

CHAPTER-4

DIFFUSION OF INNOVATION AND TECHNOLOGY ADOPTION

4.1 INTRODUCTION

An innovation is an idea, behaviour, or object that is perceived as new by its audience. The fast growth of knowledge has led to the existing multiple forms of technology. The Internet is the most common communication and research tool for technology in worldwide. Perusal of the World Wide Web quickly reveals the variety of information available. In fact, the diffusion of technology adoption can be considered as the most important event of the late 20th century (Matute, 2006). Technology adoption can be considered the late 20th century's most important event. Spite of the emergence of many forms of innovations for storing and delivering information, the Internet has remained the most valuable source of information. This can be seen from the prevalence of using the technology for different purposes in the community among all age groups and income levels, from all types of share trading members in the stock market

Understanding Technology adoption behavior and diffusion of innovation plays a significant role in determining acceptance factors and new adopters' behavior regarding new technologies. Diffusion of Innovations seeks to explain how innovations are taken up in investors. Adopting new innovations is one of the major areas in technology that has been researched extensively in order to determine the primary factors influencing people to accept technologies and implement them in their activities (Venkatesh, 2003).

Many diffusion of innovations theories have emerged in order to study community members' acceptance of these innovations. Researchers in a number of disciplines have used these theories to comprehend the factors influencing people to accept or reject technologies. Diffusion of innovation theories have spread all around the world because they offer a conceptual framework for discussing the process of acceptance at a global level (Dillon & Morris, 1996). These theories form a general framework of the social impact of technologies on people and provide insight into the characteristics of technology that may influence specific groups to adopt them.

Thus, the consideration of adopting technology and how it affects users' commitment to incorporate use of new information systems seems important for understanding, explaining, and predicting system usage and acceptance behavior. This chapter throws an aerial view on diffusion of innovation and explains the recent technological adoption and diffusion theories.

4.2 ORIGIN OF DIFFUSION RESEARCH

The concept of diffusion was first studied by the French [sociologist](#), Gabriel Tarde (1843 – 1904), who was born in France and one of the forefathers of sociology and social psychology. What was called as “imitation” is today referred “adoption”. Tarde introduced the S-shaped curve and opinion leadership. Georg Simmel (1858 –1918), German sociologist, derived concepts as social distance, heterophily, and cosmopolitaness.

The British school of diffusionism (1920) an archaeological and anthropological movement, believed that all the people of the world is not

capable of invention and creation, but people can imitate others and have cultures. "Pan Egyptian Theory" Wilhelm Schmidt (1868-1954), theorized on a conjectural universal development based on historical-geographical areas of diffusion. Leo Frobenius (1873 – 1938) defined several "culture areas" cultures showing similar traits that have been spread by diffusion or invasion.

Franz Boas (1858-1942), a German anthropological field worker, believed the cultural inventory of a people was cumulative and was the result of diffusion. Clark Wissler (1870-1947) emphasised on intercultural diffusion through the study of diffusion of horses from Spanish explorers to American Indian tribes in the West, and the spread of corn growing from the American Indians to European settlers (Rogers 1995).

Ryan (1943) identified an influential diffusion study and studied the diffusion of hybrid corn amongst farmers in Iowa covering the four main elements of diffusion innovation, communication channels, time and social system.

The Bass model that forecasting the rate of diffusion is another major contribution to diffusion theory (Bass, 1969). The basic premise of the model is that adopters can be classified as innovators or as imitators and the speed and timing of adoption depends on their degree of innovativeness and the degree of imitation among adopters.

During the early 1980s, Rogers proposed six elements that formed the fundamental framework of studying the diffusion process, (Rogers, 1983) there are four key elements in the diffusion process: 1. Innovation: Any idea, object, or practice that is perceived as new by members of the social system 2. Channels of Communication: Means by which information is transmitted to or within the social system 3. Time: rate at which innovation is diffused or the relative speed with which it is adopted by members of the social system 4. Social System: Individuals, organizations, or agencies that share a common “culture” and are potential adopters of the innovation.

