Predicting Behavioral Intention or Actual Usage of Technology? A Systematic Literature Review of the Technology Acceptance Model

التنبؤ بالنية السلوكية أو بالاستخدام الفعلي للتكنولوجيا؟ مراجعة منهجية للأدبيات حول نموذج قبول التكنولوجيا

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Abstract: Although the model which has been used the most to predict adopting and using recent systems and techs is Technology Acceptance Model (TAM), it has been found that there is a gap in research as regards understanding and distinguishing between behavioral intentions to use technology and actual technology use as two components targeted for prediction by the TAM model variables. This confusion has long led researchers to have the two converged in a single measuring scale. This paper, therefore, aims to shed some light on the evolution of the two themes to eliminate any potential misunderstanding for future subsequent measurements and investigate which one of the two has been the most predicted in TAM previous studies. We conducted a systematic literature review using a sample of 150 studies conducted up to the present study to examine the extent to which TAM and its variables predict actual usage. It is found that although predictions of behavioral intentions and actual usage are two distinct measures, they have been regularly conflated in technology accepted research. Also, TAM variables were found to generally predict Behavioral Intention (BI) better than predicting Actual Usage (AU) of technology.

Keywords: actual technology use, intention, model of technology acceptance, systematic literature review, TAM

الملخص: بالرغم من أن النموذج الذي صنف في المقدمة لتوقع تبني واستخدام النظم والتكنولوجيات الحديثة هو تام أو نموذج تقبل التكنولوجيا، تبين أن هناك فجوة في البحث فيما يتعلق بفهم وتمييز النوايا السلوكية لاستخدام التكنولوجيا والاستخدام الفعلي للتكنولوجيا كهدفين مكونين للتنبؤ من خلال متغيرات النموذج. وقد أدى سوء الفهم هذا الى قيام الباحثين في هذا المجال بدمج المفهومين في محاولة للتوصل الى مقياس واحد للقياس. لذلك، تهدف هذه الورقة الى تسليط الضوء على تطور الموضوعين لإزالة أي لبس محتمل للقياسات اللاحقة في المستقبل والتحقيق في أي منهما تم التنبؤ به أكثر في الدراسات. بعد القيام بمراجعة لما سبق من البحوث مستخدمين عينة مكونة من 150 دراسة أجريت لغاية تاريخ هذه الدراسة من أجل استكشاف قدرة النموذج المدروس ومكوناته على توقع كل من الاستخدام الفعلي أو نية الاستخدام. تبين لنا

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أنه على الرغم من أن التنبؤات بالنوايا السلوكية والاستخدام الفعلي مقياسان متمايزان، الا أنه يتم دمجهما بانتظام في بحوث قبول التكنولوجيا. كما وجدنا أن متغيرات تام تتنبأ عموما بالنية السلوكية بشكل أفضل من تنبأها بالاستخدام الفعلي للتكنولوجيا.

الكلمات المفتاحية: الاستخدام الفعلي للتكنولوجيا، النوايا، نموذج قبول التكنولوجيا، مراجعة منهجية للأدبيات، نموذج قبول التكنولوجيا.

Introduction:

This paper draws upon the researcher's personal experience noticing a gap in research in tapping into actual usage of technology (AUT) when designing, administering and analyzing a PhD questionnaire related to technology acceptance in Algerian banks employing the model of TAM.

Davis proposed in 1985 this model to predict consumers' readiness to accept and start using newly introduced technologies. Since then, the model proved to be the tool which has been mostly applied to date to measure the adoption and usage of new technologies. The proposed initial model claimed that predicting technology adoption can be captured by a combination of components which included; 1) Potential users' perception of how useful would the new technology be to them, 2) Potential future users' perception of how easy would the introduced technology be to them, 3) Their behavioral intention as regards using the new technology, and finally, 4) their attitude towards it.

Among these four components, behavioral intention is the one which has been frequently measured compared to actual usage (AU). This latter has been usually measured through self-reported variables, not through recorded usage. With this in mind, it is worth knowing whether TAM has been accurately predicting actual usage or has been only restricted to behavioral intention to use in relevant studies conducted up to 2024. This question is driven by the noticeable lack of studies which directly measure AU, and a reported divergence in some other studies, which conducted longitudinal measurements of technology implementation. This research gap can be filled by conducting a systematic review of TAM studies focusing on whether TAM and its components are tapping into actual technology use.

1. Research Problem

Though it is assumed and found throughout multiple TAM studies that behavioral intention to use technology (BI) leads to actual use of technology (AUT), it should not be assumed that BI and AU are the same component. BI to AUT relationship has been found to bear high significance in literature, However, AUT may happen to be hindered by emerging implementation difficulties and conditions of different types especially if a long period of time separates the measurements of the two constructs. As a consequence, the highly predicted association between BI and AU may be questioned. Besides, measuring AU, when targeted, has not usually been direct through actual record of use but mostly through self-reported use in the reported literature to date. In additions, it is usually noticed that research in the field did not make a clear distinction between intentions and expectation and the necessity to measure them differently. Users of technology may have high intentions to use a new system or technology, but have less expectations that that same system can be used in practice. This confusion has to be addressed by research and perhaps the best way to do this is through conducting a review of the previous studies to investigate the extent to which previous research distinguished between BI and AU and the way to measure them considering evolutionary TAM components.

