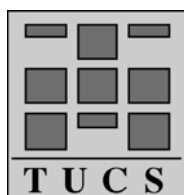


# Individual Adoption of Information Systems in Organisations: A Literature Review of the Intention-based Theories

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## **Abstract**

Users' perceptions of and intentions to adopt ISs within organisations is an important focus in IS research. In the past several decades, many studies based on different theoretical approaches have been made for predicting, explaining and increasing user acceptance of information systems in the work places. This paper mainly gives a comprehensive review of the intention-based theories of IT adoption, i.e., TRA, TPB TAM, and Triandis' model. These models have dominated the research on individual adoption of IS in organisations and contribute great knowledge to this research issue. It covers the period from 1989 till the end of 2002 and reviews all articles that have studied some aspects of IS adoption and which have appeared in leading journals in the IS fields. These theories state user adoption and usage behaviours are determined by the intention to use IT, which in turn is influenced by beliefs and attitudes about IT. Since attitudes and beliefs about IT innovations are antecedents of user intention and usage, it is critical to understand the external variables that influence the formation and change of attitudes and beliefs. We describe these theories briefly and summarise review findings according to the component constructs of the theories, i.e., behaviour, behaviour intention, attitudes, beliefs and external variables. We find that the intention-based theories seem to be a very powerful theoretical tool to predict and explain user's behaviour with regard to technologies within organisation contexts. We still find that behaviour has different dimensions; beliefs are determinants of behaviour and their relationships are complicated. It is crucial to examine the external variables or stimuli effects on other constructs because of their practical implications for management, system design and implementation. This review helps us build a strong knowledge base of users' behaviour in IS research and could guide our future research in the coming mobile world.

**Keywords:** intention-based theories, individual, adoption, information systems, usage

# 1. Introduction

Users' perceptions of and intentions to adopt the IS and the rate of diffusion and penetration of technology within and across organisations are two important foci in IS research (e.g. Straub et al, 1995; Taylor and Todd, 1995a). They are understood to represent the essential aspect, property or value of information technology (Orlikowski and Iacono, 2001). It is generally accepted that the use of information systems at work could increase employees' productivity during their working time and improve organization performance and cost saving. System Usage is an important way by which to measure IS success (DeLone and McLean, 1992).

In the past few decades, many studies, based on different theoretical approaches, have been made for predicting, explaining and increasing user acceptance of information systems at the workplace. For example, the Diffusion of Innovations theory (DIT) suggests that the user's perception of the characteristics of an innovation affect its adoption (e.g. Moore and Benbasat 1991, Plouff et al, 2001, Rogers 1995). The intention-based theories of IT adoption, i.e. the Theory of Resoned Action (TRA) (Feshbein and Ajzen 1975, Davis et al 1989), the Technology Acceptance Model (TAM), (e.g. Davis et al. 1989, Venkatesh and Davis 1996, 2000), the Theory of Planned Behaviour (TPB), (e.g. Mathieson 1991, Taylor and Todd 1995a, Venkatesh and Brown 2001), have shown that user adoption and usage of IT innovations is ultimately determined by the person's beliefs and attitudes toward the information systems. There are also other theories, e.g. Social Cognitive Theory (SCT) (Compeau and Higgins 1995a, 1995b, 1999) and the Triandis' model (e.g., Thompson et al 1991,1994,Cheung et al 2000) that have been applied in studies of user adoption of IS. These researches have produced useful insights into the cognitive, emotional, affective and behavioural reactions of individuals to technology, and into the external variables that influence these reactions.

In each of the theories noted above, behaviour, i.e. the adoption and use of an IS, is viewed as the consequences of a set of beliefs about technology and a set of affective responses (attitude) to the behaviour. If we knew the beliefs and the external variables that determine them, we could better understand why an individual adopts or rejects an IS. However, Rogers (1995) and others have argued that it is reasonable to expect that the nature and importance of the antecedents to adoption will vary across adoption setting; it is impossible to cover all of them in one paper. Therefore, we will mainly pay attention to intention-based theories of IT adoption, i.e. TRA, TPB, TAM, and the Triandis model. These models have dominated research on individual adoption of IS in organisations and contribute extensive knowledge to this issue. We will review these theories and their relevant constructs. We try to provide a comprehensive understanding of them.

Webster and Watson (2002) suggest that a good literature view should accomplish two tasks. One is to conduct a thorough review to synthesise prior research. The other is to propose a conceptual model for the future direction of research. This review covers only the first task.

This paper explores intention-based theories of the research into IS adoption that has been carried out since Davis et al first published the most influential technology acceptance model in 1989. It attempts to synthesise the results of these researches into a more coherent body of knowledge, especially on individuals' beliefs and those external variables, which have influence on internal beliefs and attitudes. It covers the period from 1989 to the end of 2002 (appendix 2) and reviews all those studies that have studied some aspects of IS adoption that have appeared in leading journals in the IS field, i.e. MISQ, Information Systems Research, Journal of Information System Management, Decision Science etc; and online databases, i.e., EBSCOhost, Ideal, JSTOR, ScienceDirect, ABI Inform: ProQuest Direct, ACM digital library and Emerald. In addition, several articles are dated before 1989 in order to understand some conceptual and theoretical frameworks.

The paper is organised as follows. The next section will introduce the theories. In order to explore the details, we make an overview of the literature according to the relative component constructs of the theories - behaviour, behaviour intention, attitude, beliefs and external variables. This section provides a comprehensive summary of the beliefs and external variables that determine the individual adoption of specific information systems. The following section summarises and discusses the findings obtained from the review. The final section presents some conclusions of our work.

## **2. Overview and Basic Concepts**

Major achievements have been made in the last decade in understanding user adoption and the usage of IT innovations. In particular, intention-based theories of IS adoption have emerged as an important stream of research. These theories include the theory of reasoned action (TRA) (Fishbein and Ajzen, 1975), the theory of planned behaviour (TPB) (Ajzen 1991), and the technology acceptance model (TAM)(Davis 1989, Davis et al. 1989). According to these theories, user adoption and usage behaviour are determined by the intention to use IT, which in turn is influenced by beliefs about and attitudes towards IT. Since attitudes and beliefs about IT innovation are antecedents of user intention and usage, it is critical to understand the external variables that influence the formation and change of attitudes and beliefs (Davis et al. 1989). Here, we include the Triandis model as well. Its structure and component constructs differ from the models mentioned above. However, they all follow the same logic in order to predict and explain an individual's adoption of a specific IT innovation. They assert, "*Intention to adopt is a reasonable proxy for actual adoption behaviour*".

These theories have been applied to studying the individual adoption of various IS applications in different organisations within different cultures (see appendix 2). By "individual" is usually meant a knowledge worker employed by the organisations under investigation. In some cases, IS researchers use students who are currently studying at university as subjects instead of real workers. The "individual" usage context is defined in terms of in "what" organisations, adopting of "which" IS applications or IT innovations during the period of the investigation. The time period could be cross-sectional or longitudinal. IS researchers use mostly survey questionnaires to collect data and depend on statistical techniques to analyse and interpret their results. Most of the

empirical studies have been conducted in the North America, with only a few having been done in Asia and Europe, e.g. Japan, Hong Kong, Singapore, Finland, Switzerland. There are some researchers who question the possibility of applying these theories to other cultures. The results of what has been done in Asia and Europe proved some constraints, but nevertheless fall far short of justifying a conclusion.

The theories have been explained and predicted the individual adoption of various numbers of IS applications. Examples include office systems - Word, WordPerfect, Excel, spreadsheet; messaging systems – e-mail, voice mail, fax; database systems, expert systems for sales personnel, telemedicine systems, bank systems, WWW web pages, e-commerce-related systems - e-supermarkets, e-bookshops, on-line banking systems; Internet technologies, digital libraries, etc (for details, see appendix 2).

These theories employ different perspectives on designing empirical studies, eliciting beliefs and focusing on different external variables or stimuli to explore users' behaviour when it comes to adopting the system in organisations. But they mostly provide similar results that prove their theoretical power in explaining and predicting individual users' adoption of IS in organisations. These theories are feasible for conducting research in this area after they have been tested intensively in different contexts within the IS domain.

## ***2.1 Theory of reasoned action (TRA)***

TRA is a general well-researched intention model that has been applied extensively in predicting and explaining behaviour across many domains - “virtually any human behaviour” (Ajzen and Fishbein 1980, p.4). Thus, IS researchers use it to study the determinants of IT innovations usage behaviour as a special case. According to TRA, the specific behaviour of a person is determined by his or her behavioural intention (BI) to perform the behaviour, and BI is determined jointly by the person's attitude (A) and subjective norm (SN) regarding the behaviour in question. Attitude is determined by his or her salient beliefs about the results of performing the behaviour multiplied by the evaluation of those results. SN is determined by a multiplicative function of his or her normative beliefs, i.e. perceived expectations of specific referent individuals or group, and his or her motivation to comply with these expectations. TRA is a general model. IS researchers using TRA must first find out the beliefs that are salient for subjects regarding the behaviour under investigation. “Salient beliefs” can be obtained by taking the beliefs most frequently elicited from a representative sample of the population. TRA asserts that any other factors, “external variables or stimuli”, that influence behaviour do so only indirectly by influencing A and SN through their relative belief structures. Therefore, TRA captures the individual internal psychological variables through which various external variables studied in IS research exhibit their power on user adoption of IT innovations.

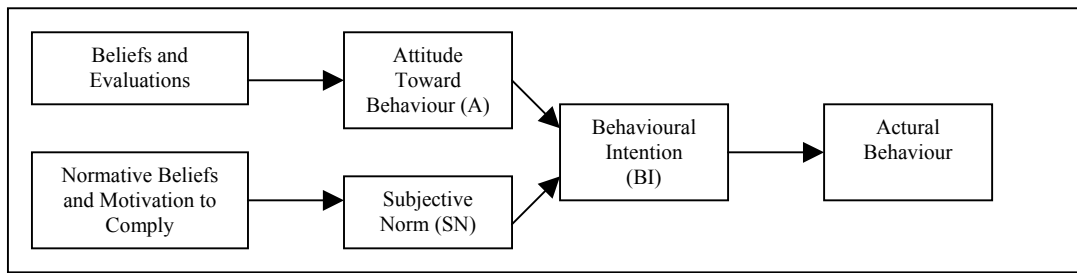


Figure 1: Theory of Reasoned Action (TRA)

## 2.2 Theory of planned behaviour (TPB)

The TPB was proposed as an extension of the theory of reasoned action. Because of the limitations of TRA in dealing with behaviours over which people have incomplete volitional control, the TPB introduced a third independent determinant of intention - perceived behaviour control (PBC). This refers to the perceived ease or difficulty of performing the behaviour and it is assumed to reflect internal and external constraints on behaviour. As in the TRA model, it includes attitudes, subjective norms, intentions to use and actual use. The components of behavioural attitudes and subjective norms are the same in TPB as in TRA. But the inclusion of behaviour control in the TPB has added to the explanatory power of TPB (Mathieson 1991, Taylor and Todd 1995a). Behavioural control encompasses two components. The first component is “facilitating conditions” representing the resources needed to use a specific system. The second component is self-efficacy, which is “*an individual’s self-confidence in his/her ability to perform a behaviour*” (Bandura, 1982). Decomposed TPB (Taylor and Todd 1995a) points out that self-efficacy, resource-facilitating conditions and technology-facilitating conditions are the most relevant determinants of behavioural control. According to TPB, behaviour is determined by the intention to perform the behaviour. Intention is predicted by three factors: attitude towards the behaviour (A), subjective norms (SN), and perceived behavioural control (PBC). Beliefs are antecedents to attitude, subjective norms, and perceived behavioural control.