4.3 LANDMARKS IN DIFFUSION OF INNOVATION RESEARCH

The process of adopting new innovations has been studied for over 30 years. Dooley (1999) mentioned several of the disciplines as political science, public health, communications, history, economics, technology, and education, as the base for the diffusion research. One of the most popular adoption models is described by Rogers that is diffusion of Innovations. Rogers’ diffusion of innovations theory is the most appropriate for investigating the adoption of technology in financial environments.

4.3.1 Diffusion of Innovation Theory

Rogers’ diffusion of innovation model is the most widely tested and implemented model. Rogers (1995) modeled innovation-decision process which an individual passes through when encountering new innovations or ideas. The process is essentially information-seeking and information-processing activities starting from obtaining initial knowledge about the innovation, to forming an attitude toward it, to deciding to adopt or reject, to implementing the new idea, and finally to confirming the decision made by the people (Rogers. 2003).

Diffusion of Innovations Theory

PRIOR CONDITIONS

1. Previous Practice
2. Felt needs/problems
3. Innovativeness
4. Norms of the social system

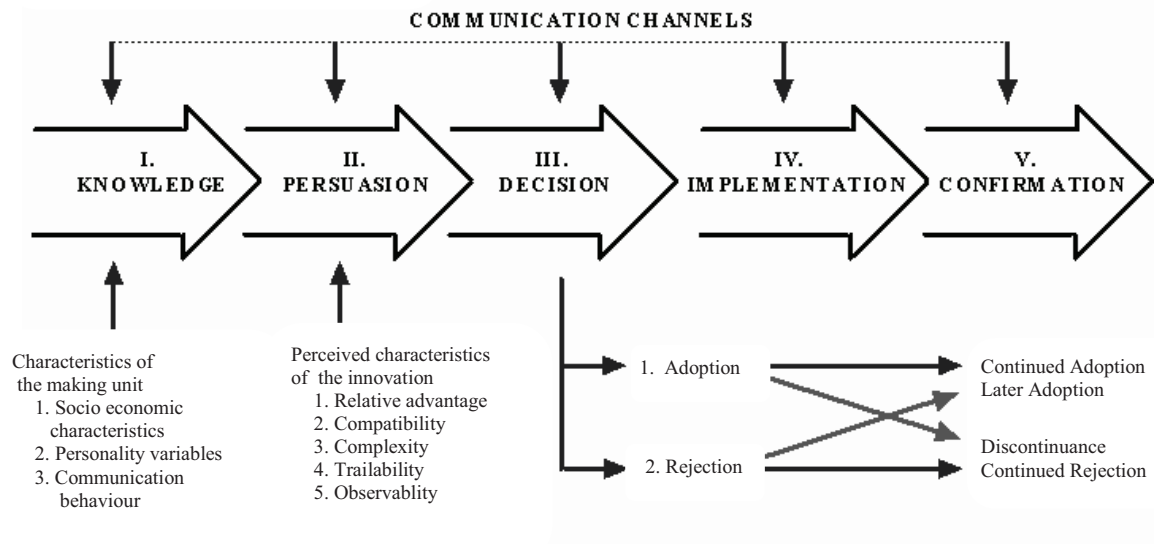


Figure 4.1: The process of Rogers' (2003) diffusion of innovations theory

Source: (Rogers, 2003).

The process of Rogers' (2003) diffusion of innovations theory consists of five sequential stages:

- I. Knowledge occurs when an individual or other decision-making unit is exposed to an innovation's existence and gains some understanding of how it functions.
- II. Persuasion occurs when an individual forms a favorable or unfavorable attitude toward the innovation based on perceived characteristics of the innovation, such as relative advantage and complexity.

- III. Decision occurs when an individual engages in activities that lead to a choice to adopt or reject the innovation.
- IV. Implementation occurs when an individual puts the innovation into use.
- V. Confirmation occurs when an individual seeks reinforcement of an innovation decision already made, or reverses a previous decision to adopt or reject the innovation if exposed to conflicting messages about the innovation.

There are two major processes in diffusion of innovations models. Adoption process is one of them and diffusion being the next. The focus of the adoption process is the stages through which an individual consumer passes while arriving at a decision to continue or discontinue the new product (Schiffman et al. 2005). This is the best applied to the socio economic issues of information and communication technology in the social system.

