INVESTIGATING CONSUMER ADOPTION, USAGE AND IMPACT OF BROADBAND: UK HOUSEHOLDS

A thesis submitted for the degree of Doctor of Philosophy

By

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Dedicated To

Sudha Didi and Murly Jija

Niece Kirti

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For all your love, support and constant encouragement, which has enabled me to reach this milestone. I could not have imagined achieving this without you all.

ABSTRACT

Despite a large investment, the majority of countries especially the UK demonstrate a slow adoption of broadband. In order to enhance the adoption and use of broadband this research examines the factors influencing the decisions of household consumers. This research aims to address the two main areas of concern: first, to investigate consumer-level factors affecting the adoption of broadband in UK households; and second, to understand the usage of broadband and its impact upon household consumers in the UK. This research adopted a quantitative approach that was executed in the following steps. First, it developed a conceptual model by selecting and justifying relevant constructs from appropriate theories and models related to technology adoption, usage and impact. Second, it operationalised the constructs by developing and validating the research instrument by employing the content validity, reliability and construct validity approach. Finally, it empirically validated and refined the conceptual model by employing a survey research approach.

The findings suggested that all the constructs included in the conceptual model, except knowledge, significantly influence the consumers when adopting broadband in a UK household. The significant constructs include relative advantage, utilitarian outcomes, hedonic outcomes, primary influence, facilitating conditions resources and self-efficacy. The rate and variety of Internet usage is significantly higher for broadband consumers than narrowband ones. It was also found that significantly more numbers of broadband consumers perceived changes in time allocation patterns on various daily life activities than narrowband ones. This research contributes towards theory, practice and policy. The contribution of this research towards theory is that it integrates and determines the appropriate information systems (IS) literature in order to enhance knowledge of technology adoption from the consumers' perspectives. An added contribution to theory is the development and validation of a research instrument that future studies can utilise to examine broadband and other similar technologies in household context. Considering the slow adoption of broadband, this research also provides implications for policy makers and the providers of broadband in order to encourage and promote homogenous adoption and usage.

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Guru Brahma Gurur Vishnu, Guru Devo Maheshwaraha
Guru Saakshat Para Brahma, Tasmai Sree Gurave Namaha

[...I offer my salutations to such a Guru who creates and sustains knowledge and destroys the weeds of ignorance.]

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List of Abbreviations

ADSL	Asymmetric Digital Subscriber Line
ANOVA	Analysis of Variance
B-2-C E-Commerce	Business-2-Consumer Electronic Commerce
BAG	Broadband Advisory Group
BBC	British Broadcasting Corporation
BI	Behavioural Intentions
BISP	Behavioural Intentions to Change Service Providers
BSG	Broadband Stakeholder Group
BT	British Telecommunication
BAB	Broadband Adoption Behaviour
C-2-C E-Commerce	Consumer-2-Consumer Electronic Commerce
CVR	Content Validity Ratio
DI	Diffusion of Innovations
DSL	Digital Subscriber Lines
DTI	Department of Trade and Industry
DTPB	Decomposed Theory of Planned Behavior
E-government	Electronic Government
FCR	Facilitating Conditions Resources
GCSE	General Certificate of Secondary Education
GNVQ	General National Vocational Qualification
HO	Hedonic Outcomes
ICTs	Information and Communications Technologies
IS	Information Systems
IT	Information Technology
ISPs	Internet Service Providers
ITU	International Telecommunication Union
KMO	Kaiser-Meyer-Olkin
MATH	Model of Adoption of Technology in Households
MBA	Model of Broadband Adoption
MSA	Measure of Sampling Adequacy
OECD	Organization for Economic Co-operation and Development
Ofcom	Office of Communications
Oftel	Office of Telecommunications
Non-QPR	Non-quantitative positivist research

PBC	Perceived Behavioural Control
PC	Personal Computer
PCA	Principal Component Analysis
PI	Primary Influence
QPR	Quantitative Positivist Research
RA	Relative Advantage
SD	Standard Deviation
SE	Self-efficacy
SI	Secondary Influence
SQ	Service Quality
SMEs	Small and Medium Enterprises
TAM	Technology Acceptance Model
TPB	Theory of Planned Behavior
TRA	Theory of Reasoned Action
TV	Television
UD	Use Diffusion
UK	The United Kingdom
UO	Utilitarian Outcomes
UTAUT	Unified Theory of Acceptance and Use of Technology
USA	The United States of America
VIF	Variance Inflation Factor
VoIP	Voice Over Internet Protocol
Wi-Fi Networks	Wireless Fixed Networks
χ^2 test	Chi-Square test

DECLARATION

Some of the material contained in this dissertation has been presented in the following publications. These include various aspects of the theoretical and practical findings that are described in this dissertation.