2.Research Questions

This study is guided by the following research questions:

Question 1: To what extent does TAM in its different versions distinguish technology actual usage from behavioral intention in its measurements?

Question 2: Which one of the two components, intentions or expectations measures brings better prediction of AUT?

Question 3: Do TAM internal structural features or implementation conditions affect the measurement of AUT?

3. Literature Review

It is necessary to review how previous research distinguished BI from AU and how the two themes evolved. We adopted a chronological approach to track how the two components evolved in research and their relationships to other components of the evolving models.

3.1. Fishben and Ajzen's (1975) Theory of Reasond Action (TRA): Intentions and Behaviors

Ajzen with Fishben formulated TRA, which emphasized that intents and acts interdepend and showed the way through which they are related to other concepts such as attitudes and beliefs (1975). According to TRA, beliefs and ideas which someone may hold about a certain behavior influence his/her attitude towards that behavior. They also influence what they labelled Perceived Behavioral Control, which is an individual's internal perceived capacity to do the activity in the absence of external barriers to execution (Dillard et al., 2013). TRA omitted acts which may not be voluntary, are consciously acted or are highly demanding in terms of skill or participants. TRA, therefore, holds that behavioral intention is influenced by both individuals and norms. Individual impact on intention relates to one's **attitude** toward engaging in an unforced activity, whereas normative influence on intention refers to one's view regarding whether important individuals think he/she should do the act (Dillard & Pfa, 2002, p. 260).

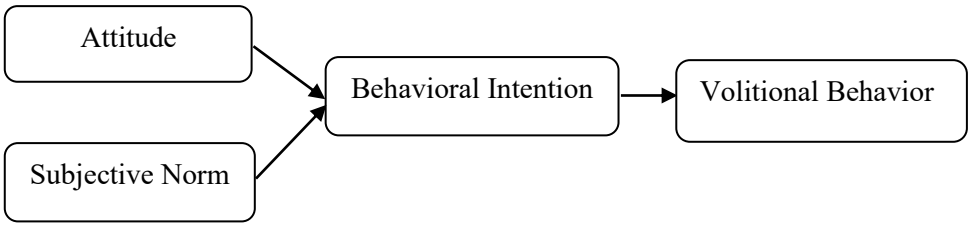

Figure 1. TRA Basic Components (Dilard & Pfa, 2002, p.260).

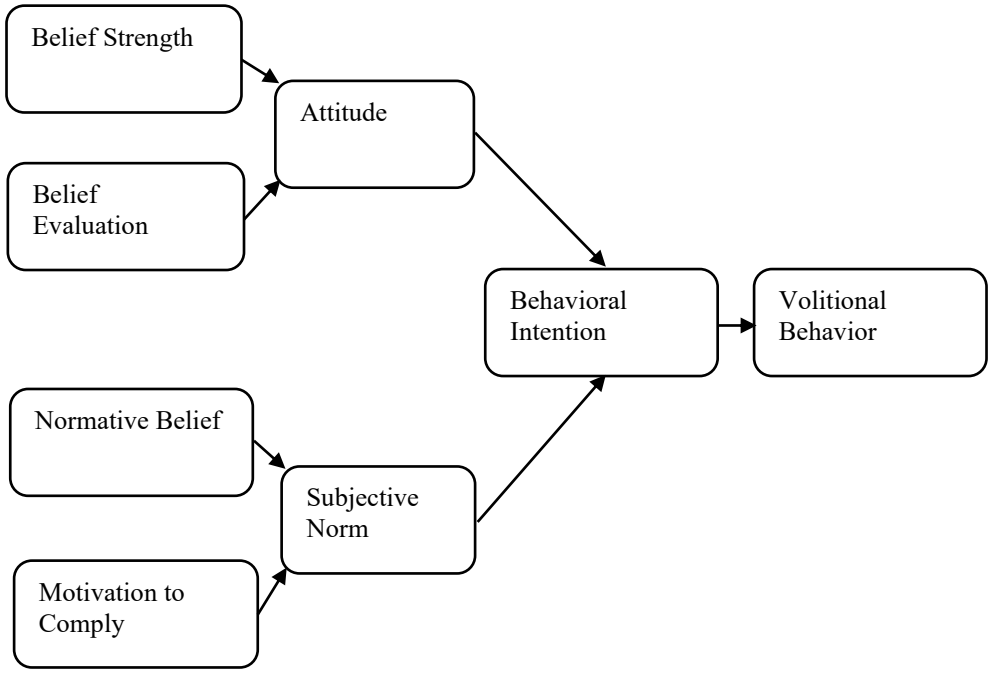

Figure 2. Theory of Reasoned Action (TRA) Complete Components (Dillard & Pfau, 2002, p. 263).

3.2. The Connection between Behaviors and BI

The link between intention and behavior was tested through good few meta-analyses. They found that the interval between behavior performance and intention measurement may cause a behavioral shift, which will weaken the correlation between the two. To mitigate this impact, some researchers recommended measuring intentions and behavioral performance over a brief period (Fishben & Ajzen, 1980).