4.3.2 Diffusion Theory

Adopter Categories

The core concept of diffusion theory is the adopter categories. The adopter categories indicate where a consumer stands in relation to other consumers in terms of the time taken by the consumer in adopting a new product (Schiffman et al. 2005). Five categories are observed in the adopters.

Innovators (Venturesome)

Innovators have a keen interest in new ideas that differentiate them from other consumers. The innovators are known to have the ability to understand complex technical information. They are willing to take risks and to cope with uncertainty about innovations at the time of adoption 2.5 %.

Early Adopters (Respect)

Early adopters are more integrated into the local social system. They check with before adopting a new idea. This category contains a greater number of opinion leaders, they are the role models. They make up around 13.5 percent of the total consumer population.

Early Majority (Deliberate)

Deliberates adopt new ideas just prior to the average time, seldom hold leadership positions. They make up 34 percent of the total consumer population.

Late Majority (Skeptical)

Skeptical adopt new ideas just after average time. Adoption happens because of necessity and peer pressures.. They make up another 34 percent of the total consumer population.

Laggers (Traditional)

Laggers are the last people to adopt an innovation. This category is around 16 percent of the consumer population.

Adopter categorisation on the basis of innovativeness

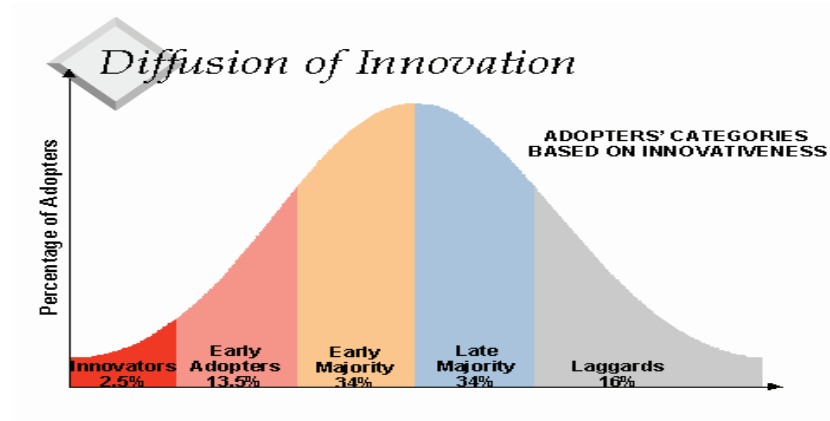


Figure 4.2 Adopter categorisation on the basis of innovativeness Source: (Rogers 2003, p.281)

Perceived Attributes of Innovations

There are five attributes as defined by Rogers (2003), Relative advantage, Compatibility, Complexity, Trialability and Observability.

Relative advantage is "the degree to which an innovation is perceived as being better than" a competing or preceding idea. Compatibility of an innovation is the degree to which it meets the needs of the consumers. Complexity is defined as the "degree to which an innovation is perceived as relatively difficult to understand and use". Trialability is "the degree to which an innovation may be experimented with on a limited basis". In every stock broking companies they are having the unique demo site for their investors. For example, one of the leading stock broking companies shows the demo site of GoTxs, the online securities trading tool provided by KARVY Stock broking ltd in Tirunelveli. The demo site has a step by step guide to show the features and functions of the tool for the potential clients.

Observability is an attribute which describes the extent to which an innovation can be "seen" in the process of being used or tried out by others.

