VALIDATION OF A NOMOLOGICAL NETWORK OF USE-DIFFUSION: A STUDY ON INTERNET USERS

by

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DEDICATIONS

To the Supreme Maker,

In acknowledgement of His abiding presence and unlimited grace throughout the seasons of my life. He is the Alpha and Omega, the beginning and the end, the first and the last of all things (Revelations 22:13).

Soli Deo Gloria

…and for both of my parents, Jin Thye and Juliet,
with much love and affection.

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ABSTRAK

Kajian ini bertumpu kepada pengesahan model penyebaran penggunaan dengan tujuan membangunkan perkembangan teoretikal. Sebanyak 219 responden telah dikumpul melalui teknik persampelan mudah, dengan individu pengguna internet sebagai unit analisis yang dikaji. Secara khusus, satu siri perhubungan sebab-akibat telah dikonsepsikan untuk mewakili rangkaian nomologikal bagi menggambarkan proses penyebaran penggunaan, bermula dari peringkat awal penggunaan sehingga ke peringkat akhir iaitu kesan pada penggunaan masa hadapan. Didapati bahawa matriks kovarians dalam model penyebaran penggunaan sangat berpadanan dengan data sampel. Ini menunjukkan bahawa sebuah model 'parsimonious' yang dapat menggambarkan proses penyebaran berjaya dibuktikan. Model ini turut menunjukkan bahawa faedah utilitarian dan sifat internet 'playfulness' mempunyai impak yang signifikan ke atas intensiti untuk melakukan aktiviti berkaitan internet. Intensiti penggunaan pula didapati mempengaruhi impak terhadap internet, kepuasan terhadap penggunaan internet dan minat terhadap teknologi masa hadapan. Bagaimanapun, jangkaan usaha, pengaruh luaran, keseronokan mengguna, dan sifat inovatif didapati tidak mempengaruhi intensiti penggunaan. Tambahan pula, kedua-dua pembolehubah iaitu impak terhadap internet dan minat terhadap teknologi masa hadapan mempengaruhi penggunaan masa hadapan, namun kepuasan penggunaan tidak dapat menjelaskan impak tersebut. Selain itu, didapati juga bahawa sifat inovatif dapat meramal pengguna intensif daripada pengguna terhad, sementara keseronokan mengguna dapat membezakan pengguna intensif daripada semua kumpulan pengguna lain. Umur yang tinggi meningkatkan kemungkinan menjadi pengguna terhad berbanding dengan pengguna intensif dan khusus manakala pendapatan yang rendah meningkatkan kemungkinan untuk diklasifikasikan sebagai pengguna terhad

berbanding dengan pengguna intensif atau pengguna khusus. Penemuan kajian turut mencadangkan bahawa pengguna terhad mempunyai persepsi yang lebih rendah terhadap impak internet serta kepuasan apabila dibandingkan dengan ketiga-tiga kumpulan pengguna yang lain. Berkenaan minat terhadap teknologi masa hadapan, pengguna intensif merekodkan skor yang tertinggi dan berbeza secara signifikan merentasi semua kumpulan pengguna yang lain kecuali pengguna tidak khusus. Namun demikian, pengguna khusus secara signifikan didapati mempunyai minat terhadap teknologi masa hadapan yang rendah berbanding dengan pengguna intensif. Akhir sekali, implikasi pengurusan dan teoretikal serta batasan dan cadangan untuk kajian masa hadapan turut dibincangkan.

ABSTRACT

This research focuses on the validation of the use-diffusion model in order to aid further theoretical development. A total of 219 samples were gathered through convenience sampling, with the unit of analysis being the individual internet user. In particular, a series of causal relationships were conceptualized to represent a nomological network to model use diffusion process from initial usage of the internet to its impact on future consumption. It was discovered that the model-implied (use-diffusion model) covariance matrix was found to closely fit the sample population dataset. This shows that a parsimonious model that fully represents the use-diffusion process was successful. The model indicates that utilitarian benefits and internet playfulness have a significant impact on intensity to engage in internet related activities. In turn, intensity to use was found to influence perceived impact of the internet, satisfaction in using the internet and interest in future technologies. However, effort expectancy, external influences, perceived enjoyment and innovativeness did not play a role in usage intensity. In addition, perceived impact of the internet and interest in future technologies jointly influenced future consumption, while satisfaction was not able to explain the said consumption. It was also discovered that innovativeness is able to predict intense users from limited users, while perceived enjoyment was able to differentiate the former from the rest of the internet user groups. Increase in age results in a higher likelihood to be limited users as opposed to intense or specialized users while lower income results in higher chances in to be classified as limited users as compared to intense or specialized users. The findings also indicate that limited users have significantly lower perception towards the impact of internet as well as satisfaction when compared to the other three user groups. In terms of interest in future technologies, intense users registered the highest, and differ

significantly across all groups except non-specialized users. Contrastingly, specialized users were found to have significantly lower interest in future technologies as compared to the other groups. Also, limited users registered significantly lower interest in future technologies when compared to intense users. Finally, managerial and theoretical implications as well as limitations and directions for future research are discussed.