3.3. TPB Theory

Users of systems and techs may have a feeling or awareness that they will or will not be able to use them once considering the surrounding circumstances or conditions under them these technologies or systems are being implemented. This internal awareness may be unstable and may well vary with passing time, and change in the conditions of performing acts or the nature of the targeted acts themselves. They may foreknow the possibility of their own engagement with and commitment to

the new or potential system. This concept was operationalized by Ajzen as **perceived behavioral control** (PBC) and inserted to the TRA theory to create what has become known as theory of planned behavior (TPB). In this model, engaging in a future performance of an act is an aftereffect, which results from the conjunct outcome of intention and PBC. This latter is unique to TPB and is determined by Control Belief combined with Perceived Power. PBC, attitudes, and subjective norms work together in TPB model to predict intention. Figure 3 illustrated these relations.

According to Ajzen (1985, 1987), PBC either directly impacts behavior or facilitates intention to influence behavior. Several meta-analytic studies such as Ajzen's (1991), Hasselblad's et al. (1997) as well as Kok's in 1996 reported PBC to have a statistically significant impact on behaviors.

Part of this study is to review the applications of this new model at the time of its appearance, through testing the significance of the obtained findings. A couple of studies were included to sum up the different variables of the TPB perdition power to the real-world usage of the technologies and not just the speculative possibility. To test the usages of this version of the Ajzen's (1985) model in health, Goddin with kock examined in 1996 the literature of research published from 1985 onwards. **Intention** was found to be the main predictor, but in 50 % of the studies reviewed, **PBC** is found to significantly affect **behavior** prediction.

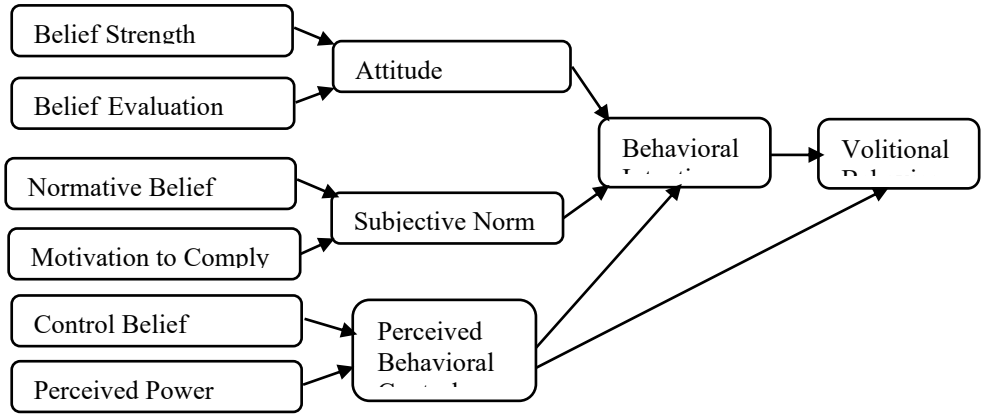

Figure 3. Diagram illustrating Aizen's (1985) Theory of Planned Behavior

3.4. Technological Acceptance Model (TAM) as defined by Davis (1986)

We can read from Figure 3 that TAM suggested initially that an actual use of a system is a behavioral response to an effective response (potential users' motivation), which is in turn influenced by the capabilities and features of that system.

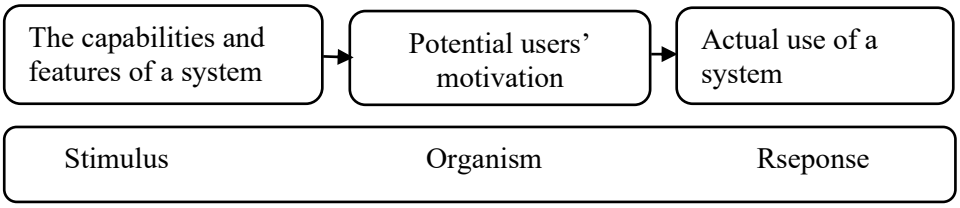

Figure 4. TAM Initial Determinants of Actual Use of a System (Designed by the Researcher).

Later, refined TAM introduced three new constructs to explain the motivation of potential users' systems usage. The main one for Davis is the scope of belief of a potential system user on his use of a given technology or system. It is the variable which measures how helpful can the use of the system be in enhancing one's execution of his or her job. It is termed; Peceived Useflness (PU) (Davis,1989). This motive is found in several later studies to be the principal invoke of users' attitude towards technology usage, and consequently its eventual actual use. Even though PU is the dominant cause leading to the ultimate usage result, how easy is a system or a technology to use also proved to be another variable, which determines the attitude towards making use of it. It was labeled "Perceived Ease of Use" (PEU). The final act of usage is found in empirical studies to be the outcome of the attitude, which the user forms. Attitude is the result of PU and PEU together, with PU playing the major role. In later versions of the TAM, PU is found to have a significant direct impact on AU without needing attitude.

In the earliest TAM (Davis, 1986), as can be read from Figure 5, end system user's actual system use is determined by their **attitude** towards using that system. The attitude might be either favorable or unfavorable. The two elements; (PU) and (PEU) are what decide whether someone has a negative or positive attitude. It is

considered an individual's affective response. This means that in the original model, **attitude** is a direct determinant of **Actual System Use** and facilitating or inhibiting factors of actual system use behavior are not taken into account. In the original Davis's (1986) model, intention, as in Figure 5, was removed. PEU and PU are the constructs which form the user's attitude. This latter, attitude, is the one which ends up to the eventual behavior that is, system use or non-use.