Variables determining the rate of adoption of Innovations

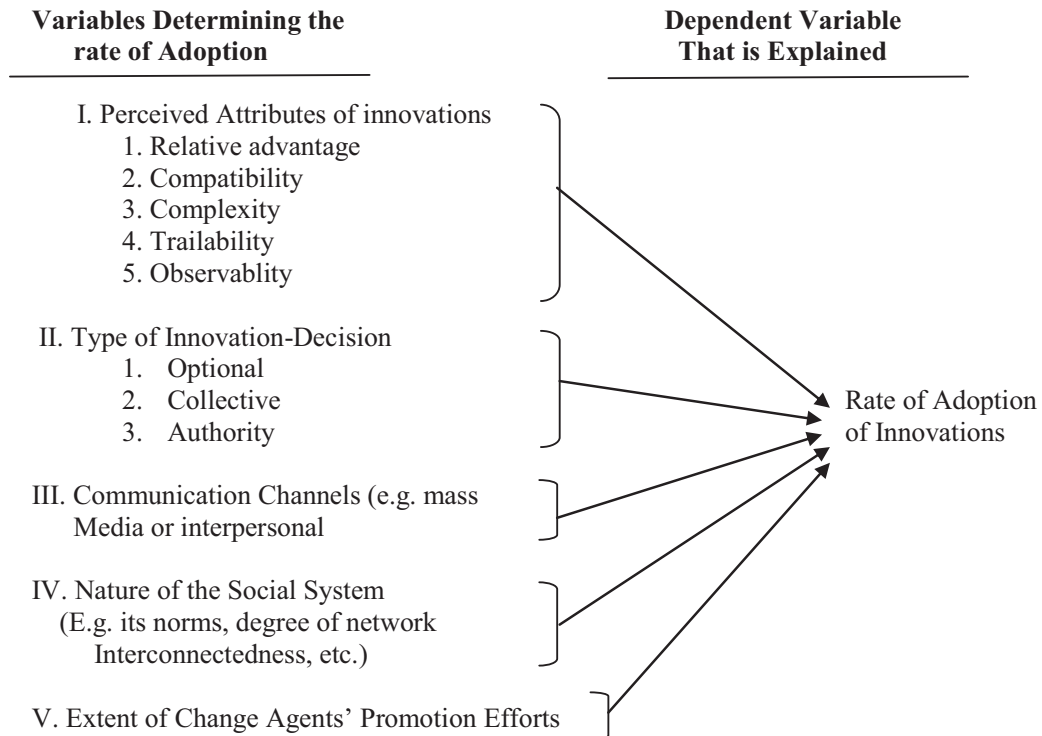


Figure 4.3 Variables determining the rate of adoption of Innovations

Source: (Rogers 2003, p. 222,)

The Change Agent

A change agent is an individual who influences the users' innovation decisions in a direction deemed desirable by the change agency. Rogers (2003) classifies seven roles of the change agent (Rogers, 2003):

- to develop a need for change on the part of the users
- to establish an information exchange relationship
- to diagnose a problem

- to create an intent to change in the user
- to translate intentions into action
- to stabilise adoption and prevent discontinuance
- to achieve a terminal relationship with users.

4.3.3 Adoption Theory

The theory shows that there are a wide variety of factors that will influence the adoption of new technology.

AIDA Model

Garber and Dotson (2002) stated that the AIDA model, shown in Figure 4.3, is said to have been originated by E.K. Strong. AIDA is the acronym made up of Attention, Interest, Desire and Action.

AIDA Model

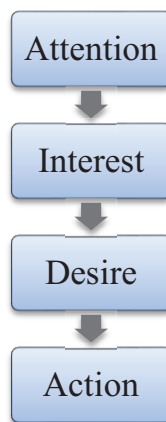


Figure 4.4 AIDA Model Source: (Garber & Dotson 2002)

Hierarchy-of-Effects Model

Lavidge and Steiner stated that advertising may be thought of as a force which must move consumers up a series of steps. According to this model, to get a consumer to adopt a product, the marketer of the product has to create awareness first by advertising the product.

The marketer's task is to get the consumer into action to buy the product. There are many means to convince the consumer to execute the final decision, for example, offering a premium price or allowing a trial of the product. Finally, the consumer may purchase the product and adopt it. These developments eventually change investor perspective in viewing advertising effects. This is due to more critical public or potential customers and no longer can be dictated by advertising information. Although the advertisement is quite interesting, but it's not enticing enough to create a passion to purchase the advertised financial services. They tried to look for information before they decide to buy.

