

Dynamics of Psycho-Social Process in Technology Transition

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Abstract. Information technology has a huge impact on our daily lives and it has been constantly replacing the old technologies. People shift to new technologies when they think it is an improvement of the ones they are using. They often use both the technologies simultaneously before shifting to the new one. Shifting from one technology to another is termed "technology transition". We derive our hypotheses from the model based on the theory of reasoned action and the theory of planned behaviour. We focus on the individual perspective so as to better understand the psycho-social processes that influence technology transition. We expect the theoretical explanation and empirical evidence we put forward to extend the previous studies in this field of research and to provide new understanding for the practitioners.

1. Introduction

Pro-environmental behaviour can be approached from an impact oriented perspective and intention perspective [66]. [62] mentioned about a "knowledge deficit model" for promoting pro-environmental behaviour. The model assumes lack of behaviour stems from lack of knowledge. The behaviour analytic approach for changing behaviour puts emphasis on observable actions and contextual variables for changing behaviour. Subjective norm is the social pressure perceived by individuals to perform a certain action. It can be a predictor of a person's behaviour [4]. People closer to self influences one's behaviour than who are socially distant. The visibility of behaviour also affects people's reaction [4].

Information technology (IT), has taken over older technologies. These new technologies often offer higher performance, improved functionality, lower operating costs, or better usability. People often use both the technologies simultaneously before shifting to the new one. They shift to new technologies when they think it is an improvement of the ones that are being used. With the advancement of technology, new computer anxiety and attitude is also surfacing. [25] explains computer anxiety as the stress due to cognitive as well as psychological factors which are aroused

by the use of computers. Factors like age, gender, ownership, computer accessibility and experience also affects the computer anxiety and attitude [42]. Similarly, conventional knowledge management systems have been replaced by Web 2.0 solutions and social media[74]. While organisations are shifting to cloud computing from the information technology platforms, individuals are switching from conventional cell phones to smart phones, which help them to manage better with the business model and opportunities through the help of internet [27]. There has been an increase in the use of tablet computers among private users compared to the desktop PCs and the notebooks. Until recently one needed a personal computer to access the internet. With the advent of smart phones and the rapid rise in technology, one can access internet without the computers. Unlike the earlier days, internet usage is common among the youth in developed countries. Once the access to internet becomes regular, the way one uses it would show a group's particular characteristics[26]. Many students (in mainstream western schools) have access to computers at a very young age[36]and spent a lot of their non-working hours using computers [56]. Interactions with family and friends is an important factor in outside school computer experiences, and their abilities and beliefs about technology [71].

The act of moving from one technology to another, in an organizational group setting is called *technology transition* and it was coined by [16]. Thereby, the process “starts when some person in an organization expresses interest in using a new technology and [...] ends when a community of users has become self-sustaining” [16,p.153].The time which is lost while a user finds stability with a new technology after switching from an old stable version is called transition time. Technology acceptance and diffusion assumes a positive transition through all stages, while IT transition does not necessarily assume a positive outcome. With technology transition the user may end up going back to the stable existing technology, adopt an unplanned technology alternative or stick to the planned technology [63].Perceived knowledge seems to be a better index of computer anxiety than actual experience.Other studies found that prior computer experience did not correlate to positive computer attitudes [53].

In this paper, we describe our research model, which explains technology transition and attempts to answer the question of why people switch to new technologies. The model is based on the theory of reasoned action [28] and the theory of planned [3], as well as Bagozzi's suggestio [8,9], and we derive our hypotheses accordingly. We do not present any results at this stage as the study presented in the paper is currently in progress. Alternatively, we are providing a detailed outline of our study's research steps.

We expect the theoretical explanation and empirical evidence we put forward to extend the previous studies in this field of research and to provide new understanding for the practitioners. We focus on the individual perspective so as to better understand the psycho-social processes that influence technology transition. By identifying the key antecedents that influence the transition process, we hope to provide better reasoning for replacing some stable technologies over a period of time. We hope our findings will be useful to technology manufacturing industry, as they look to design new products and services which can capture the market.

The rest of this paper is organised as follows: The next section describes the theoretical foundations on which our work is being built. Then the development of our research model is explained along with our hypotheses. The next section outlines the future research activities of the study. As a conclusion, the study's results are summarised and its implications, limitations, and contributions are outlined.