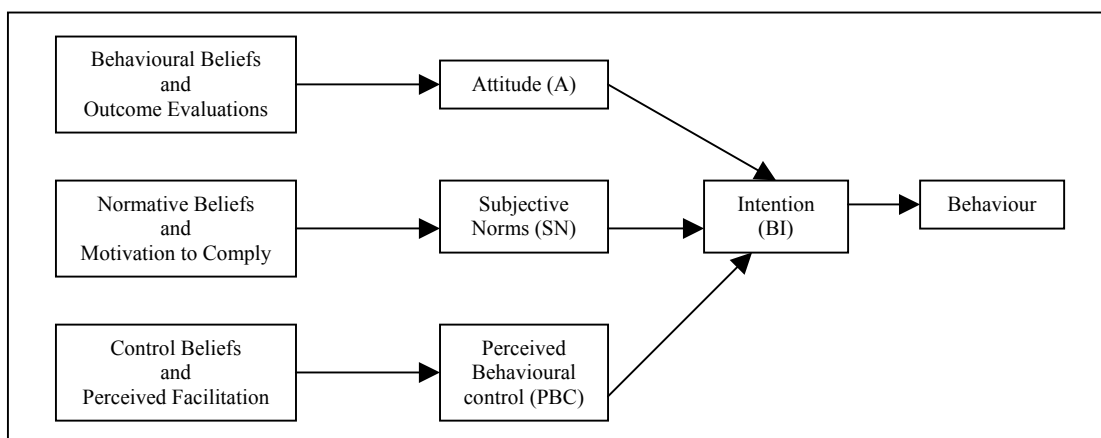


Figure 2: Theory of Planned Behaviour

## 2.3 Technology acceptance model (TAM)

TAM is an adaptation of TRA that has been specially introduced to explain computer usage behaviour. TAM uses TRA as a theoretical basis for identifying the strong links between two key beliefs, perceived usefulness (PU) and perceived ease of use (EOU), and user's attitude (A), intentions (BI) and actual computer adoption behaviour. According to TAM, computer usage is determined by BI, but differs in that BI is viewed as being jointly determined by the person's attitude towards using the system and PU with relative weights. TAM does not include SN as a determinant of BI. PU and EOU have been hypothesised to have positive influences on A. EOU influences attitudes and behaviour through two mechanisms: self-efficacy and instrumentality. The easier a system is to interact with, the greater should be the user's sense of efficacy (Bandura, 1982) and personal control regarding his or her ability to carry out the sequences of behaviour needed to operate the system. EOU effects attitude and behaviour more significantly in users who use the system for the first time than in users who have used the system for a long time. To the extent that increased EOU over time leads to improved performance, EOU would have a direct influence on PU. External variables have critical effects on the formation and changes of beliefs construct. TAM's "PU and EOU are postulated a priori, and are meant to be fairly general determinants of user acceptance" (Davis et al., 1989) This approach was chosen in order to construct a belief set that can be more readily generalised with regard to different computer systems and user populations.

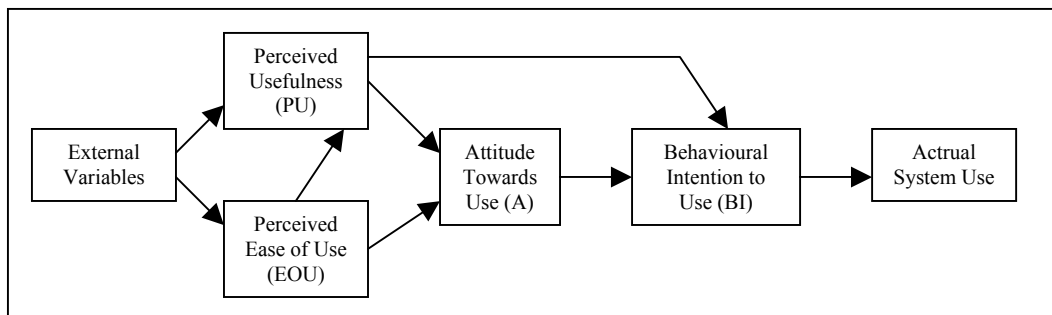


Figure 3: The Technology Acceptance Model

TAM compares favourably with TRA and TPB (Venkatesh 1999, Venkatesh and Davis 2000) in the research domain of information technology. It is parsimonious and robust, and has been applied in various systems and organisation settings. (See recent review by Gefen and Straub, 2000, appendix 2)

## 2.4 Triandis' model of interpersonal behaviour

Beside the three dominant models in the intention-based theories, Triandis (1980) provides a comprehensive model of interpersonal behaviour. The subset of this model was first tested by Thompson, Higgins and Howell (1991) in the context of information technology. The results demonstrate that this model can be used to predict, explain and understand an individual's technology acceptance behaviour within the organisation. Triandis stated that behaviour is determined by what people would like to do (attitude),



what they think they should do (social norms), what they have usually done (habits), and by the expected consequences of their behaviour. He argued that attitudes involve cognitive, affective, and behavioural components. The cognitive component of attitudes involves beliefs. Behaviour intentions are simply what individuals intend to do. This model exhibits that social factors affect, and perceived consequences influence BI, which in turn affect behaviour. Habits are both direct and indirect determinants of behaviour. The facilitating conditions could make the behaviour impossible even though the intention is high. Even this model was not applied intensively in IS research, but it provides very useful concepts, i.e. facilitation conditions and habits, which help the researcher to refine and extend above three models, especially TPB to gain more explanation power.

## **2.5 Summary**

The four models have a different emphasis when studying the individual adoption of IT innovation and IS in the real world. The constructs they applied, the study design and analysis may follow different approaches to exploring the issue. But, as all these models are labelled as intention-based, they support the common individual decision-making process when considering adoption of IS, i.e. behavioural intention is a prior and accurate predictor of the real usage of IS, attitude and different beliefs will affect behaviour through behaviour intention; and external variables or stimuli will have indirect impacts on behavioural intention mediated by these attitudes or different beliefs. In some cases, they may exert a direct impact on behavioural intention. Generally, these theories provide feasible analytical tools for exploring the individual adoption behaviour of IS in organisations both theoretically and empirically. Recently, IS researchers have applied these theories to the on-line consumer behaviour context and proved them to be powerful explanation and prediction tools as well (Chen et al 2002, Koufaris 2002, Jiang et al 2000). We conclude key concepts from these theories in Table 1.

TRA, TPB and Triandis' model have been intensively applied in other research domains. TAM is tailored to study a user's behaviour of using computer technology in organisations. Therefore, TAM has occupied the leading position in explaining and predicting user acceptance of IT innovations in IS research. It has been examined as a way to predict choice behaviour (Szajna 1994).

TRA is the theoretical basis of TPB and TAM. TAM compared favourably with TPB, but TPB gave much richer information about the research site (Taylor and Todd 1995a). TAM is parsimonious and robust (Venkatash and David 2000).

**Table 1: Key concepts from the intention-based theories**

Concepts	Definitions
Behavioural Intention (BI)	A measure of the strength of one's intention to perform a specified behaviour
Attitude (A)	An individual's positive or negative feelings (evaluative effect) about performing the target behaviour or user's evaluation of the desirability of his or her using the system
Subjective Norm (SN)	A person's perception that most people who are important to him think he should or should not perform the behaviour in question
Beliefs (Behavioural belief)	An individual's subjective probability that performing the target behaviour will result in a particular consequence
Normative beliefs	An individual's perception of a referent other's opinion about the individual's performance of the behaviour
Motivation to Comply	The extent to which a person wants to comply with the wishes of the referent other
Control belief (PBC)	A perception of the availability of skills, resources and opportunities
Perceived facilitation	An individual's assessment of the importance of those resources to the achievement of outcomes
Perceived Usefulness (PU)	The degree to which an individual believes that using a particular system would enhance his or her job performance/productivity
Perceived Ease of Use (EOU)	The degree to which an individual believes that using a particular system would be free of effort

### 3. Description and Analysis of Component Constructs

The intention-based theories support the causal links between their component constructs. We will examine these different constructs and variables that appear in the literature on individual adoption of IS in organisations. We present only some important or intimately involved constructs, instead of including all in the review.

In psychological terms, a construct is an object of perception or thought. In intention-based theories, behaviour, behaviour intention, attitudes, beliefs and external variables or stimuli are foci constructs. We will introduce their concepts and present some examples of their effects and functions in determining user acceptance of IS.

#### 3.1 Behaviour

Information technology can, in all probability, improve individual and organisational performance. The systems that are available to organisations cannot fully demonstrate their value until they are used. In the review of existing literature, there are different dimensions to usage behaviour. From the temporal dimension, we may categorise behaviour in two groups. There is initial adoption behaviour i.e. initial adoption, first-time usage, and rejection at the pre-implementation stage. The other is post-adoption or post-implementation behaviour, i.e. sustained continuous usage, discontinuance

(replacement or disenchantment). From the volitional dimension, usage could be mandatory or voluntary. There are two measures of system usage. One is self-reported current usage, self-reported future usage; the other is computer-recorded system usage.

### **(i) Temporal dimension of system usage**

One of the main purposes of the intention-based theory is to predict and explain initial adoption behaviour (Davis et al 1989, Moore and Benbaset 1991). In this dimension, system usage frequency and volume are used to measure the initial adoption behaviour, besides variety of use, e.g. the number of tasks accomplished or number of applications used (e.g., Igarria et al., 1995). ISs diffuse because of the cumulative decision of individuals to adopt them. Users may be persuaded to use a new system early in the implementation process but the benefits of system usage may never be derived in the absence of continued sustained usage. There may be some discontinuance behaviour as well. Two types of discontinuance behaviour exist. Replacement means users use an alternative system instead of the original one; the other, disenchantment, means users become dissatisfied with the system or services and therefore do not use it any more (Parthasarathy and Bhattacharjee 1998).

The temporal dimension of system usage may give rise to different formation of behaviour intention, attitudes and beliefs towards the system which are used in turn, to predict the probability of usage.

### **(ii) Mandatory use vs. voluntary use**

One assumption shared by intention-based theories is that, given sufficient time and knowledge about a particular behavioural activity, an individual's stated preference to perform the activity (i.e. behavioural intention) will, in fact, closely resemble the way he or she behaves. This assumption only applies, however, when the behaviour is under a person's volitional control. (Ajzen and Fishbein 1980)

The major differences between Ajzen's (1985) volitional control and the volitional control associated with mandatory behaviour is that, in the former category, the absence of volitional control hinders a person's will to perform the behaviour, whereas mandatory use of technology hinders a person's will not to perform the behaviour. Thus, Ajzen introduced perceived behaviour control, a measure of the extent to which the individual feels control over performing the behaviour rather than not performing the behaviour. Moore and Benbaset (1991) introduced perceived voluntariness to measure the degree of willingness to perform the behaviour. Venkatesh and Davis (2000) used this voluntariness as one of the control variables to conduct their study.

Although most previous studies have been designed in the voluntary use context, mandatory use is becoming an increasingly important research issue in organisations (Rawstorne et al, 2000).

### **(iii) Measuring system usage**

Different empirical design usually has different indicators to measure system usage. Behavioural intention is a proper predictor for current and future usage. "Assuming a system were available at my job, I predict that I would use it on a regular basis in the future". Such self-predictions, or "behavioural expectations", are among the most accurate predictors available for an individual future behaviour. Not enough is known at present about how accurately self-reports reflect actual behaviour. Szajna (1996) argued that the intention-usage link appeared to depend on the method used to measure usage. Intentions predict self-reported usage but do not predict actual usage well. Szajna's results showed that intentions explain 32% of the variance in self-reported usage, but only 6% of the variance in actual usage.

Some researchers use computer-recorded system usage to measure actual usage (e.g. Straub et al,1995, Szajna 1996). But these two constructs do not appear to be strongly related to each other, counter to expectations of previous MIS research. In the face of this conflict, it would be tempting to argue that *research that has relied on subjective measures for dependent variables, such as system usage, may not be uncovering the true, significant effects, but mere artefacts (Straub et al., 1995).*

Agarwal and Prasad (1997) proved that current usage was not a significant predictor of future use intentions. This suggested that factors generated by initial use cannot be relied on to explain and predict continuing, sustained use of the target innovation. Initial usage is an outcome of an individual's assessment of the usefulness offered by the innovation. They argued that "*at this point (initial usage), the technology is essentially an addition to other options, potential adopters may have to accomplish their work and does not entirely replace any of these options. Thus, the technology is not at the stage of maturity where adequate work-related benefits have been unequivocally established, consequently, initial use is not instrumental in predicting future use.*"

Therefore, the temporal dimension of system usage calls for the need to design empirical studies that can explore system usage behaviour (Lu and Gustafson 1994). The momentum generated by initial use should be reconsidered or modified when we take the temporal dimension into consideration.