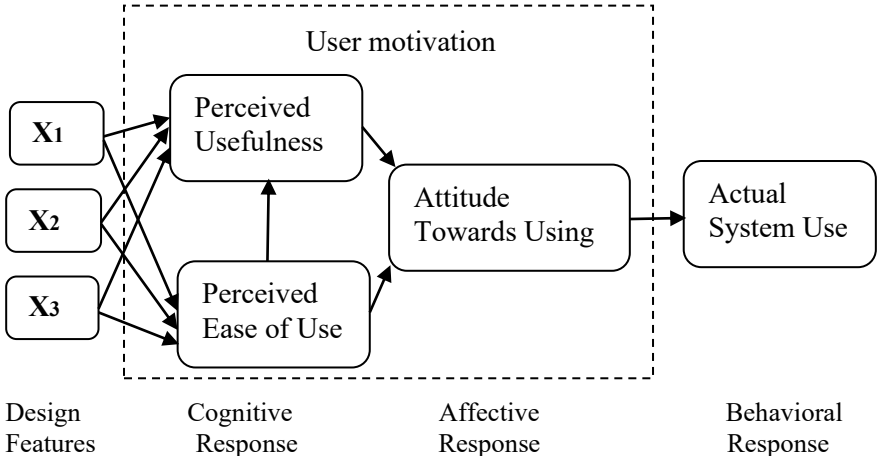

Figure 5. Davies, 1986's Technology Acceptance Model

3.5. Introducing Behavioral Intention (BI) to TAM (Davis et al., 1989).

Davis (1985) made informants reporting on their self-predicted future use of suggested systems by responding to a questionnaire item which asks them their predictions as regards the potential of regularly using a particular system made available in their job. He discovered a favorable relationship between the measures employed and self-predicted future usage. Numerous studies, similar to this one, were conducted and used the same tool. This study grouped them into those which used self-reporting and those which tested the number of times or occurrences a system or one of its features is used. The first category of studies was far more numerous than the second category perhaps given their practicality and ease of conduct.

In 1993, Davis, contrasting his previous findings, suggested that PU has the potential of a direct influence on AU. He also found that **system characteristics** could directly influence the **attitude** without the persons' need to form an actual **belief** about that system.

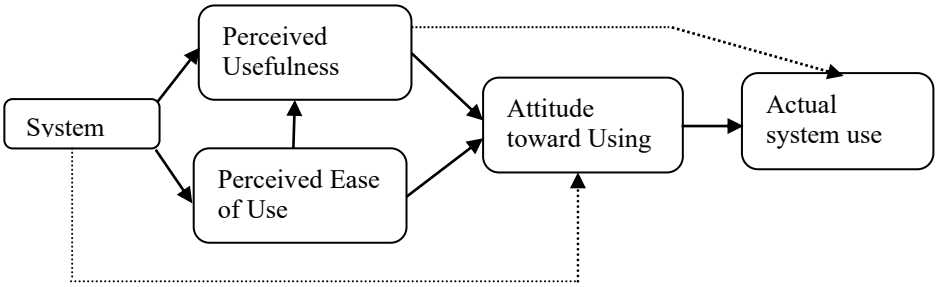

Figure 6. New Relationship Introduced on TAM (Davis, 1993, p. 481).

In 1989, Davis with colleagues modified TAM, as can be seen in Figure 7, **Behavioral Intention to Use** (BI) is the outcome of the attitude, which results from PU and PEU combined, or is the direct result of PU. Therefore, the eventual factual use of a system is the result of BI. According to Davis (1986), when a system is thought to be helpful, a person may immediately have a strong behavioral intention to use it without developing an attitude. As illustrated in Figure 6, it is the potential impact of the system on the performance and job enhanced results which comes first before considering the characteristics of the system itself. Again, in this modified TAM, actual system use is predicted subsequent to BI, which is formed by individuals after considering the usefulness of the system to their job's objectives and partially considering the easiness of implementing the system. External inhibitors or facilitators were not introduced in this model.

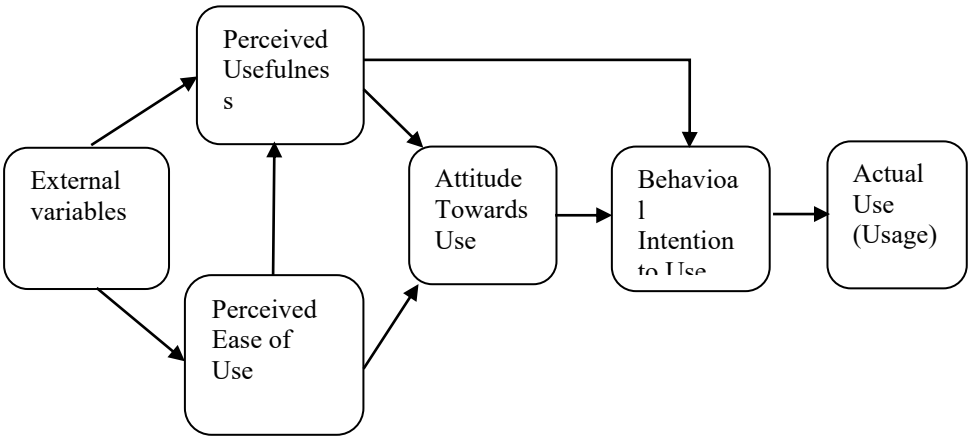

Figure. 7. First Modified Version of TAM. (Davis, Bagozzi, & Warshaw, 1989) with Behavioral Intention (BI) Added.