Hierarchy-of-Effects Model

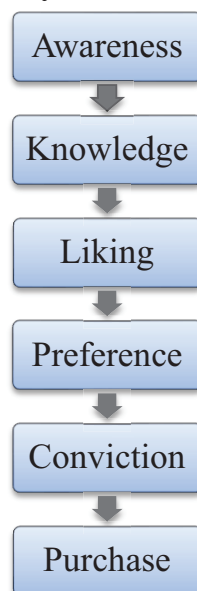


Figure 4.5 Hierarchy-of-Effects Model

Source: (Lavidge & Steiner 1961) (Kotler 2000)

4.4 ACCEPTANCE AND CONSEQUENCES OF INNOVATIONS

Many models have been proposed to explain and predict the use of a system. The wide body of research focuses on identifying factors affecting people's intentions to use new technologies and how these intentions predict actual usage. The following sections summarize some of the major adoption theories.

4.4.1 Theory of reasoned action (TRA)

The TRA is a fundamental model that was created by social psychologists to study conscious intentional behaviour. Ajzen & Fishbein(1980) indicates that the behavioural intention is a function of two determinants: a personal factor termed 'attitude toward the behaviour' and a person's perception of social pressures or 'subjective norm'. TRA is a well-known general theory to explain behaviour beyond adoption of technology. The model asserts that specific beliefs influence behavioural perceptions and actual behaviour. According to TRA model, the behaviour intention is the immediate antecedent of an individual's execution of a piece of behaviour.

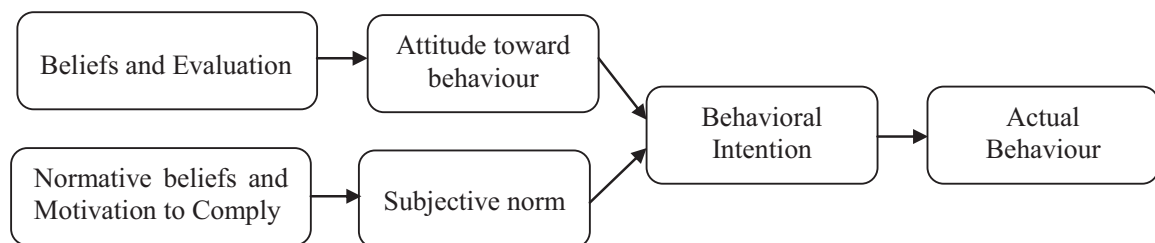


Figure 4.6 Theory of reasoned action (TRA) Source: (Fishbein & Ajzen, 1975)

4.4.2 Technology acceptance model (TAM)

Technology Acceptance Model by Davis (1989) can be considered as an adaptation of the TRA model and was used to explain individual user's intentions of using a system.

Davis introduced a Technology Acceptance Model (TAM) as a model for researching information technology adoption. Davis proposed that the behavioural intention of adoption of a computer technology by the users is determined by two factors: Perceived Usefulness (PU) and Perceived Ease of Use (PEU). Perceived usefulness is defined as the probability of the user's belief that the adoption of the technology will enhance his performance in the organisational context. It is the task oriented outcome that looks at how the adoption of a certain IT technology helps a user in completing tasks.

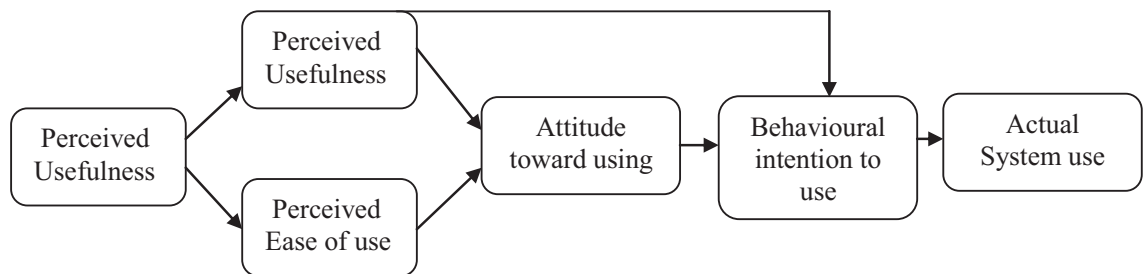


Figure 4.7 Technology Acceptance Model (TAM) Source: (Davis, 1989).

The final conception of TAM does not include the attitude construct; this is to better explain intention parsimoniously. TAM has been widely applied to a diverse set of technologies and users. They indicated the major theoretical limitation of Technology Acceptance Model is the “exclusion of the possibility of influence from institutional, social, and personal control factors’ (Dillon & Morris 1996).