## **3.2 Behaviour Intention - BI**

According to intention-based theories, user adoption and usage behaviour are determined by the intention to use IT. This kind of self-prediction, or "behavioural expectation", is one of the most accurate predictors available for an individual's future behaviour (Davis 1989).

Behaviour intention is a measure of the strength of one's intention to perform a specified behaviour. Some empirical studies have designed BI as the outcome construct to be measured. Basically, BI is self-reported based on two statements: 1) Assuming I have access to the system, I intend to use it, 2) Given that I had access to the system, I

predict that I would use it. These two statements are intensively applied in different empirical settings.

Some research just measures behavioural intention instead of behaviour to explain individual adoption of IS (e.g. Chau 1996). Behaviour intention is theorised to mediate the effects of beliefs and attitude to behaviour. The empirical results are mixed. Most research confirms this causal link, but other research indicates that beliefs or external variables may directly affect behaviour. Igarria (1994), for example, argued that computer skills had a strong positive direct effect on system usage. Some empirical results support these beliefs, e.g. perceived usefulness (PU) had a strong direct effect on system usage (e.g. Igarria and Iivari 1995).

### **3.3 Attitude – A**

Attitude is defined as an individual's positive or negative feelings (evaluative effect) about performing the target behaviour (Davis et al 1989, Zanna and Pempel 1988). From the psychology perspective, attitude is traditionally defined as a psychological tendency that is expressed by evaluating a particular entity with some degree of favour or disfavour. Attitudes are formed on the basis of antecedent cognitive, affective, and behavioural processes and are manifested in these three categories of evaluative responses. Attitude is a very important construct in studying a user's acceptance of technology. It directly influences the user's intention to use a particular system and even user behaviour to actually use the system. Indirectly its effects on behaviour through behaviour intention are significant in most empirical cases.

The measurement of attitude is usually self-reported. Different empirical designs may apply different statements to ask a user's opinion of the degree of agreement. Researchers usually use descriptive words to study the user's attitude towards adopting a system in the job. These include terms such as extremely negative, positive, or extremely good or bad, extremely harmful or beneficial.

Agarwal and Prasad (1998) demonstrated that awareness could be considered a favourable attitude towards using IS. It improved Rogers' DIT theory on awareness, which regarded it as the first stage of innovation diffusion. The notion of a favourable attitude is important because of the likelihood that information about many innovations may flow through the social system simultaneously. It is an adopter's acknowledgement that one or more of these innovations hold promise because of their ability to address a felt need that causes information-seeking behaviour. Such awareness of the innovation, although not a predictor of adoption behaviour, compels potential adopters. Townsend et al (2001) proved that experience-based attitudes in this context continue to offer an explanation for individual use and performance with IS technologies.

### **3.4 Beliefs**

At the most basic level of explanation, intention-based theories postulate that behaviour is a function of salient beliefs relevant to the behaviour. An individual might have a great many beliefs about any given behaviour, but he/she can take into consideration

only a relatively small number at any given moment. It is these salient beliefs that are considered to be the prevailing determinants of an individual's intentions and actions. Identifying these beliefs has been the most important step in previous studies of the acceptance of technology. Because every single study was made in a specific organisation or situation for different target systems, these beliefs differ. According to Ajzen (1991), we divide them loosely into three categories - behavioural beliefs, normative beliefs and control beliefs. Separating these beliefs makes it easier for investigators to extract the relevant external variables and formulate strategies for influencing user acceptance via controllable external interventions that have measurable influences on particular beliefs.

Our classification presented below is not precise since different models have various views of beliefs. According to TRA beliefs are related to evaluations of performing a certain behaviour. TAM is very parsimonious; it posits PU and EOU as two prior important beliefs that determine a user's behaviour. Our description is one way to interpret the beliefs in the literature. We soon found that some beliefs overlap in meaning with different notions.

### **(i) Behavioural beliefs**

Behavioural beliefs are assumed to influence attitudes toward the behaviour. Reviewing the relevant literature, we could summarise these beliefs in two categories: improve job performance and intrinsic affect. Some researchers consider these beliefs act as a motive for adopting a particular IS (e.g. Davis et al 1992, Teo et al. 1999, Venkatesh, 1999, 2000, Venkatesh et al. 2002). There are two classes of motivation: extrinsic and intrinsic motivation. Extrinsic motivation relates to the drive to perform behaviour to achieve specific goals/rewards. Intrinsic motivation relates to the perceptions of pleasure and satisfaction from performing the behaviour. Therefore, we may also consider belief in improving job performance as extrinsic motivation whereas affective beliefs as intrinsic motivation.

#### Category 1: Improve job performance and social image - extrinsic motivation

Perceived usefulness is one of the prior belief constructs developed by TAM to measure the degree to which using the system could improve an individual's job performance or productivity. This belief construct has been intensively applied or replicated in many studies (see Appendix 1). It is very similar to the notion of relative advantage from the Diffusion of Innovation Theory (DIT) (Rogers 1995). According to Rogers, relative advantage means the degree to which using the innovation is perceived as being better than using its precursor. In TPB, this belief is interpreted as outcome evaluation or expectations to rate the desirability of the outcome. Chau (1996) divides this belief into two: perceived short-term usefulness and perceived long-term usefulness. In the short term, the use of a specific system will improve job performance; in the long term, its use may improve his/her career prospects or social status. Some researchers have developed other similar notions, e.g. output quality, perceived consequences, etc. We summarise these beliefs in Table 2 and give some references where these beliefs are defined.

## Category 2: Affect - Intrinsic motivation

Besides these usefulness evaluations to formulate behavioural belief, another category still needs our attention because of its strong implication for system design. Affect, the feelings of joy, elation or pleasure, or depression, disgust, displeasure or hate associated by an individual with a particular act, have a major impact on an individual's affective response to a specific system, such as computer playfulness or computer satisfaction. Some researchers argue that a negative affective response may be considered a control belief, indicating that the individual may lack some capacity or has less volitional control to perform the behaviour in question. These relevant intrinsic motives are summarised in Table 3.

**Table 2 Behavioural beliefs-Extrinsic motivations**

Behavioural beliefs	Definition	References
Perceived usefulness (TAM), Relative advantage (IDT+PCI) Perceived near-term usefulness+ perceived long-term usefulness	The degree to which an individual believes that using a particular system would enhance his or her job performance / Productivity  Near term-improving job performance or enhancing job satisfaction; Long term improving one's career prospects or social status (future consequence, image, social approval)	Davis et.al 1989; Adams et al 1992; Rogers 1995; Moore and Benbasat, 1991; Chau, 1996, Segars and Grover, 1993, Subramanian 1994
Outcome evaluation /expectations (TPB) / (SCT)	A rating of the desirability of the outcome; two dimension- outcome expectations—performance (improvements in job performance, efficiency and effectiveness, associated with using computer.), outcome expectations—personal (change in image or status or to expectations of rewards, such as promotions, raises, or praise)	Mathieson 1991; Compeau and Higgins, 1995a,b, Compeau et al, 1999
Perceived consequences: i)near-term consequences— (complexity, job fit); ii)Long-term consequence (Triandis model)	Job fit: the extent to which an individual believes that using a IS or innovation can enhance the performance of his or her job. Long-term Consequences: outcomes that have a pay-off in the future, i.e., increasing the flexibility to change jobs or increasing the opportunities for more meaningful work	Thompson et al, 1991, 1994
Compatibility (IDT+PCI)	the degree to which adopting the IT innovation is compatible with the existing values, needs, and past experiences of potential adopters	Moore and Benbasat, 1991; Karahanna et al, 1999, Rogers 1995
Job Relevance	An individual's perception regarding the degree to which the target system is applicable to his or her job; The degree to which the system matches tasks as carried out in the current environment and as specified in the task analysis	Venkatesh and Davis, 2000; Hong et al, 2001-2002
Output Quality	How well the system performs tasks match his or her job goals (job relevance)	Venkatesh and Davis, 2000



**Table 3 Affect-Intrinsic motivation**

Behavioural beliefs	Definition	References
Affect (Triandis' model) emotional belief (affective response) (SCT)	Feelings of joy, elation, or pleasure, or depression, disgust, displeasure, or hate associated by an individual with a particular act. The enjoyment a person derives from using computers. (SCT)	Thompson et al, 1991,1994; Compeau et al,1999
Computer anxiety (affective response)	The tendency of individuals to be uneasy, apprehensive or fearful about current or future use of computers Feelings of apprehension or anxiety that one experiences when using computers. It is a negative affective reaction toward use.	Igbaria,1994 Compeau et al, 1999, Venkatesh,2000
Perceived enjoyment/fun	To the extent to which the activity of using the computer is perceived to be enjoyable in its own right, apart from any performance consequences that maybe anticipated. Perceived fun has a positive effect on user acceptance of IT.	Davis et al, 1989; Webster and Martocchio, 1992; Igbaria et.al ,1996; Henderson et al,1998, Teo et al 1999
Computer playfulness i)the trait of playfulness ii) the state of playfulness, situational characteristic of the interaction between an individual and the situation	The degree of cognitive spontaneity in microcomputer interactions. Measure how an individual will behave when interacting with a particular kind of IT. Playful individuals may tend to underestimate the difficulty of the means or process of using a new system because they enjoy the process and do not perceive it as being effortful.	Webster and Martocchio, 1992, Agarwal and Prasad, 1999, Venkatesh, 2000; Moon and Kim 2001
Computer satisfaction	Satisfaction that IT will have a direct effect on usage. Satisfaction will increase the continuous usage of system; it depends on the extent to which individuals perceive their initial expectations of a service to be confirmed or disconfirmed during actual use.	Igbaria et al, 1996; Bhattacharje,2001

## **(ii) Normative beliefs**

Normative beliefs constitute the underlying determinants of subjective norms. Normative beliefs about adopting IT in organisation settings generally come from top management, supervisors, peers, friends, the MIS department, and local computer specialists or team members. From the social influence perspective, the perceived pressure to perform the behaviour in question is exerted through messages and signals that help to form perceptions of the value of a product or activity. TAM does not include social factors, but still provides empirical results to support that normative beliefs do influence individual adoption and usage of information systems. (Taylor and Todd, 1995a, Henderson et al, 1998)

## **(iii) Control Beliefs**

Control beliefs provide the basis for perceptions of behavioural control. Behavioural control refers to the skills, opportunities and resources needed to use the system. Ajzen (1985) differentiates between internal control factors that are characteristics of the individual, and external factors that depend on the situation. Internal factors include skill and will power. External control factors include time, opportunity, and the cooperation of others. The most important internal control belief is self-efficacy (see recent review by Marakas et al, 1998). TAM theorises this into the EOU construct. External control beliefs concern technology facilitation and organisational facilitation. As we indicated before, mandatory use of individual usage of IS is popular today. The introduction of control beliefs will help us to clarify the degree of mandatory impacts on behaviour.

**Table 4 Control beliefs**

Control Beliefs	Definition	Reference
Perceived ease of use Complexity perceived complexity, Process expectancy	The degree to which an individual believes that using a particular system would be free of effort; The degree to which an innovation is perceived as relatively difficult to understand and use	Davis et.al 1989 Rogers 1995; Moore and Benbasat, 1991; Igarria et.al, 1996, Venkatesh, 1999
Perceived facilitation (TPB)	The individual assessment of the importance of those resource to the achievement of outcome	Mathieson 1991
Trialability (IDT+PCI)	The degree to which an IT system may be experimented with before making an adoption or rejection decision	Rogers 1995; Moore and Benbasat, 1991
Result Demonstrability (PCI), Observability (IDT)	The degree to which the result of adopting/using the IS are observable and communicable to others Or “ tangibility of the results of using the innovation	Moore and Benbasat, 1991; Karahanna et al, 1999
Visibility (PCI)	The degree to which the IS is visible in the organisation	Moore and Benbasat, 1991; Karahanna et al, 1999
Facilitating conditions (Triandis) Personal facilitation conditions + technology facilitation conditions (DTPB)	Objective factors, out there in the environment, that several judges or observers can agree make an act easy to do	Thompson et al, 1991, 1994; Taylor and Todd 1995a
Computer Self-efficacy (SCT) (DTBP) General CSE, task-specific CSE	A judgment of one’s capability to use a computer (IS)	Compeau and Higgins, 1995a, b; Taylor and Todd 1995a; Agarwal et al 2000
Habit (Triandis)	As behaviour becomes more routinised for the individual, habits begin to exert a stronger influence while the influence of social norms weakens. Habits are situation behaviour sequences that occur without self-instruction. The individual is usually not conscious of these sequences.	Thompson et al, 1991, 1994;

### **3.5 External variables**

Davis et al (1989) assert “A key purpose of TAM is to provide a basis for tracing the impact of external factors on internal beliefs, attitudes and intentions”. TAM has a construct called “external variables” to label all external factors having an impact on individual internal decision process. TRA and TPB do not have an apparent construct called “external variables”; they theoretically support the causal links between external variables and individual beliefs, attitude and intention, for instance social influences (Malhotra and Galletta 1999).

