been a wide variety of outcomes that have been predicted with job satisfaction as an independent variable. These outcomes include turnover (e.g., Schleicher et al. 2004), job performance (e.g., James and Jones 1980), health outcomes (e.g., Lee et al. 1990), and organizational citizenship behavior (e.g., Bateman and Organ 1983; Williams and Anderson 1991), to name a few. In effect, these outcomes have allowed the models of job satisfaction to span phenomena more comprehensively—i.e., starting from the individuals and jobs to performance and other employee behaviors in organizations. As a result, organizational behavior and management in general have developed rich nomological networks around job satisfaction as a focal construct. In contrast to the job satisfaction literature, the investigation of outcomes in technology adoption research (e.g., technology use) is very limited (see Delone and McLean 2003; Venkatesh et al. 2003).

Synthesis

The research on job satisfaction has been so extensive that reviews related to the construct have focused on specific dyadic relationships to or from job satisfaction. Loher et al. (1985) presented a meta-analysis with job characteristics as predictors; Judge et al. (2002) presented a meta-analysis with personality on the predictor side; Petty et al. (1984) presented a meta-analysis with performance as a predictor and an outcome; Scott and Taylor (1985) presented a meta-analysis with absenteeism as the outcome; and Judge and Larsen (2001) presented a review of job satisfaction research. In sum, the many and varied syntheses in the literature are an indication of substantial theoretical progress and have helped illuminate the presence of both subtlety and nuance in a number of relationships that incorporate job satisfaction as either an outcome or predictor variable.

Summary

Table 3 summarizes the major milestones and key cites in job satisfaction research. As already discussed, relative to technology adoption research, the job satisfaction literature is richer and more sophisticated, with a greater breadth of models, problems studied, contingencies, interventions, and outcomes. Each of the areas represented in the table illustrates potential gaps that technology adoption researchers should seriously consider as part of their thinking on how to meaningfully extend technology adoption research.

Table 3. Summary of Progress of Job Satisfaction Research	
Major Areas of Progress	Representative Examples and Key Cites
Influential models (examples)	<i>Genetic influences:</i> Arvey, Bouchard, Segal, and Abraham (1989); Cropanzano and James (1990) <i>Job characteristics:</i> Hackman and Oldham (1975, 1980); Umstot et al. (1989) <i>Leadership:</i> Janssen and Yperen (2004); Weed et al. (1976); Wood and Sobel (1970) <i>Person-organization fit:</i> Saks and Ashforth (1997) <i>Personality:</i> Adler (1980); Ganzach (1998); Perone, Dewaard, and Baron (1979)
Replication, generalizability, and contingencies	<i>Cross-cultural differences:</i> Jones, James, Bruni, and Sells (1977); Kirkman and Shapiro (2001); Liu, Borg, and Spector (2001); Moch (1980) <i>Full-time vs. part-time:</i> Eberhardt and Shani (1984) <i>Gender and/or age differences:</i> Glenn, Taylor, and Weaver (1977); Kacmar and Ferris (1989); Varca, Shaffer, and McCauley (1983) <i>Occupational differences:</i> Ivancevich (1969) <i>Value importance:</i> Butler (1983)
Theory base to study unique problems	<i>Drug use:</i> Stein, Smith, Guy, and Bentler (1993) <i>Dysfunctional thought processes:</i> Judge and Locke (1993) <i>Health-related behaviors:</i> Howard, Cunningham, and Rechnitzer (1986) <i>Job structuring:</i> Brass (1985) <i>Marketing:</i> Bluen, Barling, and Burns (1990); Speier and Venkatesh (2002) <i>Newcomers' adjustment:</i> Maier and Brunstein (2001) <i>Organizational change:</i> Begley and Czaika (1993) <i>Telecommuting:</i> Golden and Viega (2005) <i>Voting in union elections:</i> Schriesheim (1978)
Interventions	<i>Flexible working hours:</i> Orpen (1981) <i>Goal setting:</i> Latham and Yukl (1976) <i>Mood:</i> Brief, Butcher, and Roberson (1995) <i>Perceived organizational support:</i> Eisenberger, Cummings, Armeli, and Lynch (1997) <i>Performance feedback:</i> Kim and Hamner (1976) <i>Socialization tactics:</i> Maier and Brunstein (2001)
Outcomes	<i>Health outcomes:</i> Lee et al. (1990) <i>Job performance:</i> James and Jones (1980) <i>Organizational citizenship behavior:</i> Bateman and Organ (1983); Williams and Anderson (1991) <i>Turnover:</i> Schleicher et al. (2004)
Synthesis	Judge and Larsen (2001); Judge et al. (2002); Loher, Noe, Moeller, and Fitzgerald (1985); Petty, McGee, and Cavender (1984); Scott and Taylor (1985)

Conclusions

Our review and comparison of the major milestones in technology adoption, TPB, and job satisfaction research lead us to different conclusions. The good news is that there has been impressive progress in technology adoption research. The bad news, however, is that, for a small field like information systems (see Valacich et al. 2006 for a comparison of researchers in various functional areas of business management), an excessive focus on replication and minor “tweaking” of existing models can hinder progress both in the area of technology adoption and in information systems in general. This, of course, does not mean research on technology adoption is dead. Rather, it suggests the need to focus on important and interesting questions in this area of research. In comparing the progress of technology adoption research to TPB and job satisfaction research, we have identified a number of directions where new research in the domain might usefully be directed. Moving forward, we believe that a valuable next step for researchers in the area may be to use this comparison as a basis to build a framework-driven set of future research directions that can leverage current knowledge and that are focused on today’s relevant business problems.

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