4.4.3 Theory of Planned Behavior (TPB)

TPB expanded TRA with the concept of “perceived behavioral control”. Theory of planned behaviour is an extension of the theory of reasoned action and was proposed by Ajzen. TPB model added a third construct, “perceived behavioural control” compared to TRA. Ajzen (1985) extended the TRA model to cover willing behaviours for predicting behavioural intention and actual behaviour. TPB specifies the nature of relationships between beliefs and attitudes. According to Ajzen, people’s evaluations of behaviour are determined by their accessible beliefs about the behaviour. TPB model links belief, attitude and expectation of an individual. The behavioural intention is influenced by the strength of the belief according to Ajzen.

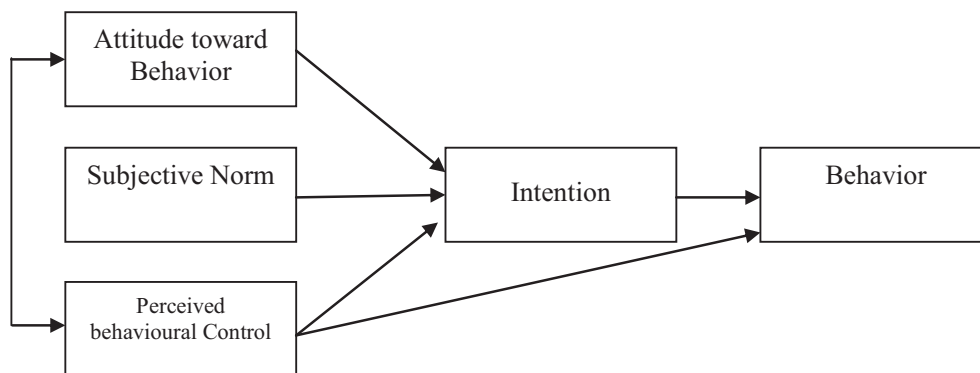


Figure 4.8 Theory of Planned Behavior Source: (Ajzen, 1991).

4.4.4 Unified Theory of Acceptance and Use of Technology (UTAUT)

UTAUT is a model of individual acceptance that is compiled from eight models and theories (Venkatesh, Morris, Davis, & Davis, 2003). TRA, TAM, Motivational Model (MM), TPB, Combined TAM and TPB, Model of PC

Utilization , Innovation Diffusion Theory, Social Cognitive Theory, addressing the new framework of Unified Theory of Acceptance and Use of Technology (UTAUT). UTAUT model integrates the issues that are mentioned in the relevant documents into four main core determinants: Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), Facilitating Conditions (FC), and four control variables, which are “Gender”, “Age”, “Experience”, and “Voluntariness of Use”. A manager can use UTAUT to weigh the introduction of new technology and predict and explain the user’s behavior of accepting information technology. From the previous test result, one found that the explanatory power of this UTAUT model is up to 70% with regard to technology using behavior, it is more effective than any of the models that are known before and the use of UTAUT model has become more extensive in recent years, it is no longer confined to the discussion of the use of information system, such as e commerce, online learning , and wireless network and the study problem of this study takes investors desire and behavior as the core, thus, this study uses UTAUT model as the theoretical foundation of this study. The UTAUT model is well suited to the context of this study. Based to these observations, the researcher developed the model and hypotheses of this study.