CHAPTER 1

INTRODUCTION

Technology and technological systems are integral to everything we do and can do.
(Pearson & Young, 2002)

1.1   Introduction

In the history of technology, no other innovation has attained such amazing achievements with the exception of the internet. Since its inception to its preliminary usage in the academic community and eventually various forms of commercialization, the internet has evolved and completely transfigured our daily, contemporary lives. Adoption-wise, it is believed that the internet will take a relatively shorter time frame to reach broad consumer acceptance compared to other technologies such as the television set and microwave ovens which took roughly 2 decades to achieve mass acceptance.

Yet, identifying the acceptance of a particular technology only composes part of the story in understanding consumer behaviour. The other half concerns how the usage of that technology is disseminated among its adopters. This is what constitutes the *raison d'etre* of this research – unraveling the concept of use-diffusion in internet technology.

Beginning with a background on the research carried out, this chapter proceeds with the problem that warrants this research. Following this is an outline of this study's objectives as well as the research questions that it seeked to answer. Brief but concise definitions of key terms are included as an introductory explanation to the terms that would be frequently referred to throughout this whole manuscript. The importance and contribution of this study are identified in the section 'significance of the study'

and lastly, the organization of the remaining chapters is presented as a preview of what is to follow.

1.2 Background

With the society's growing realization of the wonders and benefits of using the internet, the number of internet users has shown an encouraging increase over the last few years. As proof, the number of internet dial-up subscribers breached the three million mark in the first quarter of 2004, from 2.89 million in the previous year to 3.14 million ("Malaysians Rush", 2004). Table 1.1 shows the internet dial-up subscriptions from 1998 to 2004.

Table 1.1

Internet Dial-Up Subscriptions (in '000s)

Year	Quarter	Total	Growth rate	Penetration rate	Estimated number of users
1998	-	405	97.6	1.8	1215
1999	-	668	64.9	2.9	2004
2000	-	1659	148.4	7.1	4977
2001	-	2113	27.4	8.8	6345
2002	-	2614	23.7	10.5	7842
2003	-	2897	10.8	11.4	8691
2004	1	3148	8.7	12.4	9444

Source: Malaysian Communications and Multimedia Corporation (2004)

To this point, the outlook for further growth in internet usage looks promising as the figures depict an increased acceptance of internet technology in Malaysia. The government and internet service provider (ISP), i.e. TM net is aggressively pushing in for a more widespread use of broadband access services ("Malaysians Rush", 2004). Table 1.2 presents number of broadband subscriptions by technology.

Table 1.2

Number of Broadband Subscriptions by Technology

Year	Qtr	ADSL	SDSL	Others	Total	Penetration rate
2002	-	18 511	542	249	19302	0.08
2003	-	108 173	1931	302	110406	0.45
2004	1	139 862	2168	302	142332	0.56

Source: Malaysian Communications and Multimedia Corporation (2004)

There is no doubt that the figures above paint a positive picture for the future of internet in Malaysia. Nevertheless, it takes more than just mere subscriber numbers to provide meaningful information that can be used in the development of information and communication technologies (ICT) in Malaysia. Instead what would prove to be more valuable is more data on usage trends and behavioral patterns which can help explain internet users better and in the process also provide a macro profile of a typical internet user in Malaysia. Even so, information regarding this area is still relatively sparse and incomplete.

1.3   The Methodological and Theoretical Gaps of Use-Diffusion Model

Numerous works produced by researchers following Rogers' (1983) theory on diffusion of innovations have customarily concentrated on the timing or rate of a new product's adoption. Elements which contribute to the adoption-diffusion of a new product, i.e. the observability, compatibility and triability of a new product have been routinely studied and tested across various product categories with the sampled respondents being divided into a typology of adopters, namely innovators, early adopters, early majority, late majority and conservatives (as suggested by Rogers, 1983). Nonetheless, adoption-diffusion studies have failed to consider two important criteria in the diffusion of new products which is the rate and variety of use. As a

result, the typology of adopters generated can only portray how fast a new product will be accepted.