Refereed Journal Papers: Published

Choudrie, J. and Dwivedi, Y. K. (2005). The demographics of broadband residential consumers of a British local community: The London Borough of Hillingdon. *Journal of Computer Information Systems*, 45 (4), 93-101.

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Refereed Journal Papers: Under Review

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Choudrie, J. and Dwivedi, Y. K. (2004). Analysing the Factors of Broadband Adoption in the Household. *Proceedings of the 12th European Conference on Information Systems* (ECIS-2004), Turku Finland, June 14-16, 2004.

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Choudrie, J. and Dwivedi, Y. K. (2004). Investigating the socio-economic characteristics of residential consumers of broadband in the UK. *Proceedings of the American Conference of Information Systems*, pp 1558- 1567, New York City, USA, August 5-8, 2004.

Choudrie, J. and Dwivedi, Y. K. (2004). Investigating the research approaches for examining the technology adoption in the household. *Proceeding of the 3rd European Conference on Research Methodology for Business and Management Studies* (ECRM-2004), Reading UK, April 29-30, 2004.

Choudrie, J. and Dwivedi, Y. K. (2004). Developing a model of broadband adoption in the household. *Proceeding of the ETHICOMP 2004 conference*, Syros, Greece, April 14–16, 2004.

Refereed Conference Papers: Accepted/Forthcoming

Choudrie, J. and Dwivedi, Y. K. (2005). Examining the Socio-economic determinants of broadband Adopters and Non-adopters in the United Kingdom. **Forthcoming** in *the Proceedings of the HICSS*-2006.

PhD Consortium Paper

Dwivedi, Y. K. (2003). Evaluating the impact of broadband on various Internet users. *Proceedings of 12th PhD Consortium of United Kingdom Academy for Information Systems* (UKAIS), page 19-27, April 8th -9th, The University of Warwick, Warwick, UK

Chapter 1: Introduction

1.1 INTRODUCTION

This chapter provides an introduction to the proposed research. The following section provides a definition of broadband, outlines broadband's potential and then provides a discussion of the research problem. Section 1.3 will provide a discussion on the state of broadband adoption, usage and impact. Section 1.4 will define the research aim and objectives. A discussion of the research approach that will be used to achieve the proposed aims and objectives are offered in Section 1.5. The research contributions of this study are then offered in Section 1.6. To familiarise the readers with the remaining dissertation, an overview is offered in Section 1.7. Finally, Section 1.8 provides a summary of this chapter.

1.2 RESEARCH PROBLEM

1.2.1 Defining Broadband

Before proceeding further, a term frequented within this dissertation is 'broadband' and a short explanation of it is warranted. The umbrella term of 'broadband technology' embraces a variety of high-speed access technologies, including ADSL (Asymmetric Digital Subscriber Line), cable modems, satellite, and Wi-Fi (Wireless Fixed) Networks (Sawyer *et al,* 2003). The term 'broadband' has no established definition. It varies amongst countries (Firth and Kelly, 2001) and evolves over time, as the underlying transmission and routing technologies continuously advance; yesterday's broadband is today's 'narrowband' (Sawyer *et al,* 2003).

Given the variations in defining 'broadband', for the purpose of this research we follow the technology neutral definition suggested by the Broadband Stakeholder Group (BSG) that defines broadband as "*always on access, at work, at home or on the move provided by a range of fixed line, wireless and satellite technologies to progressively higher bandwidths capable of supporting genuinely new and innovative interactive content, applications and services and the delivery of enhanced public services*' (BSG, 2001). This definition was chosen, as it is technology neutral. That is, it has less to do with the technical speed and instead focuses on functionality, which is more to do with what a user can do with broadband (Sawyer *et al,* 2003). According to Ofcom (2005), the term 'broadband' refers to higher bandwidths and always on services offering data rates of 128 kbps and above. Dial-up or narrowband refers to internet access that offers speed equal to or below 128 kbps (Ofcom, 2005).

1.2.2 Outlining the Potential of Broadband

Since the emergence of the Internet, broadband is being considered as the most significant evolutionary step. It is considered to be a technology that will offer end users with fast and always-on access to new services, applications and content with real lifestyle and productivity benefits (Sawyer *et al*, 2003). International organisations such as the International Telecommunication Union (ITU) and the Organisation for Economic Co-operation and Development (OECD) foresighted broadband to be a vital means of enhancing competitiveness in an economy and also of sustaining economic growth (BSG, 2004; ITU, 2001; OECD, 2001; Oh *et al*, 2003). According to a report from the United Kingdom Broadband Stakeholder Group, broadband provides a number of ways of enhancing a national economy and quality of a citizen's life, as it stated that:

> "*...Full exploitation of broadband-enabled ICT, content, applications and services can help the UK to become a truly competitive knowledge-based economy and can be leveraged to help the UK's citizens become healthier, better educated and more engaged in their communities and society. ...Societies that adopt, adapt, and absorb the benefits of broadband enabled ICT, services and applications quickly and deeply will achieve significant benefits in terms of productivity, innovation, growth and quality of life as well as significant competitive advantage over societies that don't*...(BSG, 2004)".