Unified Theory of Acceptance and Use of Technology

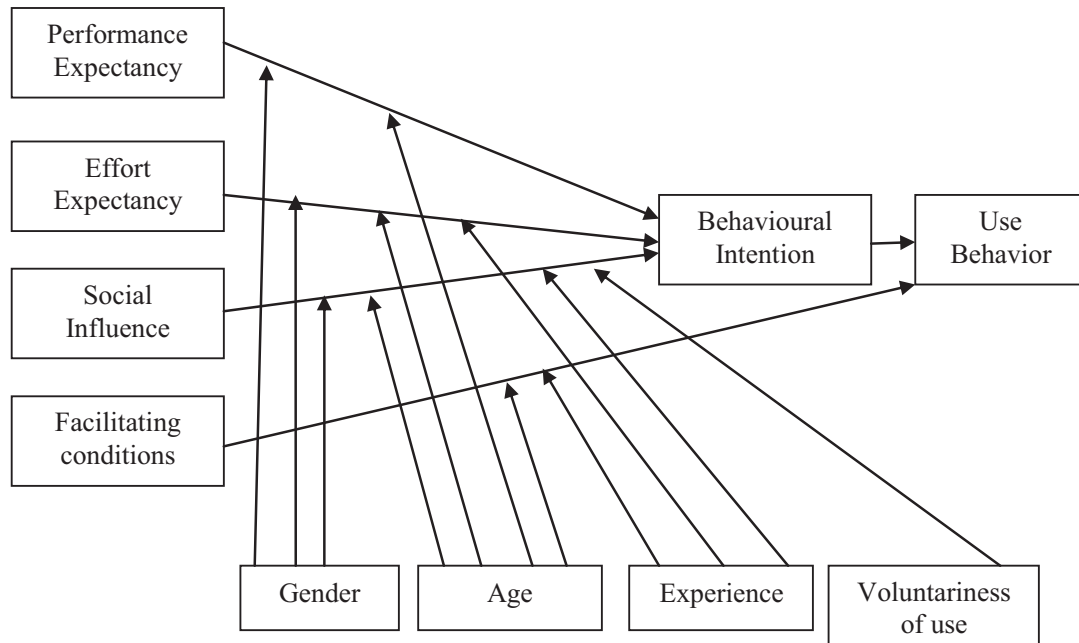


Figure 4.9 Unified Theory of Acceptance and Use of Technology Source: (Venkates, 2003).

4.5 PROPOSED MODEL FOR RESEARCH

TECHNOLOGY ADOPTION BEHAVIOUR MODEL

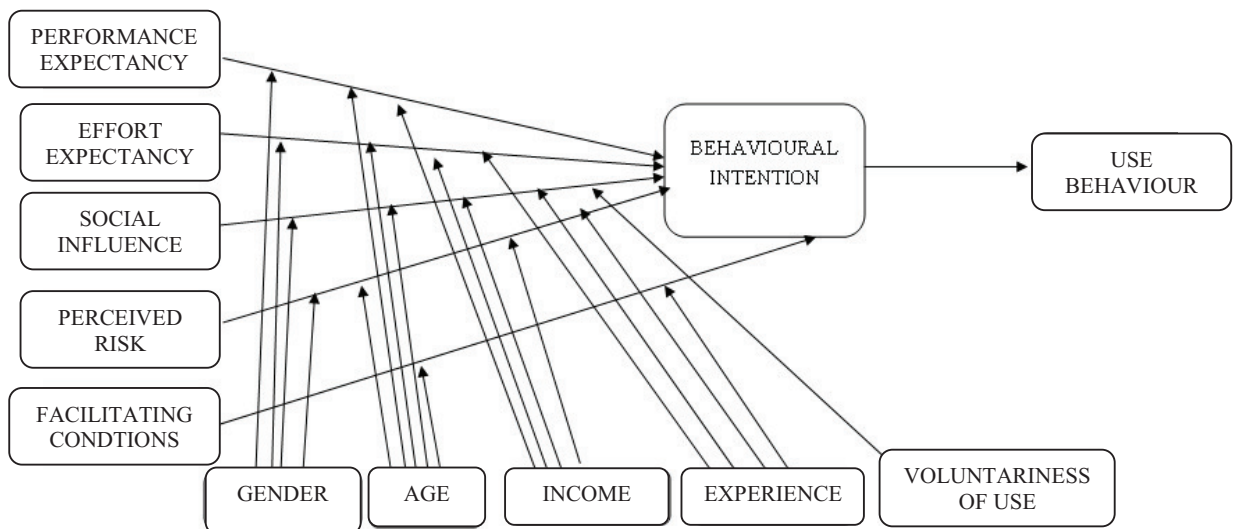


Figure 4-10 Proposed Research Model

The study framework

The framework of this study is derived integrating the determinants from different model as shown in the figure 4.11. The external variables are formed from the four core determinants in UTAUT model and by adding one external variable namely perceived risk. The control variables are adopted from UTAUT model's variables with one addition as level of income. Perceived Risk represents one person's attitude towards taking risk. This is indicated as an important concept that has implications for both financial service providers (Share broking institution or other financial planner) and consumers (investors). Income is one factor which may determine the appropriate composition of many decision for a portfolio. Investors invest based on their preference in terms of risk and return relative to the needs of the individual investors. Table 4.1 shows the model in terms of determinants and sub determinants.