3.6. Final Version of TAM (Venkatesh, Davis, 1996).

The final version proposed by Venkatesh and Davis (1996) when it was clearly proven that PU and PEU directly affect BI. Figure 8 illustrates the elimination of the **attitude** component from the model.

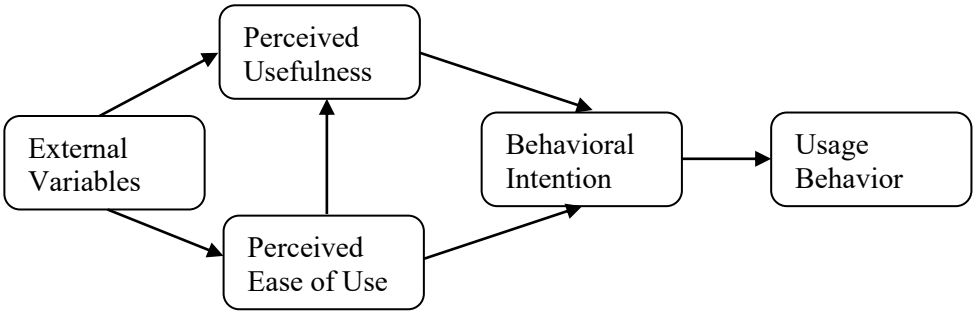

Figure 8. Last TAM (Davis & Venkatesh, 1996).

3.7. Unified Theory of Acceptance and Use of Technology (UTAUT)

Hoping for a more precise and behavior explanatory model, and drawing upon the previously introduced models in addition to Diffusion of Innovation (DOI), UTAUT was formulated by Venkatesh et al. in 2003. Same concepts in TAM were given a different name by Venkatesh et al. PU was substituted by the potentiality of performance, and PEU took another name. Table 1 illustrates the new labels introduced so that researchers avoid confusing or repeating the same construct and link studies which used the new terms to those which used the old ones. For example, the influence of other people on the user or the role of conditions in performance is labelled differently even though it refers to the same variable. This may construct a source of confusion or overlap of the different measurements.

Table 1. Different Labels of TAM's Main Components

newly labels (Venkatesh et al., 2003)	Its close equivalent in previous models
Expectance of performance	Perceived Usefulness
Expectancy of Effort	Perceived Ease of Use
Social influence	Subjective Norm (TPB)
Facilitating conditions	Compatibility (DOI)

The construct '**Facilitating Conditions'** has been introduced in Venkatesh et al.'s model in 2003, which gave the model more potential to directly measure the **use behavior**. Facilitating and inhibiting conditions were considered in measuring behavioral intentions in the model. In what follows, the different explanations provided by reviewed studies to the predictivity of intentions versus expectations is provided in table 2.

Table 2. Expectations vs Behavioral Intentions Predictive Power

Warshaw and Davis (1985)
intentions
1-Do not take potential facilitating or inhibiting factors into account because people are stating their felt internal future intention to behave in a certain way.
2-The way informants are asked makes the difference. In investigating expectations, they are

questioned about their plans (intentions). (Are you planning to _?) 3-Because of the lag between intentions and behavior performance, intentions may well change. This may lead to a change in behavior and consequently the relationship between intention and behavior will be attenuated.
Expectations 1-take potential facilitating or inhibiting behavior performance factors into account because people are stating the likelihood that their felt internal future intention to behave in a certain way taking external inhibitors into account. 2-The way informants are asked makes the difference. In investigating expectations, they are asked what they expect they will do (specify how likely you will do something) or (what do you expect you will do?)

4. Research Methodology

The methodology adopted in this study is qualitative in nature, which used synthesis of the results of previous research regarding or research questions and then describing and analyzing the results.

Theoretical Review and Studies' Selection

First, we conducted a theoretical review of research, which tracked the evolution, relationship, and measurement of actual use and intention to use technology. Then, we compared the two concepts highlighting the fact that they are apart and not the same. After that, the empirical studies to be selected in our review of TAM are specified, which included all the studies published on TAM up to 2024, and matched our criteria of inclusion. We focused on the ones which tried to tap into the distinction between intentions and expectation's predictive power of actual use of technology. Only the studies relevant to our research questions' answers were taken into count. An extensive search in Google Scholar and different databases including management information journals was conducted to retrieve all relevant studies which dealt with Technology Acceptance Model (TAM). Studies which did not report data relevant to our stated objectives were eliminated from the pool. If one publication reported several studies in depth, then whose results are reported are included in the count.

We employed a vote-counting meta-analysis as our systematic review was inclusive to all the studies which used different TAM versions. We first extracted relevant findings regarding TAM variables, such as coefficients and significance levels. We, then, divided the results, and accordingly the studies, into: significant positive results, significant negative results, non-significant results and untested relations. After that, the studies were further divided into those which objectively measured AUT and those which conducted subjective measures of AUT.