Alternatively, the use-diffusion model proposed by Shih and Venkatesh (2004) is able to overcome the shortcomings of the adoption-diffusion paradigm. They proposed that the rate and variety of use of internet applications can be segmented to show the cycle after which innovation diffusion has occurred. In turn, their classification scheme was able to illustrate the pre and post of internet usage. Although given the novelty of their research, it has certain methodological concerns. The statistical techniques employed in their study renders the interpretation of the results to be treated with caution. Firstly, their use-diffusion model is analyzed separately in two stages. In the first stage, the relationships between the determinants (household social context) to rate and variety of use were tested. Subsequently, in the second stage, the use-diffusion pattern constructed from the rate and variety of use is compared. This forms the four segments that made up the internet user profile. The internet user profile or termed as use-diffusion pattern by Shih and Venkatesh (2004) were compared across three outcomes; perceived impact of technology, satisfaction with technology and interest in future technologies.

Given their modeling technique in stages, this treads on conceptual issues in scientific explanations in reductionism. Reductionism refers to the "idea that the principles explaining one range of phenomena are adequate for explaining a totally different range of phenomena…" (Hoult, 1972, p. 267). Although Shih and Venkatesh (2004) and many others such as Rogers (1985) had implicitly touched on this domain, their results cannot be interpreted without having knowledge that when an analysis is carried out in stages, the conceptual frames in both models might not be represented

in a holistic theory. In this case, the conceptual frames implied are ones related to the formulation of the use-diffusion model. In order to advance the scientific enquiry from use-diffusion model and developed it into a theory, serious empirical testing and model evaluation should be carried out. Yet, there is no existing study in use-diffusion that seeks to merge both continuum of theoretical testing and model validation. In addition, their application of the 2 stage least squares (2SLS) regression was misguided. Shih and Venkatesh (2004) claimed that their analysis should be conducted due to the reciprocal effect of rate and variety of use (i.e. the dependent variables). However, a 2SLS regression corrects for biasness in errors for *independent* and *dependent* variables that have reciprocal effects. In addition, their modeling technique did not take into account measurement errors and their instrument was not validated.

In their study, Shih and Venkatesh (2004) considered the variety and rate of use to be important. However, they did not anchor the total variety of usage applications with the individual's extent of involvement in each application. Subsequently, this study further advances their profiling method of use-diffusion patterns. Therefore, an index was developed for variety of use (termed as 'activity diversity' in this study) to further improve on the classification scheme. Subsequently, this study extended their model to investigate internet users' propensity to engage in future state-of-the art technologies.

1.3.1   Problem Statement

Therefore, the gaps that this research seeks to address are ones belonging to the lack in the model validation rigors for the expansion and test of the use-diffusion model. The first problem that will be focused is the incoherency of separate model

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assessment procedures that are integrated in anticipation that a holistic theory holds. An integral aspect of this research would be to redress the imbalance and ascertain nomological validation through the cross-examination of the use-diffusion model. The medium of diffusion that is being considered in this study is internet applications. The second area of expansion is to provide an improvement towards Shih and Venkatesh's (2004) use diffusion pattern's classification scheme. Finally, given the list of improvements that can be further achieved for the advancement of the use-diffusion discipline, this study seeks to provide a "one step for man and one giant leap for mankind" adage through the initiatives in the following section.

1.4   Research Objectives

In reference to the problem statement above, this study seeks to achieve the following objectives:

1)   To test, investigate and validate the fit of the measurement and structural models of use diffusion.

2)   To constructively understand and objectively interpret the determinants and outcomes of actual internet usage, given that nomological validity had been ascertained.

3)   To compare and contrast between the different segments of internet user profile (use-diffusion patterns), which had been computed from the rate and variety of use.

1.5   Research Questions

This study was undertaken in the attempt to uncover the answers to these questions:

1)   Does the model fit the population? In other words, is it reliable and valid?

2)   What are the factors and outcomes of use-diffusion?

3)   How are various internet user segments (use-diffusion patterns) significantly different or similar to each other?

1.6   Definition of Key Terms

1. **Utilitarian benefits** – The degree to which an individual believes that using a technology/system is useful, functional and effective, thereby producing valued outcomes such as enhancing one's job performance (Davis, 1989; Davis, Bagozzi & Warshaw, 1989).