2. Foundations

Information Systems (IS) research, which deals with the adoption and usage of technologies, has been greatly influenced by the work of [22] who proposed the technology acceptance model (TAM) in 1989. TAM proposes that adoption of information technology (IT) is influenced by its

behavioural intention which in turn is affected by the attitude of a person. The extent to which a person is willing to put effort to carry out a particular task can be referred to as behavioural intention while an attitude may concern an individual's positive or negative feelings, evaluative affect, about performing the target behaviour. Attitude is determined by two behavioural beliefs: perceived usefulness (PU), which is defined as the extent to which IT is believed to enhance performance, and perceived ease of use (PEOU), which is defined as the degree to which users think that they can use IT effortlessly. Literature review shows culture influences the level of computer anxiety. According to [57] the concept of “national culture” which dominates the information technology (IT) research literature has a theoretical weak base.

Omitting “attitude” construct from the model was the first important modification in the model structure. It was done on the basis that “attitude did not fully mediate the effect of perceived usefulness on intention” [22, pp. 995-996]. This modified model has been tested with different types of technologies (e.g., office automation and business application) in different circumstances (e.g., time and culture) with different control factors (e.g., gender, organisational type, and size) and different population (e.g. undergraduate students, MBAs, and knowledge workers), and thus demonstrating its strength to its advocates [46]. The different studies that had been done have made the original model a little more refined [34]. On the basis on the emerging studies, TAM developed into TAM2 [73] which combined the general determinants of perceived usefulness. This was later developed to TAM3 [72], which extended TAM2 by combining the determinants of perceived ease of use. TAM3 aimed at becoming the homological framework to help the managers for employee adoption and use of IT. Through all the advancements, the insights gained through all the TAM studies, managers could chart the intervention strategies and the graph for future progress [20,72].

Modelling research on technology transition has its roots in the technology acceptance research stream. So as to explain staff behaviour in military operations,[16] influential work used qualitative inquiry to produce a technology transition model (TTM). They wanted to figure out why organisations stop using a particular technology as mentioned in the installation records of the group support systems (GSS) [16]. TTM, which is based on the revised, outlines behavioural intention (BI) to be directly determined by a set of beliefs, such as perceived-magnitude-of-net-value (M), and perceived-net-value-of-transition (T), with BI consequently leading to system usage. M is further given importance by a certainty ‘C’ factor, which represents the probability of realizing the net-value; and the combination is multiplied by the perceived frequency of occurrence (i.e. perceived-frequency-of-net-value (F)). The construct M supersedes the TAM PEOU construct and integrates all the factors that determine why perceptions of GSS vary among different groups of users. [16] work was noted in information research. However, TAM research could not be separated from the research on technology transition. So, only very few studies have been published that overtly deals with the issues in technology transition[e.g 2, 15,17, 24, 43, 63].

The studies based on TAM were criticised by the researchers. Issues like relying self-reported usage to measure system usage construct, poor theoretical foundation on TAM, assumptions about the will of human nature, how beliefs such as perceived use, which is an individual nuance, can be applied to a group or an organisation and the usage of surveys in cross-sectional research design in order to validate the causal model [12,20,45] made the most striking observation on TAM-based studies and observed that despite attempting to achieve breadth all these contributions lack depth. It becomes essential to reappraise the existing variables and deepen TAM constructs. The direct links between attitude and behavioural intention, as well as between behavioural intention and behaviour, as represented in TAM raises serious doubts among researchers. With regard to the former links, it was felt that attitude would not result in intentions in the absence of motivational processes acting as a catalyst [8]. Furthermore, it is vague how the reasons for a doing particular behaviour and not doing it, are converted to be decision or an intention to act. [9]. Three major issues pop up with respect to the later link. The first issue relates to the assumption of behaviour as an end in itself, embodied in the relationship, whereas behaviour can also be a means to bring about more

fundamental ends or goals. Attitudes can be changed by changing the behaviour using “free will” compliance. The foot-in –the door procedure with implicit request and foot-in –the procedure with labelling can be more effective in the changing the attitude. Second, when forming intentions and initiating actions, multiple psychological processes happen. TAM and its extensions have failed to understand these processes. Third, while a decision is made, an individual takes into consideration the hindrances or incertitude related to the particular action and that differs from the way TAM represents belief processing[10].