Intention-based theories emphasise the importance of studying how various external variables or stimuli impact on the formation of and changes in individual beliefs and attitudes. From the literature, we categorise different variables into system characteristics, organisational factors, individual differences, and environmental and situation (task) factors.

#### **(i) System (technology) characteristics**

Information systems deployed in the organisation are meant to increase employees’ productivity and organisational performance. The intention-based theories demonstrated that the easier the system is to use, the greater the likelihood of the employee deciding to use it into his/her working practice. The system characteristics are important variables that influence individual’s beliefs and attitudes towards the target system. System characteristics are variables that managers should be able to influence through design and operating practices.

System interface design may have influence individual perception of the ease of use of the system (Davis et al 1989, Davis, S and Brostrom 1993). The menus, icons, mice or touch screen style may improve the usability of the system, and thus positively influence user’s perceived ease of use of the system. The interaction style with a direct manipulation interface affects how easy it is perceived to be to use (Wiedenbeck and S.Davis, 1997). Functionality, equipment performance, interaction, environment and the quality of the user interface, the five dimensions of system quality, need to be studied by researchers (Igbaria 1994) to examine the relative influences of external variables on the individual’s beliefs. The differences of system social presence and information richness may influence the user’s choice of medium when he/she communicates with others in the organisation (Straub 1994). Venkatesh and Davis (1996) introduce objective usability as a way to measure individual perception of ease of use of the system after having a direct hands-on experience with a specific system.

When the World Wide Web pages became a target of IS adoption research, the terminology, i.e. words, sentences, and abbreviations used by a system, screen design, in other words, the way information is presented on the screen, came to be examined as important factors influencing the user’s beliefs in the website (Cheung et al., 2000). The ease of grocery item location is important in the e-supermarket (Henderson et al., 1998). The response time of a website also affects users’ beliefs. The response time of a website refers to the time that the user spends waiting to interact with a site. The length

of response time greatly affects the user's beliefs of a website (both PU and EOU). Shorter response time will result in a smoother man-machine interaction, which will lead to a higher EOU of the website by the user (Lin and Lu 2000). The authors further suggested that response time is the most prominent factor in developing the user's beliefs in a website. Any design that jeopardises response time will definitely affect the user's perception of the website. The characteristics of useful information, task environment information, strategic areas for corporate decisions and functional area information are considered to be important antecedents of the perceived usefulness of the website for users (Lederer et al., 2000).

For using communication technology, such as fax, e-mail, voice mail or video conferencing, users' perceptions of usefulness and ease of use may be influenced by the perceived social presence and information richness of the system, and the perceived physical and informational accessibility of the system.

Social presence and information richness (SPIR) refer to the capacity to transmit information about facial expression, direction of looking, posture, dress and non-verbal cues. For example, voice mail has a higher SPIR than e-mail because of the vocal information conveyed. Perceived accessibility (ACC) includes both physical or terminal accessibility of the technology and informational accessibility. Physical accessibility refers to the extent to which someone has physical access to the hardware needed to use the system, and informational accessibility refers to the ability to retrieve the desired information from the system. Empirical results have proved SPIR and ACC impacts on relevant beliefs (e.g. Straub 1994, Gefen and Straub 1997, Karhanna and Straub 1999, Karhanna and Limayem 2000, Townsend et al 2001). System accessibility is a very important factor when it comes to studying user adoption of Internet technology (Lin and Lu 2000).

## **(ii) Organisational factors**

Systems are deployed within a specific organisation setting. Organisational factors are important variables that exert a heavy impact on an individual's use of target systems. These factors include end-user computing policy, end-user support, management support, and organisation usage of the system, encouraged by others. Usually the organisation provides some training programme to help end-users to understand how the systems function and how to use them in work.

1. End-user computing policy. The first step in the management of end-user computing is a set of policies, standards, and guidelines that must be developed to ensure a standard technical environment. (Igarria, 1994, Galleta and Hufnagel, 1992, Montazemi et al 1996). Therefore, an organisation must create the right environment to operate the system.
2. End-user support includes the availability of system development assistance, specialised instruction, and guidance in using a target application (Igarria et al 1995). End-user support contributes to end-user satisfaction. Users with different levels of technical sophistication also differ in the support they need,

and in the support provided, and levels of end user satisfaction vary with fulfilment of those end-user needs (Shaw, DeLone and Niederman 2002). When an organisation implements some support for end- users, it should consider “service quality” very carefully to avoid a service quality gap. Such support is much more important than management support (Igbaria et al 1995).

3. Management support includes top management encouragement, information centre support and allocation of resources. (Igbaria et al 1995) The organisational culture has inertial impacts on IT implementation (Copper 1994).
4. Organisation usage means organisational pressure (social pressure) and comes from three sources: management, peers, and subordinates (Igbaria, 1994). Organisational usage had a strong effect on individual usage (Igbaria and Iivari, 1995).
5. Encouragement by others within the individual’s reference group - the people to whom an individual looks to obtain guidance on behavioural expectations - can be expected to influence both self-efficacy and outcome expectations.
6. Training is the most significant method for an organisation to remove the barriers to acceptance of a specific system. Training will increase an end-user’s computer skill and self-efficacy, which in turn will reduce computer anxiety and increase the usage of the system. There is evidence to show that training is a key ingredient in user acceptance of IT in organisational settings. (e.g. Olfamn and Mandviealla 1994, Venkatesh 1999)
7. Gallivan (2000) argued that formal training may not be treated as a panacea for increasing system usage and user performance. Since the new system must fit in with the user’s work context, the knowledge and beliefs from his/her workgroup (community) have a large influence on individual technology usage. Common practices of the team or community may exert their influence on an individual’s technology usage through three pathways. One path is in terms of skill-transfer and knowledge-sharing – namely, co-workers may pool their knowledge, and share tips and strategies for using the system. A second possibility is through the formation and shaping of attitudes, values, and norms so that group members become similar in their technology usage. These we label the attitudes/values/norms explanation. The third possible pathway for the community of practice effect - that peers provide the motivation to use the technology - is the social influence explanation. His study results confirm the importance of building a team or community to increase the user’s acceptance of the technology. Lou et al. (2000) also found that the critical mass usage of groupware in a group influenced a user’s decision to use it positively and significantly. They suggested that the positive impact of perceived critical mass on perceived usefulness may derive from two factors. First, there is the effect of a network externality. Second, potential users witness more examples and different ways of using the technology when more and more of their peers use it. These two examples point out the importance of a team or community role in influencing a user’s adoption behaviour of a system.

### **(iii) Individual differences**

Individual differences refer to user factors that include traits such as personality and demographic variables, as well as situational variables that account for differences attributable to circumstances such as experience and training (Agarwal and Prasad, 1999). Individual differences exert an influence on an individual's behaviour towards a new information technology via their effects on his/her beliefs about the new IT. To the extent that beliefs are a learned response, then individual differences are expected to influence belief formation (Zmud 1979, Harrison and Rainer 1992, Thatcher and Perrewe 2002).

#### **Personality variables**

1. Self-efficacy and computer anxiety are considered individual beliefs about the capacity to use computer technology. But these two also concern the personality of the individual in some empirical cases (Compeau and Higgins, 1995 a,b; Igarria and Iivari, 1995, Agarwal et al. 2000, for the most recent review see Marakas et al., 1998). For example, computer self-efficacy is an important antecedent of EOU (Venkatesh and Davis, 1996).
2. Computer skills refer to the acceptance of technology and depend on the technology itself and the level of skill or expertise of the individual using the technology. Higher computer skills may increase individual self-efficacy in using the system and reduce computer anxiety significantly (e.g., Igarria 1994).
3. Personal innovativeness in the domain of IT - PIIT - has a moderating role in the development of behavioural intentions. Personal innovativeness is the willingness of an individual to try out an innovation. PIIT is conceptualised as a trait, i.e. a relatively stable descriptor of individuals that does not vary across situational considerations (Agarwal and Prasad 1998,1999). PIIT serves as a key moderator for the antecedents as well as the consequences of perceptions.
4. User competence is multi-faceted. It is composed of an individual's breadth and depth of knowledge of end-user technologies, and his/her ability to creatively apply these technologies (fitness) (Munro et al., 1997). Different users have different competences for using computer technology. Users such as doctors who have higher competence may weaken the explanatory power of intention-based theories, e.g., TAM (Hu et al, 1999, Chau and Hu 2001, 2002 a, b).
5. Cognitive style, decision style: different individuals have different cognitive styles or different ways of processing information, in other words, decision style. These differences have effects on perceptions of different DSS acceptance (H.-P, Lu et al 2001).
6. Media style refers to a marked personal preference or organisational role requirement for using a communication medium in getting one's task done. It has significant effects on the use of IS, e.g., email (Karahann and Limayem 2000).

## **Demographic variables**

1. Age is an important demographic variable in individual adoption of IS research. Computer skills were more easily learned by younger subjects than by older subjects. Age may exert effects on perceptions of using computer technology. For example, age has significant negative effects on EOU to using email and MSword (Hubona and Kennich 1996), perceived enjoyment of using Internet, daily Internet usage and diversity of Internet usage (Teo et al 1999).
2. Gender is a fundamental aspect of culture. Studying three culture—North America, Asia, and Europe, Gefen and Straub(1997)found that women and men differ in their perceptions but not use of email. Gender will moderate the perceived usefulness-intention, perceived ease of use-intention, subjective norm-intention, and perceived ease of use-perceived usefulness relationship (Venkatesh and Morris, 2000; Venkatesh, Morris and Ackerman 2000). Gender has significant negative effects on frequency of Internet usage and diversity of internet usage (Teo et al 1999). In Doll et al (1998) multi-group invariance analysis, authors reported that gender does not effect the invariant of PU instrument across gender, but does effect EOU instrument. Gender plays a vital role in shaping initial and sustained technology adoption decisions by today's knowledge workers.
3. Education: Higher level of education has been empirically associated with enhanced computer abilities and with more favourable attitudes towards computers (Agarwal and Prasad 1999). Empirical results support this argument. For instance, educational level had direct influences on usage frequency of a system (Huboma and Kennich 1996) and on PU (e.g., Teo et al 1999).

## **Situational variables**

1. Employment categories entail distinct and different experiences both with respect to job role and function, and with respect to the use of computer applications. For examples, employment categories had direct influence on attitude to IS as well ( Hubona and Kennick, 1996). Managers (UAE culture) are practical economists who are concerned with economic and technical costs and benefits surrounding banking automated IS. Current state of IS technological sophistication in a bank influences its manager's perception of costs and benefits of technological sophistication (Ghorab, 1997). Individual executive characteristics (executive in small business 25-200 employees) had no unique effect on adoption decisions ( Harrison et al, 1997). Job category has direct effects on PU of using a system (Hubona and Geitz 1997). An individual's role with regard to technology, that is, whether they were primarily technology users or technology providers was significant determinants of EOU of using a system (Agarwal and Prasad 1999).
2. Involvement/ participation to the software develop will help users to formulate positive perception and attitude to a system (Hartwick and Barki 1994, Jackson et al 1997). For example, Hackson et al, (1997) reported that achieving a better



understanding of factors that ultimately lead to system usage, the user involvement in the software developing process is very important.

3. **CA (cognitive absorption)** is a state of deep involvement with software. CA theorised as being exhibited through five dimensions.
  - Temporal dissociation, or the inability to register the passage of time while engaged in interaction;
  - Focused immersion, or the experience of total engagement where other attentional demands are, in essence, ignored;
  - Heightened enjoyment, capturing the pleasurable aspects of the interaction;
  - Control, representing the user's perception of being in charge of the interaction; and
  - Curiosity, tapping into the extent the experience arouses an individual's sensory and cognitive curiosity

CA represents a *situational intrinsic motivator*. It is posited to be a proximal antecedent of PU and EU. Individual traits of playfulness and personal innovativeness are important determinants of CA (Agarwal and Karahanna, 2000).