2. **Effort expectancy** – The degree to which an individual believes that using a technology/system is free of effort, in other words relatively easy to understand and use (Davis, 1989; Davis et al., 1989; Moore & Benbasat, 1991).

3. **External influences** – The degree to which an individual perceives that external parties such as the media and significant others believe that he/she should use the new technology/system (Ajzen, 1991; Davis et al., 1989; Fishbein & Ajzen, 1975; Mathieson, 1991; Moore & Benbasat, 1991, Taylor & Todd, 1995).

4. **Innovativeness** - The natural desire to acquire and experiment with the latest technologies, as well as to be a technology pioneer and thought leader (Parasuraman, 2000).

5. **Internet playfulness** - An individual's tendency to interact spontaneously with a technology/system. It can be considered either as a state of mind or an individual trait (Webster, 1989; Webster & Martocchio, 1992).

6. **Perceived enjoyment**   - The extent to which the activity of using a technology/system is perceived to be personally enjoyable in its own right aside from the instrumental value of technology (Davis, Bagozzi & Warshaw, 1992).

7. **Intensity of use** - Length and regularity of internet usage.

8. **Activity diversity** – A variety of tasks that can be performed on the internet.

9. **Perceived impact of the internet** – The extent of effects that the internet has on the users' lives.

10. **Satisfaction in using the internet** – The feeling of pleasure and fulfillment that is derived from using the internet.

11. **Interest in future-oriented technologies** – Curiosity in using futuristic, high-tech products.

12. **Future consumption** – The intention to continue using the technology/system.

1.7   Significance of the Study

Malaysia can no longer compete with the other upcoming giants like China and India on the basis of cost and labour in the industrial sector to attract foreign-direct investment. Consequently, the government is shifting its focus on to shaping the current Malaysian economy into a knowledge-based economy in order to be continuously competitive globally. The starting point towards a k-economy lies in the establishment of an erudite and technology-savvy culture. The internet, being one of the ICT tools is crucial in the formation of an information rich society. Thus enters the significance of this research whereby the contributions gained from this research is hoped to support the progress in the ICT sector.

In terms of practical significance, the findings of this study are set to paint a more complete picture of internet use-diffusion among users in Malaysia. Firstly, a better understanding of the motivations that drive the rate and diversity of internet usage can

be gained through the section that investigated the antecedents of internet utilization. Next, business practitioners as well as policy makers will benefit from the typology of internet users generated from the examination of diverse use-diffusion patterns among the users.

The Malaysian Communications and Multimedia Commission's (MCMC) move to conduct a survey to establish a profile of Malaysian internet users attests to the importance that the government place in gaining greater intelligence into the trends and patterns of internet users ("MCMC to Profile", 2005). Apart from that, insights can be also obtained on the outcomes of using the internet as well as how these outcomes will vary according to different groups of users.

As for theoretical significance, this study has managed to substantiate the concept of use-diffusion; a classification of consumers into respective categories based on rate and variety of use. In a way, the exploration of the use-diffusion concept in this study has advanced the discipline of consumer behaviour, suggesting that researchers look beyond the 5 adopter-categories of Rogers' (1983, 1985) theory of diffusions. In addition, this study has answered the call for renewed methodological rigor (Straub, 1989) by taking a step further to validate the use-diffusion model suggested by Shih and Venkatesh (2004). It has accordingly expanded our local literature available on methodological issues such as the above-mentioned instrument validation, an area which is found to be severely wanting.

1.8   Organization of the Remaining Chapters

The chapters to come are organized in this particular manner. Following the introduction, Chapter 2 presents a holistic review of relevant previous works by various authors of repute. Subsequently, the hypotheses and research framework are

constructed based upon the literature review. Chapter 3 provides an insight into the methodology undertaken in this study covering the fundamentals methods such as research design, data collection measurements, variables, statistical techniques used. Thereafter, results of the analysis are reported and interpreted in Chapter 4. Finally, lessons derived, as well as the implications of this study are discussed, with the inclusion of the study's limitations and suggestions for future research endeavors.

CHAPTER 2

LITERATURE REVIEW

2.1   Introduction

This chapter begins with an insight into the fundamental concept of diffusion of innovations and the generation of adopter categories that embody the essence of the theory. Next, various theories and models that explain technology usage among individuals are revisited. Factors underlying the usage of technology are mentioned, with the purpose of providing better understanding to the readers on the reasons that drive the acceptance and ultimately the use of a technology. Upon establishing 'the big picture' of theories within the readers' minds, a discussion on certain aspects pertaining to methodological rigour in theory testing is forwarded. More precisely, on the issue of instrument validation. After a review of the relevant literature, the hypotheses for the study are constructed followed by the research framework that guides this whole investigation. This chapter concludes with an explanation on the relationship between the variables proposed for this study.