Briggs et al. [16] argues that these limitations also apply to TTM. Bagozzi’s findings dispute the direct links between the beliefs (M, T) and BI, and between BI and system use, as depicted in TTM. The omission of the ‘attitude’ construct can again be questioned, as the study context adopted by Briggs differs from the context explored by [22]. Furthermore, in-depth exploration should reveal why the beliefs PU and PEOU are not important in TTM, but why are they most important drivers in TAM. Such flaws call for reassessment of technology transition and to develop a complete understanding of the process. [12, p.6] aptly puts forward the requirements as follows: “We have recommended that researchers revisit the core theory of TPB and redirect their focus toward examining different antecedents”. We propose a revised model of technology transition, in the next section, which would be grounded in theory and empirical evidence. This revised model aims to address the issues discussed above.

3. Research Model and Hypotheses

TAM has its foundation in the theory of reasoned action (TRA) [28]. TRA explains behaviour across a wide range of domains and is a well researched intention model. This theory hypothesizes that under assumptions of volitional control, behaviour is determined directly by a person's behavioural intention to perform the behaviour. Behavioural intention can be a function of attitude about performing an act (A) or subjective norm (SN) (i.e., the perceived social pressure to perform or not the behaviour), or it can be an interaction between the two. Negative subjective norms cancelled out the positive attitudes and vice versa [8].

So as to explain the behaviours of people over which they have incomplete volitional control, TRA was modified to the theory of planned behaviour (TPB). These behaviours are interfered by psychological or internal and external forces that influence the behaviour. According to the TPB model, the emphasis is on intention as it is important to a person’s belief system and confidence to perform a particular behaviour. Furthermore TPB introduces a new predecessor to intentions and behaviour; the perceived behavioural control (PBC). PBC could be defined as "the person's belief as to how easy or difficult performance of the behaviour is likely to be" [5, p.457] and this particular idea is similar in way to the concept of self efficacy (an individual's belief that he or she can perform a particular behaviour) [11]. PBC has its influence on motivation.

TRA and TPB has been criticized that they do not consider how intentions are energized [8]. Desires [defined as “a state of mind whereby an agent has a personal motivation to perform an action or to achieve a goal” 59, p.71] are thought to be the origin of human actions and often leads to motivations/intentions to act out a particular behaviour[59]. Such motivations, derived from the integration of different appraisal sources (e.g. emotional, evaluative, and social), represent the first step towards a decision to act, which is followed by an intention to do so. The latest developments in attribution theory explain the difference between desires and intentions. [51,52]. According to [52], for an actor to desire for an outcome and believe that specific behaviours will lead to particular outcomes, there needs to be intention on his part.

Since there is significant difference between desires and intentions, the assumptions in TRA – that desires do not differ theoretically or empirically from intentions [65], or that they are not needed because intentions already involve motivation [4]–is doubtful. Along the lines of Gollwitzer’s description for wants and wishes in his action phases model [e.g., 32, p.1119] Bagozzi

reveals that desires provide the motivational thrust that is needed for intentions. Additionally, he also suggests that A, SN and PBC work through desires to influence intentions [10]. The evidences of links between attitude and desire was gathered by [29]. It is suggested that desire, a physiological process evaluates competing attitudes. On the basis of the theoretical evidence we derive the following three hypotheses:

H1: Perceived behavioural control will be positively associated with desire to use.

H2: Attitude toward usage will be positively associated with desire to use.

H3: a: Free will compliance will be positively associated with desire to use.

H3: b: Subjective norm will be positively associated with desire to use.

The “engagement theory” reinstates the binding communication by foot in the door with labelling. Fitting labelling will promote expected behaviour by underlining the personality trait to the expected behaviour. Explicit nature, consequences, and cost of the action binds to the expected behaviour. The “contingent consistency” approach has been accepted extensively [6, 7, 33, 60]. In the presence of social support attitudes are expressed and they comprise of evaluative appraisals, followed by a desire to act. Unless motivational commitments are intrinsic, intentions tend to lose their thrust. When associated with a desire, a belief can effectively motivate an intention even without a positive evaluation. According to [23], volitive desire are the ones that are based on reasons and implying a motivational commitment. With regard to it, A, SN and PBC result in the decision-makers commitment, which in turn motivates him or her to form an intention [23].

Hence, we can deduce the fourth hypothesis as:

H4: Desire to use will be positively associated with intention to use.