5. Results and Discussion

5.1. TAM Variables Predicting BI

After comparing the predictive success of each variable's relationship with Behavioral Intention (BI) and Actual Usage (AU), we found that PU to BI (91.57%) and PEOU to ATT (93.55%) both show a strong predictive success of BI. Our results are consistent with the previous research which found that PU could be more influential on BI than other constructs. As can be concluded from comparing columns 4 and 5 in table 3, PU to BI is found to be the most tested relation in this review with 55.3 % (83 out of 150). Using a significant level (p) of 0.05, we find the proportion of success approximately 0.9517. PU to BI is successful in 91.57 %, which reflects a strong and consistent relationship across studies and supports the hypothesis that PU is a strong predictor of BI in most contexts studied.

ATT to BI (90.32%) also has high success, indicating that users' attitudes are a strong predictor of their behavioral intention. PEOU to BI has a slightly lower success rate (82.46%), but still indicates a relatively strong predictive relationship with BI. If PU to BI is compared with PEOU to BI represented in column 4, PU is a more influential predictor of BI. PEOU to BI was tested in only 57 out of 150 studies (38 %) and was found to be non-significant in 17.5 % of the cases. PEOU is therefore less influential than PU in predicting BI directly. However, PEOU predicts BI indirectly through PU as can be read from column 1. PEOU to PU was tested in 43.3 % of the

cases and proved significant in 87.8 % of cases. These high success rates suggest that TAM variables generally predict Behavioral Intention (BI) well.

5.2. TAM Variables Predicting AU

ATT to AU has the highest success rate (100%), but it was only tested in 4 studies, which limits its generalizability. BI to AU shows a strong predictive relationship (97.5%), which is consistent with TAM's premise that behavioral intention leads to AU. PU to AU also has a high success rate (84.31%), reinforcing PU's importance for actual usage. PEOU to AU has the lowest success rate among AU predictors (65.12%), indicating that ease of use alone may be less predictive of actual usage than other factors.

For the variables which better predict BI, the findings support the hypothesis that PU, ATT, and PEOU all have high success rates when predicting BI, with PU and ATT being the strongest. As for predicting AU, while BI strongly predicts AU (97.5%), direct predictors like PU and PEOU are somewhat less effective, suggesting a possible indirect influence of TAM variables on actual usage through behavioral intention.

Overall, these results suggest that TAM variables generally predict Behavioral Intention (BI) better than Actual Usage (AU) suggesting that TAM is more robust in predicting behavioral intention (BI) than actual usage (AU), with behavioral intention serving as an effective mediator between the TAM variables and actual usage. More empirical interventions are therefore needed to test AU especially through recorded use of technology rather that self-reported usage.

Table 3. Relations between TAM Variables

N	1	2	3	4	5	6	7	8	9	10
Relation	PEOU to PU	PEOU to ATT	PU to ATT	PEOU to BI	PU to BI	ATT to BI	ATT to AU	BI to AU	PEOU to AU	PU to AU
Sig R	65	29	36	47	76	28	4	39	28	43
Non-S R	9	2	1	10	7	3	0	1	15	8

Tested R	74	31	37	57	83	31	4	40	43	51
Untested R	76	119	113	93	67	119	146	110	107	99
Proportion of success	0.87	0.93	0.97	0.82	0.91	0.90	1.0	0.97	0.65	0.84

Note. **Sig R**: Significant result, **Non-S R:** Non-significant result, **R:** Result

Conclusion

Our review concluded that studies which assessed TAM prediction power and the association between TAM components and AU were generally varied in terms of the variables associated, the measurement condition and objective. Therefore, it is generally difficult to reach a significant conclusion.

The results corroborate the theory that actual use was found to be mainly foreseen by the elements which impact usage intention. The two variables, intention and behavior non-significant association got people to think about how to quantify real conduct and the multidimensional properties of the intention construct. In general, it has been discovered that expectations are more predictive that behavioral intentions.

1-PU, BI, and PEU, in this order of importance, were found to be the indicators of actual technology use. This result is relative given the type of measurement and TAM internal structure.

2-TAM and its variables are found to have a strong predictive utility.

3-TAM and its versions performed well in predicting intentional behavior but less so in the prediction of actual system or technology usage.

4-TAM better predicted actual usage in voluntary implementation settings.

5-There is a lack of distinction between users' intentions and expectations. Users may have the intention to use a system but they don't expect the behavior to occur given the external inhibiting conditions.

6-TAM is more accurate when users attempt to expect their future usage of a system more than when they express their behavioral intentions because facilitating and inhibiting factors are considered in the case of expectations.

7-The number of studies which measured the AU and its associations with TAM variables through self-reporting subjective way is far higher than studies which tested this effect in an objective manner through users' post-use actual occurrences of system usage. The proportion of studies which tackled TAM components' association to AU prediction was found to be low when actual system record is used than in cases when self-reported usage behavior is employed. Therefore, the results are non-conclusive as to whether TAM variables are better predictive to actual usage under subjective or objective measurement settings. These findings positively answer RQ 3 that TAM implementation conditions do affect the measurement of technology confirmed use. This might be interpreted from a practicality perspective as conducting objective studies is relatively challenging. Therefore, our review highlighted the need for conducting objective studies of actual technology usage due to the bias that might result from self-reporting technique and the validity of objective measuring.

A-The findings support RQ 1 answer confirming that technology actual usage is not constantly measured objectively and is usually measured indirectly through BI. Therefore, researchers need to be careful in distinguishing both variables and avoid overlapping measuring scales.