2.2   Diffusions of Innovations

Over the years, diffusion theory has been extensively studied from the point of view of different disciplines and with respect to different types of products, services and ideas. It is deemed flexible in use considering its applicability across various disciplines such as in medical sociology (Coleman, Katz & Menzel, 1957), industrial economics (Mansfield, 1961), geography (Brown, 1981), rural sociology (Rogers, 1983), etc. Furthermore, this theory has been of value in explaining the flow of information, ideas, practices, products and services within and across cultures and subcultures or markets and market segments.

Rogers (1983) defined diffusion as the process whereby an innovation is communicated via certain channels, through time, between the members of a social system. Innovation in this sense refers to an idea, practice or object that is perceived as new by an individual or other unit of adoption (Rogers & Scott, 1997). Rogers (1983) posited several conceptual foundations underlying the diffusion theory, namely, the concept of innovation, its diffusion over time, the personal influence and opinion leadership processes, the adoption process, the roles of the innovator and other adopter categories, the social system or market segment within which diffusion occurs.

Perhaps the most well-heard-of contribution of this theory is the classification of adopters. In order to better understand the acceptance and diffusion process, it is necessary to know which individuals acquire an innovation, when they do so, the reasons which led them to so do at one given time or another, etc. In this manner, adopters can be grouped into categories, in such a way that a given category will reflect individuals that are homogeneous one with another and heterogeneous with respect to all the other categories (Martinez, Polo & Flavián, 1998).

All in all , the aforementioned five adopter categories are (1) innovators, (2) early adopters, (3) early majority (4) late majority and (5) laggards. Table 2.1 depicts the five adopter categories and some of their details.

2.3   Technology Acceptance Model

Technology Acceptance Model (TAM) pioneered by (Davis, 1989) was designed to predict information technology acceptance and usage on the job. It advances the Theory of Reasoned Action by suggesting that perceived usefulness (PU) and perceived ease of use (PEU) are key determinants that inevitably lead to the actual

Table 2.1

Adopter Categories

Adopter category	*Percentage of adoption*	*Characteristics*
Innovators	2.5	The first to adopt an innovation. Venturesome, able to cope with high degree of uncertainty, gatekeeper in the flow of ideas into a system, cosmopolites.
Early adopters	13.5	Second earliest to adopt an innovation. Localites, have greatest degree of opinion leadership and potential to speed up diffusion process, role-model for members in the system.
Early majority	34.0	Adopt new ideas just before the average member of a system. Show deliberate willingness in adopting innovations, but seldom lead.
Late majority	34.0	Do not adopt until most others in their system have done so. Adopt new ideas just after the average member of a system. Skeptical and cautious, pressure of peers is necessary to motivate adoption.
Laggards	16.0	The last to adopt an innovation. Possess almost no opinion leadership, resistant and are suspicious of innovations and change agents, make decisions based on the past.

Note: Rogers (1983) used a normal curve and defined categories according to their standard deviation positions from the mean time of acceptance of the innovation for the entire market.

usage of the course website among students. PU is defined as the extent to which a person believes that using the course website would enhance his/her job performance. PEU on the other hand, is defined as the extent to which a person believes that using a particular system would be free from effort (Davis, 1989). TAM 2 extended the original TAM by including subjective norm as an additional predictor of intention in

mandatory settings (Venkatesh and Davis, 2000). Figure 2.1 shows the original TAM model.
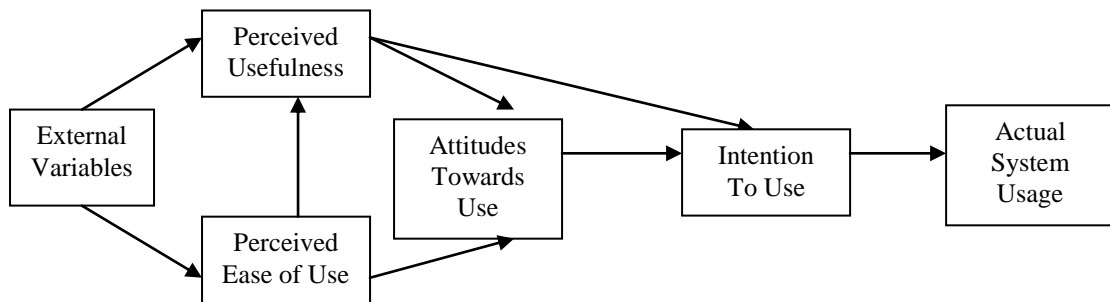