4. Exposure defined as the degree to which an individual has acquired or exchanged information about the technology and its usage. Exposure can take several forms, namely observation, communication and trial. Exposure has indirect and moderating effects on the intention of adopting mobile commerce (Khalifa and Cheng, 2002).
5. Knowledge of search domain (web interface) can support more efficient search by helping users to separate relevant information from irrelevant responses, facilitating learning of search principles, and formulating more accurate queries. It has direct effects of user perception of EOU of using e-library (Hong et al, 2001-2002).
6. Experience gained through direct use or past usage affects users perception of relevant beliefs of the target systems, current attitude and usage of the system positively in most cases. It is one of the most important sources of information about the target object and one's self-efficacy about computer technology. IS researchers take it either as external individual variables or moderating variable to explore its impacts on individual adoption behaviour. Prior experience affects perceptions of EOU, and U of the target systems (Wiedenbeck and S.Davis, 1997, Thompson et al 1994 Taylor and Todd, 1995 b, Hubona and Geitz, 1997, Henderson et al, 1998). The role of direct behavioural experience and results of such experiences are expected to be important in shaping system-specific perceived ease of use over time. (Venkatesh and Davis, 1996). Past usage (behaviour) could influence current attitude, EOU and future use. (Bajaj and Nidumolu, 1998). Experiences are important variable to effect the formation and change over time of user beliefs and adoption decisions of IT innovation (Xia and Lee, 2000). Experience influence utilisation of PC use directly (Thompson et al 1994). The results came from this study also suggested that the moderating

influence of experience on the relations between other constructs, e.g. job fit, technical support, to utilisation was generally quite strong.

#### **(iv) Environmental and situation (task) factors**

Most empirical studies have been conducted in North American culture, mostly in U.S firms. IS researchers attempt to test their intention-based theories in other cultures, e.g. Japan, Singapore, or Finland, etc. Culture does affect an individual's decision-making when it comes to adopting and using a specific system. The examination of cross-cultural working and IS is dominated by Hofstede-type studies (Myers and Tan 2002, Hofstede 1980). Straub (1994) found that cultural effects seem to play an important role in the predisposition towards and selection of electronic communication media. Response to traditional media such as face-to-face and telephone were remarkably similar between American and Japanese cultures. TAM holds for both the US and Swiss cultures, but not for Japanese culture (Straub et al 1997). Igarria and Iivari (1995) published comparative studies on users' computer self-efficacy in US and Finland. Culture exerted effects on the computer self-efficacy of Finns. Because Finland is a more feminine and a slightly more collective society, perceived usefulness may not be the dominant factor affecting usage. An individual's abilities and experiences as well as organisational support are likely to play major role in affecting usage. Besides examples examined by intention-based theories, Walsham (2002) examined cultural (Jamaican and Indian cultures) impacts on software production and use based on structuration theory. His case studies found insights of cross-cultural work and pointed out that culture is not static. A cross-cultural team member needs mutual respect from a different individual culture. It provides the opportunity for team members to move to a more negotiated culture of cooperation, and so increase the use of IS in their work.

Behaviour always occurs within some situational context. The situational factors exert some of the most pervasive influences on individual behaviour in general, and IS adoption in particular. Situational influences can be viewed as the impact of factors that are peculiar to a specific time and place that are independent of consumer and object characteristics (Engel et al 1990,p205). There are five general factors of situational influence, i.e. physical surroundings, social surroundings, time, task (the particular goals or objectives users have in a situation) and antecedent states, such as temporary moods. In the IS domain, these factors affect user adoption of target IS. For example, persuasion in one situation may influence users' behaviour. Persuasion refers to "an active attempt to influence people's action or belief by an overt appeal to reason or emotion" (Wright and Warner 1962, P7, quoted from Xia and Lee 2000) or "Communication intended to influence choice" (Brembeck and Howell, 1976, p19, quoted from Xia and Lee 2000). Fishbein et al (1981) argue that persuasion is one of the important strategies for influencing beliefs and behaviour. The recent results of a longitudinal experimental study made by Xia and Lee (2000) have shown that persuasion significantly influences the formation of the user's initial perceptions, attitude towards, and intention to adopt IT. Venkatesh and Speier (1999) and Venkatesh et al (2002) examined mood effects on users' adoption behaviour. They found that positive and negative mood influence intrinsic motivation, but not extrinsic motivation.

Mood influences BI at the time of training. The long-term effects of positive mood on intrinsic motivation are not significant compared to neutral mood. But the long-term effect of negative effects does affect intrinsic motivation. In the long run, mood does not effect extrinsic motivation. Positive mood does not have sustained effects on BI, whereas negative mood does.

An individual may rely heavily on information technology to accomplish a task in his/her work. Task is broadly defined as the action carried out by an individual in turning inputs into outputs (Goodhue and Thompson 1995). Task-technology fit theory (TTF) (Dishaw and Strong 1999, Goodhue 1995, 1997, 1998) implies matching of the capabilities of the technology to the demands of the task. TTF posits that IT will be used if, and only if, the functions available to the user support (fit) the activities of the user. Rational, experienced users will choose those tools and methods that enable them to complete the task with the greatest net benefit. IT that does not offer sufficient advantage will not be used. Lucas and Spitler (1999, 2000) illustrated that while the tasks of all brokers are similar, there are different ways to approach the job. The broker's strategy affects the degree to which the technology is relevant, and should be a determinant of perceptions of the workstation (networked, multifunctional system). Thompson et al (1991, 1994) found that technology fit with job had a positive effect on user utilisation of a PC. Keil et al (1995) also suggested that task/tool fit played a role in shaping perceptions of whether or not a system was easy to use. Gefen and Straub (2000) argued that the varying importance of EOU may be related to the nature of the task. They found that, in e-commerce, when a website is used to purchase products, EOU does not affect IT adoption because IT ease of use is not an inherent quality of the purchased product. On the other hand, when the website is used to inquire about products, EOU should affect IT adoption because the required information is embedded in the IT and thus its quality is directly related to IT ease of use. Basically, the fit between IS functionality and task requirements will lead to positive user perceptions and evaluations of using the systems, and therefore impact on users' performance positively.

Besides these situational influences and impacts of task technology fit, other factors, such as developer responsiveness, directly influence users' perception of system usefulness and ease of use, and its indirect impacts on system usage were mediated by PU and EOU beliefs (Gefen and Keil 1998, Gefen 2000).

## **(v) Discussions of external variables**

Here, we make a comprehensive review of "external variables" in the domain of individual adoption of IS in organisations. We classify them into four categories: system characteristics, organisational factors, individual differences and environmental factors. The number of these factors demonstrated the important role external variables played in influencing user's behaviour empirically. We also gave some examples of the impacts of them on internal beliefs, attitude and intention.

System is the "target" in studying a user's adoption behaviour. System factors include systems usability, interface, interaction style and system quality etc. For systems related

to Internet technologies, the characteristics of web page design, response time, information location on the web, etc. have been tested in empirical studies. For communication technologies, factors such as system social presence and information richness, system accessibility, etc. have a significant impact on the user's beliefs about using the systems. Generally, system factors affect a user's perception of ease of use of the system and his/her control beliefs, e.g. computer self-efficacy. The easier the system is to use, the greater the likelihood that users will actually use the system. If not, it may lead to the failure of the system. Different systems have their own characteristics; the same factor that promotes user acceptance of IS in one context may not have the same effects on user behaviour in other research contexts.

Organisation is the "context" which a user's behaviour occurs. In order to increase the user's acceptance of IS, organisations have to create a favourable environment to support and encourage their employees to IS in their work. Organisation computing policy, management support and encouragement are empirically proved to be very important. Many researchers directed attention to training effects on user acceptance of IS. Traditional training, game-based training, or some specifically designed training programme for specific user groups, does help users increase their knowledge about the IS, and leads them to be positive about using it in their work. Workers in a team or community could benefit from informal training or common practice, such as knowledge sharing in the group, to increase willingness to use a system. This factor is very crucial today since most employees work as members of a team.

"Individual" is the one to take action on performing adoption behaviour. Thus, this variable has been analysed from different perspectives, i.e. personality, demographic and situational variables. All these variables have differing degrees of effect on user's beliefs, attitudes and intentions to the IS. Among them, experiences play important roles in individual adoption of IS. It is worth highlighting.

Experiences from past or direct usage of IS help in processing informational and social influence perceptions, formulating positive beliefs and attitudes and performing behaviour. For instance, it is no surprise that an individual who has general experience of computer technology or specific experience of a particular IS will be more likely to take a positive attitude and intention to use newly introduced or new IS in organisations. Users with a different experiential background differ in their perception of beliefs, e.g. PU toward IS (Doll et al 1998). Empirical studies indicate that experience exerts direct and moderate effects on behaviour.

Environmental factors help researchers go beyond the organisational "context", to a broader context. To include factors such as culture, the intention-based theories have applied to other culture domains, rather than just North America. The situational factors allow researchers study in depth the "situated" context where the behaviour occurs. For example, persuasion regarding the situation and user's mood has been examined in the literature and its effects on beliefs are significant.

The diversity and complexity of the external variables examined in the literature direct our attention to the research context of individual adoption of IS in organisations. The

information from cultural, organisational, or situational contexts vary. These contexts will define different “individual” environments which influence behaviour.

## **4. Summary and Discussion**

In reviewing these intention-based theories and the relevant constructs that IS researchers have taken in studying individual adoption of IS, the following summary could make.

1. Intention-based theories share a common theoretical backbone.

Intention-based theories in the IS field commonly support a causal link between an individual’s behaviour intention and behaviour. In turn, the intention will mediate the effects of individual attitude and beliefs to the behaviour in question. Those theories are rooted deeply in social psychology and focus on the individual decision-making process of using information systems in work within organisational settings. To be precise, these theories define the research boundaries of individual adoption of IS. First, they focus on “individual”, not on group, adoption or organisational adoption behaviour. Usually, these “individuals” are treated as knowledge workers or employees working in the organisation. Their adoption of IS in their work is theorised to improve their productivity and organisational performances. Second, individual adoption of IS in an organisation is considered to be a “second-order” adoption process, organisational adoption being the first-order process (Chin and Gopal 1995). Under the “protection” umbrella of organisations, individual concerns risk or cost less than consumers when it comes to adopting a specific IS or technology. Such as, Internet technologies have been used intensively in modern society. Here the trust and risk issue has much more significant effects for consumers than for workers. Use of IS by an individual could enhance the value and benefits of an organisation’s investment in IS or technologies. Third, an individual lives in a social system, so that the formation and changes of attitude and beliefs towards an IS or technology are intensively influenced by external variables or stimuli. Intention-based theories emphasise and explain such impacts, which provide more suggestions for business practitioners so that they will adopt proper management strategies to enhance users’ usage of IS in organisations in order to improve organisational performance, even profit, for example. Fourth, the diffusion of IS within an organisation depends on the accumulation of individual adoption.

2. Behaviour has different dimensions.

Behaviour or actual usage of information systems or technology could be interpreted from two dimensions, the temporal dimension and volitional dimension. Attitudes and beliefs towards using a system will differ from initial adoption to post-adoption behaviour (Karahann et al 1999), from pre-implementation stage to post-implementation stage (Szajna 1996). Current usage (initial use) is not instrumental in predicting future use (Agarwal and Prasad 1997). Taking into consideration the temporal dimension is necessary when designing empirical studies and analysing data. The intention, attitude, beliefs and relevant external stimuli may have different impacts in different temporal dimensions. The basic assumption of intention-based theories is

that individual adoption of IS is voluntary. As mandatory use of IS in an organisation is usual, the volitional dimension of usage needs to be addressed. TPB, decomposed TPB (Taylor and Todd 1995a) and Triandis' model have "facilitation conditions" and "perceived behaviour control" constructs to cope with this volitional control effect on users' behaviour. Nonetheless, external variables that influence formation and changes in beliefs and attitudes in the volitional control context cannot function in the same way when usage is mandatory.