B-It has been found also that there is no conclusive finding as regards answering RQ2, which addressed whether intentions or expectations measures bring better prediction of AUT. The no balances of the studies conducted on the researched variables makes it hard to confirm which variables could better predict the final use of systems and technologies.

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Appendix A: Studies Reviewed

Publication		method	Reported Relationships between TAM Variables 1 PEOU to PU / 2 PEOU to ATT/ 3 PU to ATT / 4 PEOU to BI / 5 PU to BI / 6 ATT to BI / 7 ATT to AU / 8 BI to AU / 9 PEOU to AU / 10 PU to AU									
			1	2	3	4	5	6	7	8	9	10
1	Davis. F, 1989	S									Y	Y
2	Davis et al., 1989	S	Y	N	Y	Y	Y/Y	Y		Y		
3	Haynes & Thies, 1991	S									Y	Y
4	Mathieson. K., 1991	O	Y	Y	Y		Y	Y				
5	Bagozzi et al, 1992	O				Y	Y					
6	Adams et al., 1992	S	Y								Y	Y
7	Igbaria, M., 1993	S			Y		Y			Y		
8	Subramanian, 1994	S	Y/N			N/N	Y					
9	Igbaria et al., 1995	S			Y		Y			Y		
10	Igbaria & Iivari, 1995	S	Y								Y	Y
11	Straub et al., 1995	S/O									Y/Y	Y/Y
12	Taylor & Todd, 1995a	S	Y	Y	Y			N/Y		Y/Y		
13	Taylor & Todd, 1995b	S	Y	Y	Y			Y				
14	Keil et al., 1995	S	Y								Y	Y
15	Hendrickson & Colins, 1996	O	Y								N	Y
16	Szajna, B., 1996	O	Y/Y			Y/Y	Y/Y			Y/Y	N/N	N/N
17	Chau, PYK. 1996	S	Y								Y	Y
18	Gefen &	S									N	Y

	Straub,1997											
19	Igbaria et al., 1997	O	Y								Y	Y
20	Morris & Dillon, 1997	S	Y	Y	Y		Y	Y		Y		
21	Jackson et al., 1997	S	N	Y	N	Y	N	N				
22	Agarwal & Prasad, 1997	S	Y	Y	Y				Y			Y
23	Bajaj & Nidumolu, 1998	S	N	Y					Y			N
24	Gefen & Keil, 1998	S	Y								N	Y
25	Thompson, 1998	S	Y	Y	Y		Y	Y				
26	Green CW, 1998	S									Y	Y
27	Karahanna et al., 1999	S		Y/Y	Y/Y							
28	Lucas & Spitler, 1999	S	Y			N	N				N	N
29	Malhotra & Galletta, 1999	S			Y		Y	Y		Y		
30	Teo et al.,1999	S	Y								Y	Y
31	Hu et al., 1999	S	N	Y	Y		Y	Y				
32	Dishaw & Strong 1999	S	Y		Y		N	Y		N		N
33	Heijden, HVD. 2000	S	Y									Y
34	Venkatesh and Moris, 2000	S	Y			Y	Y					
35	Karahanna & Limayem, 2000	S	Y								Y	Y
36	Lederer et al., 2000	S										

37	Mathieson et al., 2001	S	Y	Y	Y		N	Y		Y		
38	Moon & Kim, 2001	S	Y	Y	Y		Y			Y		
39	Horton et al., 2001	S/O				Y	Y			Y	NY	Y/Y
40	Riemenschneider & Hardgrave, 2001	S	Y								Y	
41	Suh & Han, 2002	S	Y	Y		Y		Y		Y		
42	Chen et al., 2002	S	Y	Y		Y			Y			
43	Dasgupta et al., 2002	O	Y								N	Y
44	Huang et al., 2002	S									N	Y
45	Lin. & Wu, 2002	S	Y	Y	Y		Y			Y		
46	Chen et al,. 2002	S	Y	Y	Y		N					
47	Heijden, HVD. 2003	S	Y	Y	Y		Y	Y		Y		
48	Henderson & Divett, 2003	O	Y			N	Y					
49	Lee et al., 2003	S			Y							Y
50	McCloskey. D, 2003	S				Y						Y
51	Stoel & Lee, 2003	S/O		Y	Y			Y		Y		
52	Venkatesh et al., 2003	S								Y		
53	Yi & Hwang, 2003	O	Y			Y	Y			Y		
54	Davis & Venkatesh, 2004	O				Y	Y					
55	De Vos et al. 2004	O			Y			Y				
56	Dybå et al, 2004	S				Y	Y				Y	Y
57	Lin and Wu, 2004	S	Y								N	Y

58	Yang & Yoo, 2004	S			Y			Y				
59	Ali & Money, 2005	S									Y	
60	Cheung & Huang 2005	S							Y			Y
61	Green et al, 2005	S									N	Y
62	Hung & Chang, 2005	S	Y		Y		Y			Y		
63	Kim & Malhotra, 2005	S	Y								Y	
64	Lippert & Forman, 2005	S	Y									Y
65	Marin et al., 2005	S					Y			Y		
66	Sundarraj & Wu, 2005	S	Y								N	Y
67	Zain et al., 2005	S		Y								Y
68	Amoroso & Guo, 2006	S	Y			Y	Y			Y		
69	Cheng et al., 2006	S	Y	Y			Y	Y		Y		
70	Lee et al., 2006	S	Y				Y			Y		
71	Ngai et al, 2007	S	Y		Y			Y				Y
72	Tong, D.Y., 2009	S	N				Y					
73	Riquelme & Rios, 2010	S					Y					
74	Puschel et al., 2010	S				Y						
75	Koenig Lewis et al., 2010	S					Y					
76	Sripalawat et al., 2011	S	Y			Y	Y			Y		
77	Dasgupta et al., 2011	S				Y	Y					