Figure 2.1 Original technology acceptance model (TAM) (Davis, 1989)

In Malaysia, the application of the TAM is kept abreast with the latest development and diffusion of technologies in respective industries. In 2001, Jantan, Ramayah and Chin conducted a study to understand multiple factors that influence PC acceptance among small and medium sized companies. Contrastingly, Ramayah, Jantan, Nasser, Razak and Koay (2003) replicated the TAM to investigate the extent of receptiveness among Malaysian consumers in the e-banking sector. In addition, Ramayah, Siron, Dahlan and Osman (2002) applied the TAM to study technology usage amongst owners/managers of SME's. Recently, the study was extended to include the moderating effect of self-efficacy to assess the acceptance of web-based supply chain management among SMEs (Ramayah & Jantan, 2003).

2.4   Technology Adoption

The Innovation Diffusion Theory (Rogers, 1995) has been used to study a variety of innovations ranging from agricultural tools to organizational innovations (Tornatzky & Klein, 1982). Much later, Moore and Benbasat (1991) adapted the characteristics of innovations presented in Rogers (1995) and refined a set constructs aimed specifically to examine individual technology acceptance. The postulated factors are:

1. **Relative advantage** – the degree to which an innovation is perceived as being better than its precursor (Moore & Benbasat, 1991).

2. **Compatibility** - the degree to which an innovation is perceived as being consistent with the existing values, needs and past experiences of potential adopters (Moore & Benbasat, 1991).

3. **Complexity/Ease of use** – the degree to which an innovation is perceived as difficult to understand and use (Rogers & Scott, 1997).

4. **Demonstrability** – the tangibility of the results of using the innovation, including their observability and communicability (Moore & Benbasat, 1991).

5. **Image** – the degree to which use of an innovation is perceived to enhance one's image or status in one's social system (Moore & Benbasat, 1991).

6. **Visibility** – the degree to which one can see others using the system in the organization (adapted from Moore & Benbasat, 1991).

7. **Voluntariness of use** – the degree to which use of the innovation is perceived as being voluntary, or of free will (Moore & Benbasat, 1991).

2.5   Technology Usage Motivation

The study on motivation as an explaination for human behaviour is nothing uncommon to the field of psychology research. Several studies have considered the motivational theory and adapted it according to the specific contexts intended (Compeau & Higgins, 1995a, 1995b; Davis et al.,1992). Davis et al. (1992) for one, has applied the motivational theory to understand new technology adoption and use. Two kinds of motivation which will drive the use of technology:

1. **Extrinsic motivation** – The perception that users will want to perform an activity because it is perceived to be instrumental in achieving valued outcomes that are distinct from the activity itself, such as improved job performance, pay and promotions (Davis et al., 1992, p. 112)

2. **Intrinsic motivation** - The perception that users will want to perform an activity for no apparent reinforcement other than the process of performing the activity per se (Davis et al., 1992, p. 112).

2.6   Unified Theory of Acceptance and Use of Technology

This theory developed by Venkatesh, Morris, Davis and Davis (2003) combined elements across eight models of technology usage and acceptance and empirically validated the unified model to present it as an reliable and useful measurement for future research. The eight models reviewed were the (1) Theory of Reasoned Action, (2) Technology Acceptance Model, (3) Motivational Model, (4) Theory of Planned Behavior, (5) a model combining the Technology Acceptance Model and the Theory of Planned Behavior, (6) model of PC utilization, (7) Innovation Diffusion Theory and (8) the Social Cognitive Theory.

Four constructs were theorized to be direct determinants of user acceptance and usage behaviour i.e. performance expectancy, effort expectancy, social influence and facilitating conditions. On the other hand, three constructs, i.e. attitude toward using technology, self-efficacy and anxiety are theorized as indirect determinants of intention to use information technology.