3. Beliefs are determinants of behaviour. The relationships between them are sophisticated.

According to intention-based theories, beliefs are the ultimate determinants of behaviour. If we would like to influence an individual's intention, attitude or the actual behaviour, it would be beneficial to change his/her underlying beliefs in order to increase the probability of the individual performing the behaviour. Vast numbers of beliefs have been developed and tested in previous literature. The relationship between these different beliefs is very sophisticated. In empirical studies, some beliefs could be antecedent to or consequences of other beliefs. In other studies, the results may differ. For example, self-efficacy could be examined as an antecedent of PU and EOU beliefs (e.g., Igarria 1994), or consequences of computer skills. Basically, behavioural beliefs or extrinsic motivation exert more significant effects than intrinsic motivation in most cases. But intrinsic motivation, such as computer playfulness or computer satisfaction, increases the influence on behavioural intention or behaviour. Control beliefs concern whether users have enough resources (from individual, organisation and systems aspects) to perform a certain behaviour. Mathieson et al (2001) introduced a new concept, "perceived user resource" and Venkatesh et al. (2002) provide a "user acceptance enabler" to describe the extent to which an individual believes that he/she has the personal and organisational resources needed to use an IS. These two notions include attributes of a system and the individual's environment. These two concepts may help researchers and practitioners to identify exactly what resources individuals believe are critical in forming their overall perception of resource availability for the specific context being studied. Thus, they are closely related to relevant external stimuli derived from individual and organisations.

4. The examination of external variables or stimuli effects on other constructs in these theories is crucial. It provides many implications for practice, e.g. management, system implementation, system design.

Adoption is an individual decision (Rogers 1995). This process is influenced by many external variables. The highlights of these variables have several benefits. By understanding system (technology) variables, managers could intervene in the system design process and try to develop a system which is easily accepted by end-users. Through an understanding of organisational factors, managers could make and create a proper operational environment for end-users, implement different support methods, cultivate good workgroups to increase community knowledge and positive beliefs about systems. By understanding individual differences, managers could divide end-users into different user segments, and design a proper training or promotion programme to encourage them to use the system. By understanding environmental and situational

factors, managers could identify the embedded values from different cultures and try to exploit these differences to find a good solution to encourage different users to use the same system. It is crucial when globalisation is a must and organisations operate more and more in a multi-cultural environment. The relevance of the system to the task, a good strategy for persuading individuals to use a system and careful study of users' mood before the system is introduced are very important situation factors that require attention. Generally, macro-culture, micro-organisational factors, and situation variables, e.g. work context, individual environment or team building, all have effects on how users behave when it comes to adopting IS.

5. The research context is very specific. Possibilities of generalising findings to other usage contexts is limited.

Since every empirical study was conducted in a specific organisation context, target system, and time spent in predicting and explaining specific adoption behaviour, the external variables focused on differed as well. It means that there is no one fit-all strategy to influence a specific variable to promote adoption rate. The leeway for generalising these variables is in most cases very limited. Ajzen and Fishbein have stated in their description of TRA that all measured variables ought to be compatible for action, context, target and time. This suggestion was made to ensure that apples predict apples and not oranges. Therefore, the findings in one case may be negligible in others. Possibilities for generalisation are limited.

All in all, the literature review would seem to suggest that intention-based theories are a powerful theoretical tool for explaining and predicting user's behaviour in the IS domain.

## **5. Conclusion**

This paper aims to provide a general overview of the literature on individual adoption of IS, taking intention-based theories as its theoretical backbone. By reviewing their common shared underlying constructs - behaviour, behaviour intention, attitude, beliefs and external variables, we are able to establish their relationships, their components and their interactions. These theories state that behaviour intention is a proxy for predicting individual's actual performance of behaviour. The intention is determined by the individual's beliefs and attitudes towards a subject in a specific domain, e.g. an information system in the IT domain. Therefore, it is crucial for us to understand why and how the individual's beliefs and attitudes are formulated and change over time and situation. The theories further argue that external variables have a major impact on beliefs and attitude. We divide these variables into four categories: system characteristics, organisation factors, individual differences, and environmental factors.

The theories are easy to understand but IS researchers applied them in different ways and designed various empirical studies to explore users' acceptance of IS and technologies in organisations. This review could be useful in guiding future research efforts for several reasons. First, it provides a comprehensive view of individual adoption of IS on the basis of intention-based theories. Second, it points out areas where

significant work has been done so that new studies can build upon this work, thus increasing our knowledge of this issue. Third, it points out where work is still needed, particularly when mandatory usage is a must in organisations in the modern world.

The limits of the review are that we directed a great deal of attention to concept introduction and fact findings from the literature. Thus we were able only to cover the surface so that any deep analysis, for example, the relationships between different beliefs and external variables, their correlations and interactions, etc. is largely lacking.

A literature review is a method for analysing the past to prepare for the future. This review helps us build a strong knowledge of users' behaviour in IS research and explore new phenomena in the coming mobile world. For future studies, we will design studies based on them and examine their theoretical power in explaining and predicting users' adoption behaviour of mobile services in organisations.



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## **Appendix 1: Glossary**

1. A - attitude
2. ACC - perceived accessibility
3. BI - behaviour intention
4. CSE - computer self-efficacy
5. DIT - diffusion of innovation theory
6. DTPB - decomposed theory of planned behaviour
7. EOU - ease of use
8. PBC - perceived behaviour control
9. PCI - perceived characteristics of innovating
10. PU - perceived usefulness
11. TAM - technology acceptance model
12. TPB - theory of planned behaviour
13. TRA - theory of reasoned action
14. SCT - social cognitive theory
15. SN - social norms
16. SPIR - social presence and information richness



## Appendix 2: Previous IS Adoption Studies

Author(s)	IS applications	Research model	Research Context	Subjects	Research Methodology	Construct	Findings
Davis, et al, 1989	WriteOne	TRA & TAM	Un. of Michigan, public computer laboratories	107 full-time MBA students	Experiment, Self-reported	U,EOU,A,BI, Usage	EOU-U, U-A, EOU-A,A-BI,U-BI,BI-Usage.
Davis, 1989	PROFs, XEDIT, Chart-Master, Pendraw	TAM	IBM Canada's Toronto Development Laboratory	120 knowledge workers	Survey Experiment Self-reported	U,EOU, Usage	U-Usage, EOU-Usage
Mathieson, 1991	Spreadsheet package and calculator	TPB & TAM	A western university	163 male and 99 female student	Experiment Survey Self-reported		Both predict well, TAM slight empirical advantage. TAM is easier, general. TPB provide specific information.
Moore & Benbasat, 1991	PWS	PCI, (Rogers)	Universities and industries	Two pilot test and final field test	Experiment Survey	Voluntariness Relative advantage, compatibility, image, ease of use, result demonstrability, visibility, Trialability	PCI instrument development, generalization to many IS innovations. Need modification in other context.
Thompson et al, 1991	PC use	TRA & Triandis model	Large multinational manufacturing organization	212 knowledge workers	Survey	Complexity, job fit, long-term consequences, affect, social factors, facilitating conditions, Utilization .PC use is optional	Social factors and three components of expected consequences have a strong influence on utilization.
DeLone & McLean, 1992	(literature view)	IS success, taxonomy					
Adams et al 1993	Messaging technology: Voice and email (Study 1) WordPerfect, Lotus 1-2-3, Harvard Graphics(Study 2)	TAM	10 different organizations	Two studies	Survey	EOU and U, Usage	EOU and U are robust psychometric properties

Author(s)	IS applications	Research model	Research Context	Subjects	Research Methodology	Construct	Findings
Segars & Grover, 1993		TAM				U, EOU (confirmatory factor analysis)	No absolute measures for these constructs. It is plausible according to task and user characteristics. Cultural role is significant in new IT implementation
Cooper 1994		Organizational culture					
Subramanian 1994	Voice mail system and Customer Dial Up system	TAM	Organization	102 subject to voice mail, 104 to Dial up	Survey	EOU, U and Usage	Structural equation modelling to examine EOU and U construct measurement. U is a determinant of Usage
Hartwick & Barki, 1994	System development projects	TRA, & user participation and involvement	Members of the Canadian information processing society	105 for both predevelopment and post-implementation phases; 127 post-phase	Survey	User Involvement, attitude toward the system, attitude concerning system use, SN concerning system Use, intention to use the system 3 phases: Pre-development, post-participation, post-implementation	Participation-> >involvement-> usage. Overall responsibility is the critical dimension of user participation. Participation and involvement role differ with mandatory or voluntary use.
Szajna 1994	Database management system	TAM	University	47 MBA student		EOU, U and Usage	A continuation and enhancement of the validation research program by Davis (1989)

Author(s)	IS applications	Research model	Research Context	Subjects	Research Methodology	Construct	Findings
Phillips et al 1994	Chinese coal mining and oil-drilling industries adoption of technologies from a multitude of foreign sources	TAM	Chinese coal mining and oil-drilling industries in the context of developing country	556 representatives from China delegation in an international conference	Sampling, questionnaire	EA, PU, Attitude, BI, Demand certainty/uncertainty cultural affinity (CA) Cultural affinity	CA has a significant and positive influence on the TAM through EA. TAM offers a plausible explanation regarding B and BI to adopt new technology
Lu & Gustafson 1994	Interactive computerized support system (CSS)—CHES for crisis people (eg AIDS/HIV+) and those with certain medical problems	TAM	CSS designed for voluntary use, individual's perception	40 volunteer individuals have HIV+ or AIDS in Wisconsin-Madison	Sampling, interview, 6 months	EOU and U, Usage	EOU after exploring stage is an intervening variable. EOU and U -> stable stage usage
Igbaria 1994	Micro computer	User acceptance model of computer technology	62 companies in North America	62 companies, 766 managers and professionals	Questionnaire	Behavioural beliefs, normative beliefs, A, SN, Usage Computer skills, organizational support policies, social pressure;	Social pressure - >Usage and NB, U, computer anxiety->Usage, SN->usage,
Thompson et al, 1994	PCs	Triandis model & Thomason's construct	8 orgs, telecom, manufacturing aerospace org, software com, mining, government	219 usable response, optional use of PCs	Survey	Experience, social factors, affect, complexity, job fit, long-term consequences, facilitating conditions, Utilization <b>Experience</b>	Experience-> utilization directly, indirectly influence were present, moderating influence on the antecedent constructs and utilization was strong.

Author(s)	IS applications	Research model	Research Context	Subjects	Research Methodology	Construct	Findings
Straub 1994	E-mail & FAX	Hofstede's cultural model and SPIR, adoption models	Japan and US airlines and financial institute	209 Japanese worker, 711 US workers	Survey	Diffusion phase (I-IV), SPIR of the medium, U,EOU, media use, productive benefits <b>Cultural comparison</b>	Cultural effects play an important role in the predisposition toward and selection of electronic communications media.
Taylor & Todd, 1995a	Various systems available at CRC	TAM, TPB, DTPB	Computer resource centre (CRC), business school	786 users of CRC, 3,780 visits, 12-week period	Survey	U, EOU, A, subjective norm, Perceived behavioural control, BI, Behaviour	Three are fit and equivalent to explain behaviour. DTPB provide fuller understanding of BI..PBC->BI ,PBC->B
Compeau & Higgins, 1995	use of computer	self-efficacy, SCT	Canadian orgs	Knowledge workers, 1020 usable response	Survey	encouragement by others, other's use, support, computer self-efficacy, outcome expectations-performance, outcome- expectations-personal, affect, anxiety, usage	self-efficacy is an important individual trait, moderates orgs influences on decision to use computers.
Compeau & Higgins, 1995	Lotus 1-2-3, wordperfect 5.1	SCT	Organization training program	88 managers or professionals have little experience	experiment	Behaviour modelling, self-Efficacy, outcome expectations, prior performance, Performance	Behaviour modelling-> self-efficacy, outcome expectations, performance (lotus), self-efficacy-> outcome expectations& performance, prior performance->self efficacy & performance