78	Zhou, T. 2011b	S	Y				Y					
79	Lin, 2011	S				Y						
80	Zhou, T, 2011a.	S					Y					
81	Yu. 2012	S				N				Y		
82	Akturan & Tezcan, 2012	S			Y		Y	Y				
83	Kazi & Mannan, 2013	S									Y	Y
84	Mzoughi & M'Sallem, 2013	S					Y					
85	Achjari & Quaddus, 2003	S	Y			Y	N					
86	Oliveira et al., 2014	S								Y		
87	AlSoufi & Ali, 2014	S				Y	Y					
88	Hanafizaden et al., 2014	S				Y	Y					
89	Deb & Lomo-David, 2014	S		Y	Y			Y				
90	Hanafizadeh et al., 2014	S									Y	Y
91	Jeon et al, 2015	S	Y			Y	Y					
92	Mortimer et al., 2015	S				Y	Y					
93	Cho et al, 2015	S				Y	Y					
94	Koenig Lewis et al., 2015	S	N			N						
95	Yuan et al., 2016	S	Y			N						
96	Alavi & Ahuja, 2016	S									Y	Y
97	Baptista &	S								Y		

	Oliveira, 2017											
98	Dou et al., 2017	S	Y			N	Y			Y		
99	Walton & Johnston. K, 2018	S	Y	Y	Y		N	Y				
100	Agustina D., 2019	S	Y	Y	Y			Y		Y		
101	Chaouali et al., 2019	S					Y					
102	Baabdullah et al., 2019	S					Y					
103	Roussou. et al., 2019	S	N								N	Y
104	Mendoza et al., 2019	S	Y			Y	Y					
105	Elhajjar & Ouaida, 2020	S				Y						
106	Alqaryouti et al., 2020	S		Y				Y				
107	Singh et al., 2020	S				Y	Y	Y		Y		
108	Saif, A., 2020	S				Y	Y					
109	Kumar et al., 2020	S				Y	Y					
110	Gupta & Arora, 2020	S								Y		
111	Nuryyev. et al., 2020	S	Y			Y	Y					
112	Louissaint et al, 2020	S				Y	Y					
113	Ho et al., 2020	S			Y		Y	Y				
114	Shubhangi et al, 2020	S					Y				Y	N
115	Adjei et al, 2020	S									Y	Y
116	Ahmad et al., 2020	S				Y	Y			Y		

117	Shemesh et al., 2020	S				Y	Y	Y				
118	Albayati et al., 2020	S	Y	Y	Y			Y				
119	Nguyen-Viet & Ngoc, 2021	S	Y									
120	Ali et al., 2021	S	Y			Y	Y			Y	Y	Y
121	Bitri et al., 2021	S					Y					
122	Rafdinal & Senalasari, 2021	S		Y	Y							
123	McKee et al., 2021	S		Y	Y	Y	Y	Y		Y		Y
124	Palos-Sanchez et al., 2021	S	Y	Y	Y		Y	Y				
125	Alshurideh et al., 2021	S				Y	Y					
126	Hashem, A., 2022	S									Y	Y
127	Lisana & Handarkh, 2022	S					Y					
128	Akhter et al., 2022	S				Y	Y					
129	Jariyapan et al., 2022	S				Y	Y					
130	Ojo et al., 2022	S									Y	Y
131	Cramer et al., 2022	S	Y			Y	Y			Y		
132	Ly, B., & Ly, R. 2022	S				N	Y					
133	Alnemer, H. A. 2022	S									Y	Y
134	Agardi & Alt, 2022	S	Y			Y	Y					
135	Nathan at al., 2022	S									Y	Y
136	Alsyouf et al.,	S	Y			Y	Y			Y		

	2022											
137	Rejman et al., 2022	S				Y	Y					
138	Astari et al., 2022	S				Y	Y					
139	Ibrahim et al., 2022	S		Y	Y						Y	Y
140	Sharma & Khurana, 2022	S				Y	Y					
141	Bao et al., 2023	S	N			N	Y				N	Y
142	Balki et al., 2023	S				Y	Y				Y	Y
143	Song. 2015	S				Y	Y					
144	Saeidi et al., 2023	S	Y			Y	Y	Y		Y	Y	Y
145	Hutahaean et al., 2023	S									Y	Y
146	Balakrishnan et al., 2024	S		Y	Y							
147	Dhaggara et al., 2020	S	Y			N	Y					
148	Aji et al., 2020	S					Y					
149	Akdur et al, 2020	S	Y			Y	Y			Y		
150	Straub et al., 1995	S									Y	Y

S: Subjective self-reported usage/ O: Objective recorded usage / Y/Yes or Y/N, etc., is used when two studies are reported in one publication / Vacant cells: Untested relation/

Y: Yes (significant relation/ N: No (non-significant relation)