2.7   The Use-Diffusion Theory

Basically, studies on new innovations/technology diffusion stand on one common ground, i.e. focus on the adoption perspective (Midgley & Dowling, 1978; Mahajan &

Muller, 1979; Dickerson & Gentry, 1983; Rogers, 1995). The fact that diffusion processes cannot be fully understood without proper comprehension into the nature of adoption still holds true. The first decision that a person must make he/she is able to proceed with continual usage of that innovation/technology is to choose whether or not to adopt the innovation/technology. In this respect, the adoption concept that most technology acceptance studies adhere to only captures the part on choice i.e. to use or not to use. Thus, what happens to technologies which have already been adopted? To address this limitation and ultimately complete the story, use-diffusion processes also need to be examined. Diffusion scholars, Robertson and Gatignon (1986) attested that adoption only presents part of the diffusion puzzle.

"The speed of diffusion of technological innovation depends on the consumer's ability to develop new knowledge and new patterns of experience…..because the emphasis is on technological innovation, adoption is not the only relevant concern of diffusion research. The degree of use of that technology is an important variable that describes the extent of diffusion of that innovation." Robertson and Gatignon (1986, p.3)

The problem with most adoption/acceptance studies is that the question of 'how and how much/long you use' is left unaddressed. Moving ahead of adoption, Shih and Venkatesh (2004) considered the shortcomings of previous adoption works and developed a concept called use-diffusion model. Whereas the variable of interest in adoption-diffusion theories is rate or time of adoption, the variable of interest in the use-diffusion model concerns, more importantly, is use, that is the rate and variety of use.

In contrast with the five adopter categories of adoption-diffusion theories, use-diffusion theory suggests that users can be segregated into four main segments; intense, nonspecialized, specialized and limited users.

Nevertheless, some methodological concerns arise from their studies. In order for the use-diffusion model to be fully developed into a sound theory, serious empirical testing and model evaluation should be carried out. Yet, what was clearly missing from Shih and Venkatesh's (2004) study was the lack of instrument validation.

2.8   Instrument Validation – Construct Validity

The research process begins with the formation of concepts comprising of one's hypotheses and theory. Nevertheless, before proceeding on to further testing in the analysis section, the researcher needs to ascertain the adequacy of variables in one's theory. This is termed as construct validity – a necessary prerequisite for theory development and testing.

Previously, construct validity has been defined as "the extent to which a set of operationalization measures the concept that it purports to measure" (Zaltman Pinson & Angelmar, 1973, p. 44), trait validity and nomological validity (Campbell, 1960) and discriminant and convergent validity (Campbell & Fiske, 1959). However, the above definitions only covers some portions of construct validity. A more precise definition would be "the degree to which a concept (term, variable, construct) achieves theoretical and empirical meaning within the overall structure of one's theory" (Bagozzi, 1980, p. 114).

The achievement of construct validity, it is asserted, requires satisfaction of six important criteria:

1. Theoretical meaningfulness of concepts

2. Observational meaningfulness of concepts

3. Internal consistency of operationalization

4. Convergent validity

5. Discriminant validity

6. Nomological validity

Criteria 1 and criteria 2 refer to the internal consistency of the language used to represent a concept and the conceptual relationship(s) between a theoretical variable and its operationalization(s) respectively. Criteria 3 is strictly empirical and is designed to determine the degree of internal consistency and single factoredness of one's operationalizations. Convergent validity is "the degree to which two or more attempts to measure the same concept through maximally different methods are in agreement" (Bagozzi, 1980). Discriminant validity is the degree to which a concept differs from other concepts (Campbell & Fiske, 1959).

2.9 Theoretical Framework and Hypotheses Development

The impetus guiding this research is the aim of producing a valid, reliable and constructive model of internet use-diffusion which traces the dissemination of internet technology in a network of relationships, beginning from the factors that drive the usage to the outcomes of the using the technology.

Based on the review of relevant theories in technology usage and acceptance, a theoretical framework was developed to serve as the 'blueprint' of this research. Figure 2.2 presents this study's research framework.

This research aspires to model an integrative, holistic and comprehensive network of relationships which range from the factors that drive internet usage to the outcomes that can lead to future consumption. By examining previous works, a need is felt to secede from overly-examined, concentrated facets of technology adoption to a model that encompasses a wider scope of study and can better present a more complete picture of technology diffussion in the society. In that, a framework comprising of a nomological network of use-diffusion representing the concepts, variables of interest, their observable manifestations, and (inter)relationships among and between these variables is constructed. This warrants the use of structural equation modeling technique as it is far superior in its capability to analyze the whole series of relationships in the model at once compared to the typical regression analysis in which the model would have to be analyzed in separate steps.