TRA and its successors assume that behaviour is directly determined by intentions. The behaviour is volitional in TRA and non-volitional in TPB. Psychological processes interfere between the points at which intentions form and where behaviour occurs. TRA has no contribution in this [8]. When intentions are related to a goal, they prompt implementation processes for achieving the goal. These processes known as instrumental acts consist of planning, monitoring, guidance, and controlling activities. The activities examine the instrumental acts in order to ascertain the act’s validity, consistency, and reliability [8]. [44] is of a view that motivational aspects are innate in the implemental processes. These processes help people to overcome difficulties inbuilt in the when acting out of mental structures that are associated with intentions. Theories like TRA tend to neglect this motivational aspect. Bagozzi further assumes that the motivational aspect is a multi-dimensional psychological construct which requires commitment and effort; and it functions after intentions are formed [8]. Hence we propose the following:

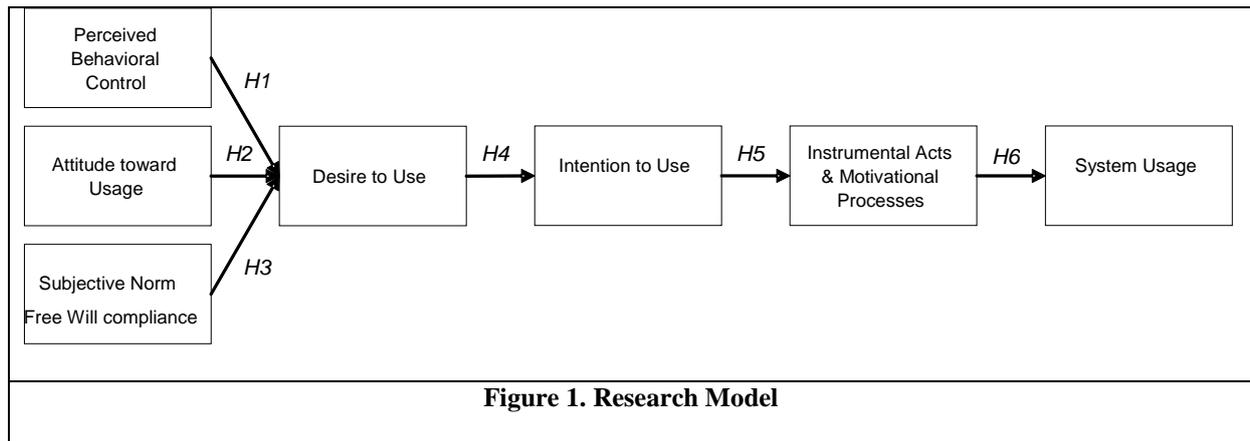
H5: Intention to use will be positively associated with instrumental acts and motivational processes.

[35] stresses on the role of effort in the motivational component and suggests it to be the determinant of actions. During the goal-pursuit process (i.e. performing the intended behaviour), some properties of inertia also develop. These factors reinforce the pursuit of the goal. They also assist in keeping up the drive established when influential acts begin [8]. Thus, we state our last hypothesis as:

H6: Instrumental acts and motivational processes will be positively associated with system usage.

Figure 1 represents our revised conceptual model of technology transition. The causal relationships shown by the arrows describe our hypothesis regarding how the different constructs (shown within rectangular boxes) interact over time. In order to keep the structure simple yet comprehensive, the model structure includes all the core processes from technology selection to technology usage, as discussed in the literature. When we extend the study, each of the model constructs will be elaborated based on field studies, so as to fully explain the phenomenon of technology transition in

different contexts.



4. Research Process

By using the revised conceptual model of technology transition (Figure 1), we try to find greater understanding of the technology transition process. The phenomenon will be investigated in depth from an individual and non-organizational point of view. There could be difference in degree of freedom the individual has regarding technology transition in a private or organisational setting. In a private setting, other than monetary limits, one has the freedom to choose whatever technology he or she wants. While in an organisation, employees always might not have a choice. They simply use the technology as per the given authorization [41]. Despite not liking a specific technology, an employee might have to use it.

We propose a two-stage approach to collect evidence and validate the conceptual model. It would consist of interviews in stage-one and surveys in stage-two. This multi-methodology approach would have various advantages [38]. Merging methods provides a richer contextual basis for interpreting and validating results, and also strengthens the findings' strength.