Table 4.1

The Four Core Determinants of Theoretical Model

| Proposed Determinant | The sub-determinant | The source determinants |
|-----------------------------|-------------------------------|--------------------------------|
| Performance Expectancy/PE | Perceived usefulness | TAM/TAM2/ C-TAM-TPB |
| | Work environment adaptability | MPCU |
| | Relative advantage | IDT |
| | Expectation/Motivation | MM |
| Effort Expectancy/EE | Perceived ease of use | TAM/TAM2 |
| Social Influence/SI | Social factors | MPCU |
| | Image | IDT |
| Facilitating Conditions/FC | Perceived behavioural control | TPB/DTPB, C-TAM-TPB |
| | Compatibility | IDT |
| Perceived Risk | Psychometric approaches | BRPM |

Performance Expectancy (PE)

PE refers to “the degree that the user believes that using the information system can improve work performance”, PE is formulated from Perceived Usefulness of-TAM/TAM2/C-TAM-TPB, external motivation of MM, work correlation of MPCU, relative advantage of IDT, and expectancy to the achievement of SCT. Gender and Age has towards performance expectancy as relatively significant. Income also is added with believing as impaction PE.

Effort Expectancy (EE)

EE refers to “the easiness that an individual thinks of when using the system”. EE includes “consciousness of easy to use” of TAM/TAM2, “systematic complexity” of MPCU, and “operating simplicity” of IDT. Gender and age have more significant, influences over EE. Experience increases easiness of using the technology and income also exposes then to accessibility to new technology.

Social Influence (SI)

SI refers to “the degree that an individual senses that the person who is important to him thinks that he should use the new system”. “Subjective norm” of TRA, TAM2, TPB/DPTB, C-TAM/TPB, “social factor” of MPCU, and “public image” of IDT are combined to from the social influence. Factors such as gender, age, experience and use voluntarily had significant influence on the determinants. Income also believed to have significant influence over SI.

Facilitating Conditions (FC)

FC refers to “the degree of supporting that an individual feels from the organizational and technical relevant equipment towards system use”. Dimensions like “the control of conscious behavior” of TPB/DTPB, C-TAMTPB, “promoting condition” of MPCU, and “compatibility” of IDT are combined to formulate FC. Age and Experience believed to have an influence over FC.

Perceived Risk

In terms of different risk perception or risk tolerance level, individual investor may show different reaction base upon their psychology factor and economic situation, which would lead to heterogeneous portfolio choice for individual investors. The individual investor would demonstrate different risk attitude when facing investment alternatives. This might influence an individual investor’s level of risk taking, Financial risk tolerance is distinct as the maximum amount of uncertainty that someone is willing to accept when making a financial decision. The Basic Risk Perception Model (BRPM) is a less well-known alternative to the psychometric approach. It incorporates and expands on the psychometric dimensions and explains more variance in risk perception. It does this mainly by adding the factors of attitude, risk sensitivity, and specific fear, and sometimes trust and moral value .It would seem that the dimensions extracted in the research to study the psychometric approach.

4.6 CONCLUSION

The past decades have also seen a tremendous increase in the application of computer modelling and simulation methods to diffusion processes. The adoption of new technologies has focused to a great extent on micro economic determinants, in part because these have proved to be the most important in explaining the broad patterns of technology diffusion, especially within technology adoption system.

It is to provide an overview of how adoption theory could help interpret adoption of technology in the learning of online share trading. The theory shows that there are a wide variety of factors that will influence the adoption of online share trading. Individual attitudes and variables could also be included to help determine the relationship but also found evidence for the positive effect of a generous technology environment on adoption decisions. In spite of the availability of various theories, there is no comprehensive theory that has been agreed upon by all or most researchers. However, technology adoption predicting share traders activities and that has been a great challenge for investors trading activities in the stock market.