Author(s)	IS applications	Research model	Research Context	Subjects	Research Methodology	Construct	Findings
Igbaria et al, 1995	micro-computer	TAM	Organization,	214 part-time MBA students employed full-time	Questionnaire, survey	EV, EOU, U, Usage Individual, organization, and system characteristics	EV-> EOU, EV->U, EOU->U, EOU->Usage, U->Usage
Igbaria & Iivari, 1995	Micro-computer	TAM	organization	450 users in Finland	Questionnaire, survey	EV, EOU, U, Usage Self-efficacy, Computer experience, organizational support	SE strongly affects EOU; U; usage. EOU->U, EOU->Usage, U->Usage Experience->SE
Keil et al, 1995	CONFIG, expert systems for sales representatives		A computer company		Field research	EOU; U; task	EOU and U are equally important, task component to perceive EOU
Straub et al, 1995	Voice mail	TAM	Organization	A large financial institution in America	Survey, field interview	U.EOU; Usage, Measurement of system usage, Theory testing: Self-report vs. computer-recorded	U->usage, EOU->Usage, Measurement influences study results.
Taylor & Todd, 1995b	CRC	TAM	university	430 experienced and 356 inexperienced users	Survey	U, EOU, BI, Usage, experience, SN, Perceived behavioural Control Experience	Experience->BI, B
Galletta et al, 1995	Spreadsheet	TAM;TPB and DOI	University		Experiment	Word of mouth (WOM) messaging, training, social influence, attitude, intention, behaviour, performance Three group: positive, control, and negative	WOM -> attitude, intention, behaviour, and performance

Author(s)	IS applications	Research model	Research Context	Subjects	Research Methodology	Construct	Findings
Chin and Gopal, 1995	GSS	Beliefs and intention	university	64 students	experiment	Relative advantage, PEU, compatibility, enjoyment, adoption intention Four methods to study beliefs to intention	Beliefs-> intention of adopting GSS. Other factors unique to GSS need to surface.
Hubona & Kennick, 1996	Email and word for windows	TAM	organization	106 staff and professional employees of a large public corporation	Survey, questionnaire	EV, U, EOU, A, BI, Usage Age, experience education	Results are consistent with previous studies. EV explain how much it is used. The importance of fit between technology, task, individual characteristics.
Montazemi et al, 1996	30 software package		A large Canadian integrated steel company	24 ICPS from MIS department, 22 end users	Questionnaire	Computer experience, Computer anxiety, EOU; U	ICPS and end user assess EOU similar, different in U, end user participation in selection of software package could effect usage.
Igbaria et al, 1996	Micro-computer		Companies in North America	52 companies, 519 managers and professionals	Questionnaire	U, Perceived Enjoyment/Fun, Social Pressure, perceived complexity, computer skills, organizational support and usage	U is principal motivator, perceived complexity is a key intervening variable, Skills promote usage.
Chau 1996	Word, Excel	TAM	A large organization	285 administrative/clerica I staff	Questionnaire, Survey	EOU, Near-time U, Long-term U, BI	EOU->Near-term U, EOU->BI, Near term -> Long-term U, Near-term->BI, Long-term U->BI
Davis and Venkatesh, 1996	Wordperfect, Lotus	TAM	university	students	Three experiment survey		Strongly validate the original (grouped) format of TAM measurements

Author(s)	IS applications	Research model	Research Context	Subjects	Research Methodology	Construct	Findings
Szajna 1996	Email	TAM	university	61 graduate business students	Experiment, 15 week longitudinal study	U, EOU, BI, Usage Pre-implementation and post - implementation	EOU->U, U->BI, BI->Usage
Venkatash and Davis, 1996	IBM PC-Based graphics systems Chartmaster and Pendraw	TAM	University	40 MBA student	Experiment(subjects are not familiar with two systems)	EOU, computer self-efficacy, objective usability	Self efficacy->EOU, objective usability->EOU only after direct experience with system. Training to improve self-efficacy
Agarwal & Prasad, 1997	WWW		University	73 Part-time MBA students—business professionals	Experiment	Innovation characteristics (8), voluntariness, acceptance outcomes (current use, future use intention)	Innovation characteristics->acceptance, (different characteristics have different relevant to outcome); external pressure->outcome
Harrison et al, 1997	Various IT	TPB	Small business	Executives' decisions	Survey	SN, Attitude, PBC, Intention, Adoption, actual control, EV	SN;PCB, A-> adoption, firm and executive characteristics no effect on adoption decisions.
Hubona & geitz, 1997	Email	TAM	Government agency in the mid-Atlantic states	125 staff, professional and managerial employees	Survey, questionnaire	EV, U, EOU, A, Usage Job category, system experience, computer experience	Validate TAM model. EV play direct or indirect role in promoting the user adoption of new IS:
Jackson et al, 1997	a wide range of IS development projects	TAM, TAME	6 large accounting firms, organizations involved in IS project by regional system development firms	585 instruments, 111 usable response	Survey	EOU, U, BI, User involvement (situational, intrinsic) argument for change, prior usage, Attitude	TAME is favourable comparing with TAM. Situational involvement -> BI, Attitude plays a mediating role, Intrinsic involvement shape perceptions

Author(s)	IS applications	Research model	Research Context	Subjects	Research Methodology	Construct	Findings
Wiedenbeck & S.Davis, 1997	Word Processing	TAM	University	173 student (little or no knowledge of computers)	Experiment	EOU,U, attitude, interactive style,(Interface) prior experience First time use, and subsequent use	Prior experience and interface->attitude, EOU
Ghorab 1997	CBIS in UAE bank, banking automated IS	TAM	UAE banks	47 UAE bank managers	Survey	Usage, adopt level of technological sophistication, managers' perception	Managers are practical economists, current technological sophistication influences their perception of cost and benefits, user's perception ->usage and adopt
Straub et al. 1997	Email	TAM	Japan, Switzerland and US airlines	99 US,142 Japan, 152 Swiss	Survey	U, EOU, Usage Culture	TAM holds for both the U.S and Switzerland, but not for Japan, TAM may not predict technology use across all cultures.
Gefen & Straub, 1997	Email	TAM	Airline industry in North America, Asia, and Europe		Cross-sectional survey, self-reported	Gender, U, EOU, Usage, SPIR(social presence/information richness) Culture-gender	Gender->SPIR, Gender->U, Gender->EOU, SPIR->U, U->Usage
Henderson et al, 1998	Electronic supermarket	TAM, TPB	New Zealand shopping mall	80-qualitative study, 65-quantitative study	Focus group and interview, questionnaire	U, enjoyment, Peer-group norms, Usability, electronic shopping experience, (ESEP) Intention to Use individual-situational factors,(age, education, income)	Enjoyment and peer group norm strongly impact intention. A high level of intention to use the system



Author(s)	IS applications	Research model	Research Context	Subjects	Research Methodology	Construct	Findings
Bajaj & Nidumolu, 1998	Debugger (DBG)	TAM	University	8 female, 19 male in the final study	Pilot and final study, experiment	Attitude, Usage, EOU; U Past usage of the system	Past usage ->EOU and future usage. implication to implement new ISs.
Gefen and Keil, 1998	CONFIG, expert system	TAM, SET (social exchange theory)	Organization	307 subjects, 196 useable response	Survey	PU, PEOU; PDR (perceived developer responsiveness), self-reported use Developer responsiveness	DR is an important antecedent of PU and PEOU, and be a major contributing factor to successful IS adoption
Agawal & Prasad, 1998	CONFIGURATOR		Fortune 500 corporation	306 survey, 76 response	Field study	Awareness, channel type, perceptions, personal innovativeness, adoption	Perception->adoption, personal innovativeness->adoption. Channel types->perception
Agarwal & Prasad, 1998	WWW	PIIT (personal innovativeness in the Domain of IT)	orgs	175 part-time MBA from business	Survey	Information about a new IT from alternate Channels, perceptions about a new IT, PIIT, Intention to Use a new IT	PIIT exhibits a moderating influence on the relationship between perceptions and usage intentions.
Agarwal & Prasad, 1999	PC use	TAM,	Fortune 100 corporation, information technology vendor	468 survey, 230 useable response	Survey	Belief of U, belief of EOU, Attitude, BI, individual difference (role with regard to technology, tenure in workforce, level of education, prior, similar experiences, participation in training) Individual difference	Individual difference->beliefs, TAM is an adequate and parsimonious conceptualisation model, the process of belief formation is essential for learning, learning potentially influences belief difference

Author(s)	IS applications	Research model	Research Context	Subjects	Research Methodology	Construct	Findings
Lucas and Spitzer, 1999	Broker workstations	TAM	A major investment bank	Knowledge workers, broker and sales assistances	Survey, self-reported	PU,PEOU, Norms, perceived quality, Use, Intended use, control (workload, prior performance), Performance, Job Perceived system quality, control of job	No support for TAM, Norm and prior performance are important. Job (task)difference->use,
Compeau et al, 1999	Computing technologies	SCT(Social Cognitive Theory)	Subscribers to a Canadian business periodical	394 matched responses in the final sample	Survey, self-reported, longitudinal data	Self-efficacy, outcome expectations (performance, personal), affect, anxiety, use	Significant relationships between self-efficacy and outcome expectations, between self-efficacy and affect and anxiety & use. Performance->affect use, affect related to use
Venkatesh, 1999	Virtual Workplace system--game-based training	TAM, motivation, training	Knowledge workers	Study 1: 69, study 2: 148, 146 useful response	experiment	U, EOU, Intention to Use, Training interventions Traditional training vs. game-based training	EOU –a strong catalyst fostering acceptance in a positive and enjoyable training environment. Using intrinsic motivator during training.
Karahanna et al, 1999	Windows 3.1		A large single organization	268 usable response, 107 potential adaptors, 161 users	Questionnaire, survey, interview	Behavioural beliefs, Attitude, Intention, voluntariness, Normative beliefs Pre-adoption, post-adoption	Users and potential adopters of IT differ on their determinants of BI, Attitude, and subjective norm
Hu et al, 1999	Telemedicine technology	TAM	Public tertiary hospitals in Hong Kong Health-care context	Physicians, 408 usable response	Questionnaire, survey	U,EOU, attitude, BI,	U->BI. TAM has limitations, need incorporate additional factors.

Author(s)	IS applications	Research model	Research Context	Subjects	Research Methodology	Construct	Findings
Karahanna & Straub, 1999	Email	TAM, social presence, social influence, Triandis model of TRA	A fortune 500 transportation company	200 questionnaire, 100 responses	Survey	Social presence—SP, Social influence—SI, Perceived accessibility—ACC, Availability of user training and support – SUPP, U, EOU, Use	U->Use, EOU->U, SI->U, SP->U, ACC->EOU, SUPP no impact on both U and EOU.
Dishaw & Strong, 1999	IBM mainframes, MVS COBOL/CICS application maintenance tool	TAM, TTF(task-technology fit)	3 fortune 50 firms	Working programmer analysts	Survey	Tool functionality, task characteristics, tool experience, TTF, U, EOU, Attitude, BI, Use	Integrated Model provide better explanation
Teo et al, 1999	Internet usage	TAM, perceived enjoyment	Internet users	Singapore	Web survey	U, EOU, Usage, (frequency, daily, diversity), perceived enjoyment Control variables: gender, age, education	U->Usage, EOU & enjoyment affected each specific usage dimension differently.