Given the extensive number of variables and relationships present, the framework, accordingly, is viewed from three stages. This is such as the variables studied hold both independent and dependent roles. In the first stage, there are six independent variables which are postulated to drive the intensity of internet usage (dependent variable). The said variables are utilitarian benefits, effort expectancy, external influences, innovativeness, internet playfulness and perceived enjoyment. In the next stage, intensity of use (or usage as it is called interchangeably) as the independent variable is hypothesized to lead to the dependent variables of perceived impact of the internet, satisfaction in using the internet and interest in future-technologies. Subsequently in the third and last stage, perceived impact, satisfaction and interest in future technologies (this time as independent variables) are presumed to result in future consumption (dependent variable).

2.9.1 Utilitarian Benefits

People tend to use or not use a system if they believe that the system is useful, functional and effective and seen to produce valued outcomes such as enhancing one's job performance (Davis, 1989; Davis et al., 1989). The more the benefits derived from using the internet, the higher the user's propensity to increase the intensity of use. Therefore, it is hypothesized that:

H1a: Utilitarian benefits has a positive influence on intensity of use.

2.9.2 Effort Expectancy

A system also has to be relatively easy to understand and use, not complicated or confusing (Davis, 1989; Davis et al., 1989; Moore & Benbasat, 1991). If the internet is perceived to be easy to use, in other words, not much effort is to be exerted; the likelihood of users spending more time on the internet increases, thereby giving way to the notion that:

H1b: Effort expectancy has a positive influence on intensity of use.

2.9.3 External Influences

Apart from reasons related to the system's characteristics, the power of external parties cannot be ignored. The user might be influenced by the opinions of other significant people around him/her and also the messages from the media, e.g. the local dailies, television, radio, etc in which they believe how others will view them as a result of having used the technology (Ajzen, 1991; Davis et al., 1989; Fishbein & Ajzen, 1975; Mathieson, 1991; Moore & Benbasat, 1991, Taylor & Todd, 1995). In this manner, it is suggested that:

H1c: External influences has a positive influence on intensity of use.

2.9.4 Innovativeness

The element common to both adoption and use-diffusion theories is innovativeness, an inherent trait to acquire and experiment with the latest technologies, as well as to be a technology pioneer and thought leader (Parasuraman, 2000). The presence of innovativeness is thought to be able to speed up the process of technological diffusion, hence, permitting the premise that:

H1d: Innovativeness has a positive influence on intensity of use.

2.9.5 Internet Playfulness

An individual's tendency to interact spontaneously with a technology/system i.e. internet playfulness (Webster, 1989; Webster & Martocchio, 1992) can potentially affect the intensity of internet usage. The contention is such that the possibility of a person to engage in longer and more frequent hours of usage will be higher if the person displays more playfulness traits e.g. spontaneity, imaginativeness, creativity. In this respect, it is argued that:

H1e: Internet playfulness has a positive influence on intensity of use.

2.9.6 Perceived Enjoyment

In logical sense, if the activity of using the internet is perceived to be personally enjoyable in its own right aside from the instrumental value of technology (Davis, et al., 1992; Yi & Hwang (2003), there exists a higher likelihood that the person will be involved in higher intensity of use. With that, it is alleged that:

H1f: Perceived enjoyment has a positive influence on intensity of use.

2.9.7 Intensity of Use and Use-Diffusion Outcomes

On the relationship between intensity of use and use-diffusion outcomes, the argument here is that the more time a person spends on the internet, naturally some change is evident in the user's life. The impact may be witnessed in terms change in a person's daily routine, communication, etc. As more time is spend on the internet, the contention is such that the user will undergo a period of experimentation with the many other applications available on the internet. This process of discovery will lead to a sense of satisfaction in experiencing the wonders of using the internet. It can perhaps also create interest in other technologies, embedding a fascination for tech gadgets and opening up the person's mind to the endless possibilities that technology has to offer. Therefore, it is surmised that:

H2a: Intensity of use is positively related to perceived impact of the internet.

H2b: Intensity of use is positively related to satisfaction in using the internet.

H2c: Intensity of use is positively related to interest in future-oriented technologies.

2.9.8 Use-Diffusion Outcomes and Future Consumption

In relation to the proposition above, the effects of perceived impact, satisfaction and interest in future-technologies is hypothesized to result in future consumption. The change in routines for instance will create a dependency on the internet for continued usage. Similarly, a growing satisfaction in using the internet presents a higher possibility for continuous future consumption. As a person develops a keen interest in future oriented technologies, it is quite likely that internet usage will be further enhanced as the use of internet is intertwined with many other technological products (think digital cameras and the related downloads available on the products' website). Thus, it is sufficient to say that:

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