At the first stage, an exploratory research design would be adopted. A guided interview will be used to collect information of various aspects of individual level technology transition. So as to avoid the confirmation bias, the conceptual framework would not be shared with the interviewees [50]. With the help of the constant comparative method, evidence obtained from the interviews will be analysed [30], which will help us to refine the model. This will also divulge the different dimensions (i.e. measurement items) that characterise each of the constructs, as well as their different backgrounds. To attend to the criticism on TAM based studies that it excessively relies on survey methodologies, exploratory research design will be made use of [20]. So as to ensure a wider acceptance and to generalise our observations, surveys will be used in the second stage. A web-based survey instrument will be developed, containing questionnaire items that relate to each of the different measurement items and constructs. The items would be the same ones contained in the refined model used in the first stage. In order to put into use the conceptual model's constructs, various authors' recommendations to use tested and proven measures will be followed, where available, to enhance validity [e.g. 13, 37]. Thus, the items identified in previous studies will be adapted and modified to use in our specific research context, where required. As a start, we have done a compilation of preliminary pool of items, from which the most appropriate ones would be selected to develop our questionnaire.(Table 1).

Construct	References
Perceived Behavioral Control	Ajzen and Madden (1986), Leone et al. (Leone et al. 1999), Sparks et al. (1997), Venkatesh and Davis (2000)
Attitude towards Usage	Bhattacharjee and Premkumer (2004), Davis et al. (1989), Karahanna et al. (1999), Tylor and Todd (1995), Venkatesh and Davis (2000)
Subjective Norm	Karahanna et al. (1999), Tylor and Todd (1995), Venkatesh and Davis (2000)
Desire to Use	Davis (1984), Perugini and Bagozzi (2001), Perugini and Bagozzi (2004)
Intention to Use	Bhattacharjee and Premkumar(2004), Tylor and Todd (1995), Venkatesh and Davis (2000)
Instrumental Acts and Motivational Processes	Abelson (1988), Burke and Reitzes (1991), Heider (1958), Kuhl (1981), Miller et al. (1960)
System Usage	Burton-Jones and Hubona(2005) , Davis et al. (1989), Taylor and Todd (1995), Turner et al. (2010)

Card-sorting and item-ranking techniques will be used to validate the questionnaire [37, 55]. Pre-test session and pilot-tests will also be conducted [48]. Then responses from a large number of individuals who recently shifted to a new technology will be collected using the final questionnaire. The data would be collected through a large-scale survey in Germany and India. Once the empirical data is collected, statistical analysis would enable us to validate the model and enable us to make generalisation of our findings. Therefore, we will apply structural equation modelling, either using PLS or LISREL to perform the calculations [67; 70].

5. Conclusion

Our research's overall objective is to attempt to answer why people switch to new technologies. As a first step, we develop and present in this paper a conceptual model that explains technology transition. We base the model on the theory of reasoned action [28] and on the theory of planned behaviour [3], as well as Bagozzi's suggestions [8,9]. We also outline our future research activities. The cost that an individual evaluates before switching to a new technology has not been considered entirely and it would be a limitation of the proposed model [e.g 2009]. Those "switching costs" will be taken into consideration as an additional precursor of technology transition when the model developed further. The research presented here has also the limitation of being based merely on extensive literature review and authors' experience. And we would suggest that it be considered only as a basis for future empirical work. Accordingly, future research will empirically test the conceptual model, as described in this paper. Furthermore, we intend on starting to validate the model from an individual perspective in a non-organisational (private) context. Further research should look into if the results achieved are also applicable in an organizational setting, and if differences between private and organizational settings can be observed. Additional research can also explore the cultural differences in individual behaviour, related to technology transition. Since we plan on collecting empirical data from two countries with different cultural backgrounds, we most probably will have the necessary empirical basis for such analysis.

Both researchers and practitioners are targeted through our study. We hope to gain a better understanding of the psycho-social processes that influence an individual to make a technology transition. We hope our research would identify the key antecedents that influence the process of technology transition. Also, that it will provide better reasoning for replacing technologies over time. Subsequently, we plan to go beyond previous contributions on technology transition and thus, to broaden the existing body of knowledge.

Our research will provide additional insights into the motivational process in individuals who are

willing to or looking forward to switch to new technologies. This, from a practical point of view, would be beneficial for practitioners. When designing new products or services and developing marketing activities, technology manufacturing corporations and related industries may integrate the findings. The results might also be helpful in corporate IT planning. Though in the past, private and corporate settings were separated in terms of IT, these two levels are becoming increasingly entwined. Many technological trends that emerged in the private context has been adopted in the corporate world (e.g. as Web 2.0 applications) [61]. Furthermore, organisations increasingly using BYOD (“bring your own device”) policy so that their employees can use their personal mobile devices to access organisational systems [49]. That way, it is highly relevant even from an organisational point of view to understand the technology transition of individuals.

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