Author(s)	IS applications	Research model	Research Context	Subjects	Research Methodology	Construct	Findings
Venkatash & Speier 1999	Database	Mood, motivation (intrinsic & extrinsic), training, BI, usage of technology	A midsize accounting firm	Of 388, 316 usable	Experiment	Intrinsic and extrinsic motivation, BI, usage, training, short-term and long-term effects Positive, negative and neutral mood	Positive and negative mood influence intrinsic motivation, but not extrinsic motivation. Mood influence BI at the time of training. The long-time effects of positive mood are not significant to impact on intrinsic motivation compared to neutral mood. But long-time effect of negative effects do impact on intrinsic motivation. IN the long time, mood does not effect extrinsic motivation .Positive mood does not have sustained effects on BI, negative mood does.
Gefen, 2000	MRP II	TAM, social exchange theory	A MRP II vender and buyers	135 usable response	Survey	Perceived Vender responsiveness—PVR, perception of the vendor's cooperative intentions—PCI, Belief in software Correctness—PSC.EOU,U, self-reported use	PVR->PCI, PCI->PSC and EOU, PCI->U, EOU->U, U->self-reported Use

Author(s)	IS applications	Research model	Research Context	Subjects	Research Methodology	Construct	Findings
Lucas, Spilter 2000	Broker workstation	TAM,	A major stock brokerage firm	Time 1: 41, time2:25	Survey, interview	Broker strategy, system quality, performance, social norms, U,EOU, Usage(Intention)	TAM and its extensions are weak predictor of acceptance of a broker workstation. SQ,EOU decreased over time
Venkatesh & Morris, 2000	Data and information retrieval system	TAM, social influence	5 organizations	342 usable responses, 156 female, 186 male	Survey	U, EOU, BI, Social norm-SN, gender, experience Gender, experience	U->man's use, EOU+SN->woman's use
Venkatesh et al, 2000	Data and information retrieval system	TPB	4 orgs	355 usable response, 160 women	Survey, longitudinal field investigation	A, SN,PBC (behavioural control), BI, B (behaviour) Gender, timing (post training, 1,3,5 month	Gender plays an important role in shaping individual technology adoption and sustained usage in the workplace.
Venkatesh & Davis, 2000	Study 1: proprietary system, study 2: Windows mainframe, Study 3: windows-base customer account management system, study 4: stock analysing system	TAM, social influence cognitive instrumental processes	4 different organizations: a medium-sized manufacturing firm, a large financial service firm, a small accounting firm, a small international investment banking firm	Study 1: 48, study 2: 50, study3: 51, Study 4: 51	Survey, Longitudinal field studies	U, EOU, BI, Usage, SN; Image, job relevance, output quality, result demonstrability, experience, voluntariness Experience voluntariness	SI and cognitive instrumental process significantly influence and user acceptance. SN; Image, job relevance, output quality, result demonstrability are determinants of U.
Venkatesh, 2000	1. new interactive online help desk system; 2. multi-media system for property management; 3.payroll application in PC-based (windows 95)	TAM	1: a medium-sized retail electronic store; 2: a large real estate agency; 3: a medium-sized financial services firm	Study 1: 70; Study 2: 160 Study 3: 52	3 longitudinal field studies	U, EOU, BI, Anchors ( computer self-efficacy, perception of external control, computer anxiety, computer playfulness), Adjustments( perceived enjoyment, objective usability.), Experience	Anchors and Adjustments explained up to 60% of the variance in system-specific perceived EOU.

Author(s)	IS applications	Research model	Research Context	Subjects	Research Methodology	Construct	Findings
Karahanna & Limayem, 2000	E-mail and V-mail	TAM & media choice theory	A large financial institution	211 email user, 173 v-mail user	Survey, field interview	U, EOU, social presence, SI; physical accessibility (ACC), informational accessibility, media style, support, system Use	SI->EOU, EOU->U, EOU->Use, SP->U & EOU, for both email and v-mail. For email, ACC-> PU, Support(training)->V-mail
Lou et al, 2000	Lotus Domino Discussion database (groupware)	TAM	University	385 students	Experiment	U, EOU, BI, perceived critical mass (PCM)	PCM-> BI, PCM-U & EOU
Lin & Lu, 2000	Website, www.chinatimes.com .tw	TAM	University	145 undergraduate students, (92 M, 53 F)	Experiment	U, EOU, preference for a web sit (Attitude), Intention to reuse, IS Quality (information quality, response time, system accessibility)	Validate TAM in the internet environment. IS quality-> U& EOU, specially response time-> U&EOU.
Cheung et al 2000	WWW/Internet	Triandis social psychological model	Working environment	241 part-time and MBA students from industries, Hong Kong	Survey	Complexity, near-term and long-term consequences, affect, social factors, facilitating conditions current usage	Facilitating conditions & social factors -> Usage, near-term consequences-> usage, complexity negatively->usage.
Ridings & Gefen, 2000	Customer service system (old vs. new)	TAM, SET (social exchange theory)	A large telecommunications organization	148 usable response	Survey	U of new IT, U of old IT, EOU of new IT, EOU of old IT, user's preference to adopt the new IT	U of new IT increase adoption, U of old IT decrease adoption. EOU-> U
Roberts & Henderson, 2000	Micro computers	TAM; TRA	Australian public service		Survey	Computer anxiety, U, perceived fun, SN, computer satisfaction, Usage	Moderate support for TAM.

Author(s)	IS applications	Research model	Research Context	Subjects	Research Methodology	Construct	Findings
Agarwal & Karahanna, 2000	WWW	TAM; cognitive absorption (CA)	University	288 student	Survey	BI, U, EOU, SE, CPS (playfulness), personal innovativeness (PIIT), CA (temporal dissociation,, focused immersion, heightened enjoyment, control, curiosity) Volitional	U->BI, EOU->BI, CA->U & EOU, CPS->CA, PIIT->CA
Agarwal et al, 2000	Windows 95, Lotus 123	Computer self-efficacy CSE	University	186 usable responses	Experiment, 14-week period	PIIT, general computer self-efficacy, windows 95 self-efficacy, window 95 EOU, Lotus 123 self-efficacy, lotus 123 EOU General self-efficacy, task-specific self-efficacy	General CSE strongly predict task specific CSE; CSE->Usage; PIIT-> task-specific CSE
Lederer et al, 2000	WWW (work-related)	TAM	Online news group	163 response	e-mail survey	U, EOU, U antecedents, EOU antecedents, Usage	Support TAM. Ease of understanding and ease of finding ->EOU, information quality->U
Gefen & Straub, 2000	e-commerce site for selling book	TAM	University	217 MBA students	Web survey	EOU, U, Intended Inquiry, Intended Purchase	EOU->inquiry task, U-> inquiry & purchase task, EOU->U

Author(s)	IS applications	Research model	Research Context	Subjects	Research Methodology	Construct	Findings
Tan & Teo, 2000	Internet banking	TPB & DOI	Online users in Singapore( Only available in Singapore)	454 online users	Internet survey	Attitude ( relative advantage, compatibility, complexity, Trialability, risk), SN, perceived behavioural control ( self-efficacy, facilitating conditions), BI, Usage	Attitudinal and perceived behavioural control factors significantly - > BI to internet banking
Jiang et al, 2000	e-commerce, internet/WWW	TAM, utilization of Internet Technology	Senior students at universities	120-US, 105-Hong Kong, 110-France	Survey	Utilization of the internet, near-term consequences, long-term consequences, facilitating conditions, experience with the internet	Consequences & experiences & facilitation conditions->utilization. Experience is an important driver, facilitating conditions has significant relationship with utilization
Xia and Lee, 2000	CASE software package	Intention-based theories, DOI, and persuasion theory	Undergraduate student	92	Survey, questionnaire	Argument quality, Training, direct-use experience, Perceived Innovation characteristics, attitude, intention	Persuasion affects initial perceptions, attitude and intention. Training helps form realistic expectation. Direct use change perception and intentions over time substantially.



Author(s)	IS applications	Research model	Research Context	Subjects	Research Methodology	Construct	Findings
Gallivan 2000	Computers	Training, situated learning theory, community practice	Nonprofits organization	195 employees, 96 answers	survey	Amount of IT training, quality of IT training, quality of available support, usage of other members in the group, self-efficacy, system use	Amount of training no relate to usage, quality of training and support relate to usage, usage of community member relates to usage, self-efficacy no relation
Rawstore et al, 2000	A patient care IS	Tam, TPB	hospital	138 nurses, 61 useful response	Longitudinal, questionnaire	PU, PEU, attitude, SN, PBC, intention, perceived voluntariness, behaviour (1,2,3) Mandatory use	Both TPB and TAM failed to predict behaviour1, successful for behaviour 2 & 3. determinants of Intention may not contribute to behaviour.
Venkatash & Brown, 2001	Home adoption of PC	TPB& MATH-model of adoption of technology in households	American households	733 completed response at phase 1, 87.9% follow-up response in phase 2	Mail survey, telephone interview, Longitudinal investigation	Attitudinal Belief, normative belief, control belief Voluntary	Utilitarian outcome, hedonic outcome, social outcome-> adoption; rapid technology changes and fear of obsolescence-> non adoption
Mathieson 2001	1: database system 2. Bulletin board system	TAM, perceived user resources--R	Institute of management accounts IMA	Study 1: 30 Study 2: 401 IMA staff	Survey	U, EOU, R, Attitude, BI	R is a valuable addition to the TAM
Townsend et al 2001	DTV C-desktop video conferencing	TAM	University	64 undergraduate students	Laboratory experiment	Anticipated system U, anticipated EOU, system satisfaction, system utility, workgroup performance	Anticipated attitudes-> system utility and satisfaction, system utility->workgroup performance
Plouff et al, 2001	Smart card-based payment system	TAM & PCI	Canadian merchants involvement in system trial	176 usable response	survey	Comparison of TAM and PCI instruments	PCI provide more variance than does TAM.

Author(s)	IS applications	Research model	Research Context	Subjects	Research Methodology	Construct	Findings
Chau & Hu, 2001	Telemedicine technology	TAM, TPB & decomposed TPB	Public tertiary hospitals in Hong Kong	408 usable response	Survey	Comparison of three models	TAM & TPB have limitations, models have to be re-examined in a professional setting.
Moon & Kim (2001)	WWW	TAM	university	152 usable response	Survey	U, EOU, playfulness, Attitude, BI, Usage	Playfulness->A, U->A, EOU->A
Fich 2001	4 Greeting card websites	Protocol analysis		8 volunteer 4 f, 4 m	Tape-record		Clear path to products, transparency of the ordering process are crucial usability goals.
Bhattacharjee 2001	Online brokerage (B2C e commerce)		Online brokerage users	172 usable response	Online survey	Confirmation, satisfaction, U, loyalty incentives, continuance	Satisfaction, U & loyalty-> continuance, confirmation-> satisfaction & U
Chau & Hu 2002	Almost same as 2001						
Hong et al, 2002	Digital libraries	TAM	Universities in Hong Kong	584 have experience with the digital libraries	Telephone interviews	Individual differences (computer self-efficacy, knowledge of search domain), system characteristics (relevance, terminology, screen design), U, EOU, BI	Self-efficacy->EOU, knowledge of search domain->EOU, Relevance->U&EOU, terminology & screen design->EOU,
Khalifa & Cheng 2002	Mobile commerce	TPB		202 usable response		Exposure (trial, communication, observation PBC, SN, Intention, attitude)	Exposure has indirect or moderating effects on the intention of adopting m-commerce.

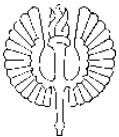
Author(s)	IS applications	Research model	Research Context	Subjects	Research Methodology	Construct	Findings
Chen et al, 2002	B2C eCommerce, virtual store	TAM & IDT	IS world mailing list –expert opinions, pilot test in universities, web survey	235 usable response	Web survey, online user	Compatibility, EU, PU, A,BI, Usage	TAM IDT valid in b2c eCommerce context. Compatibility, PU EU -> Consumer attitude, Compatibility and EU-> PU

Author(s)	IS applications	Research model	Research Context	Subjects	Research Methodology	Construct	Findings
Koufaris, 2002	B2C e commerce, web-based store	TAM & consumer behaviour & flow and environmental psychology	Booksamillion.com customers	300 first part, 280 first and second part	Online questionnaire	Concentration, shopping enjoyment, perceived control, skills, challenges, involvement, PU; EU, intention to return, value-added search mechanisms	Double identity of online consumer: shopper and computer user. Shopping enjoyment and PU ->BI. Product involvement, web skills, challenges, use of value-added search mechanism -> web consumers.
Venkatesh et al 2002 <sup>1</sup>	Database system and virtual work place	TAM, motivation model, Integrated model			Experiments and survey	User acceptance enablers (UAE), (training environment, Pre-training mood, control), intrinsic motivation, extrinsic motivation (PU), EOU, BI, short-term use, continued use	IM-EOU .45, IM-PU .27, EOU-PU .27. EOU-BI.23, PU-BI .44 have significant effect on BI. IM no direct effect on BI, only through EOU and PU. BI- immediate use (short term) .59, fully mediating the influence of IM,EOU,PU; Short-term use-continued use .59, it is the sole predictor of continued usage. All other variables measured at t1 and t2 were non-significant predictors of continued use.

<sup>1</sup> This work is based on the publications of (Venkatesh 1999, Venkatesh and Speier 1999). Authors integrated these two works together and made a longitudinal study of Venkatesh 1999.

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