The focus group BSG had the forethought that broadband will benefit a national economy in the following four ways: by delivering economic value, delivering public value, delivering efficiencies in the public sector and improving people's lives (BSG, 2004). Examples of delivering economic values include the potential of improving the productivity and competitiveness of SMEs by employing broadband as a communication channel for capturing emerging business opportunities (BSG, 2004). Broadband also offers potential benefits to larger companies as it provides an efficient supply chain and economical ways to do business with customers, such as online retailing (BSG, 2004). Furthermore, since broadband facilitates homeworking it can also save costs in office space for both large and small organisations (BSG, 2004).

Similar to commercial organisations, broadband also offers the potential to governments in creating electronic services and delivering them to citizens in a cost effective and transparent manner. By exploiting the potential of broadband, direct benefits can be obtained that include improvements in education delivery, empowering patients, effective utilisation of patient records and employing cost effective broadband for enabling tele-monitoring health applications in order to reduce the number of patients in hospitals (BSG, 2004). Such electronic services in the public sector will specifically help to reduce the cost of delivery, increase the quality of healthcare, thereby increasing the citizens' trust and confidence in public services and generally in the government (BSG, 2004). The Gershon

spending review 2004 suggested a direct link between ICT investment made by the government and the ability of ICTs in delivering efficient savings in the government (BSG, 2004).

Broadband can also improve citizens' lives in several ways. It can help equip children with ICTs skills for employment purposes and improve the way they obtain education. Similarly, since broadband facilitates working at home, it can help people to obtain a better work/life balance that is characterised by more empowerment, more productivity and less stress. Broadband also offers direct benefits to elderly people, as it can be utilised to provide personalised care at home; hence, removing the need to live in hospitals or care homes (BSG, 2004).

The aforementioned discussion on the potential of broadband clearly suggests that accessibility, adoption and use of broadband are likely to transform and affect almost every aspect of everyday life (Oh *et al*, 2003). Therefore, in order to harvest its full potential, it is appropriate to understand the deployment and adoption of such emerging technologies.

1.2.3 Outlining Research Problem

Although broadband offers several advantages to the public and private sectors in terms of cost savings, efficiency and competitiveness, the shift to broadband requires massive investments in terms of new networks and infrastructures, along with the development of new content, services, applications and business models. As discussed above (Section 1.2.2), since broadband diffusion is regarded as a measure of international competitiveness (BSG, 2004; Langdale, 1997; Oh *et al*, 2003; Sawyer *et al*, 2003), many governments around the world have set ambitious targets for the deployment of broadband services (BAG, 2003; National Broadband Task Force, 2001; Office of Technology Policy, 2002; Office of the e-Envoy, 2001). This is because the high penetration rate of broadband is perceived to have a positive impact on the growth and development of the Internet, electronic commerce and the information economy (Lee *et al,* 2003; Sawyer *et al*, 2003). The United Kingdom (UK) government believes that the rapid rollout and adoption of broadband across the nation is important to both its social and economic objectives (Oftel, 2003); hence it has made a commitment to making the UK the most competitive and extensive broadband market in the G7 (Office of the e-Envoy, 2001). Therefore, governments of a number of countries including South Korea, Japan, Hong Kong, Sweden, Canada and also the UK have made large investments for developing a broadband infrastructure that will deliver high speed internet access to end users, including the household consumers and SMEs (BSG, 2004; OECD, 2001; Oh *et al*, 2003; Sawyer *et al*, 2003).

Despite a large investment for developing the infrastructure, the majority of countries have had slow adoption rates of broadband (OECD, 2001; Oftel, 2003). Although the UK initiated an early rollout of infrastructure competition, the rate of broadband adoption has been relatively slow since the start (OECD, 2001). According to an Oftel (2003) report until the year 2003 the growth rate of broadband was slower than other similar European and North American countries, such as Sweden, France, Germany and USA (Oftel, 2003). Furthermore, Oftel's (the UK's communication regulator until 2003) international benchmark study (Oftel, 2003) also suggested that the percentage growth of residential broadband subscriptions was slowing down in all countries including the UK (Figure 1.1). Due to intense competition amongst Internet Service Providers (ISPs), it has been found that there was a sharp decrease in price (i.e. a monthly subscription fee offered to residential consumers) between 2002 and 2003 (Oftel, 2003). It has been suggested that when the numbers of cable modem connections are excluded, in terms of price of broadband the UK is similar to France and cheaper than all other similar European and North American countries (Ofcom, 2004). This sharp decrease in price led to sudden increases in household broadband subscriber numbers to 3.2 million (12 per cent of households) (Ofcom, 2004).

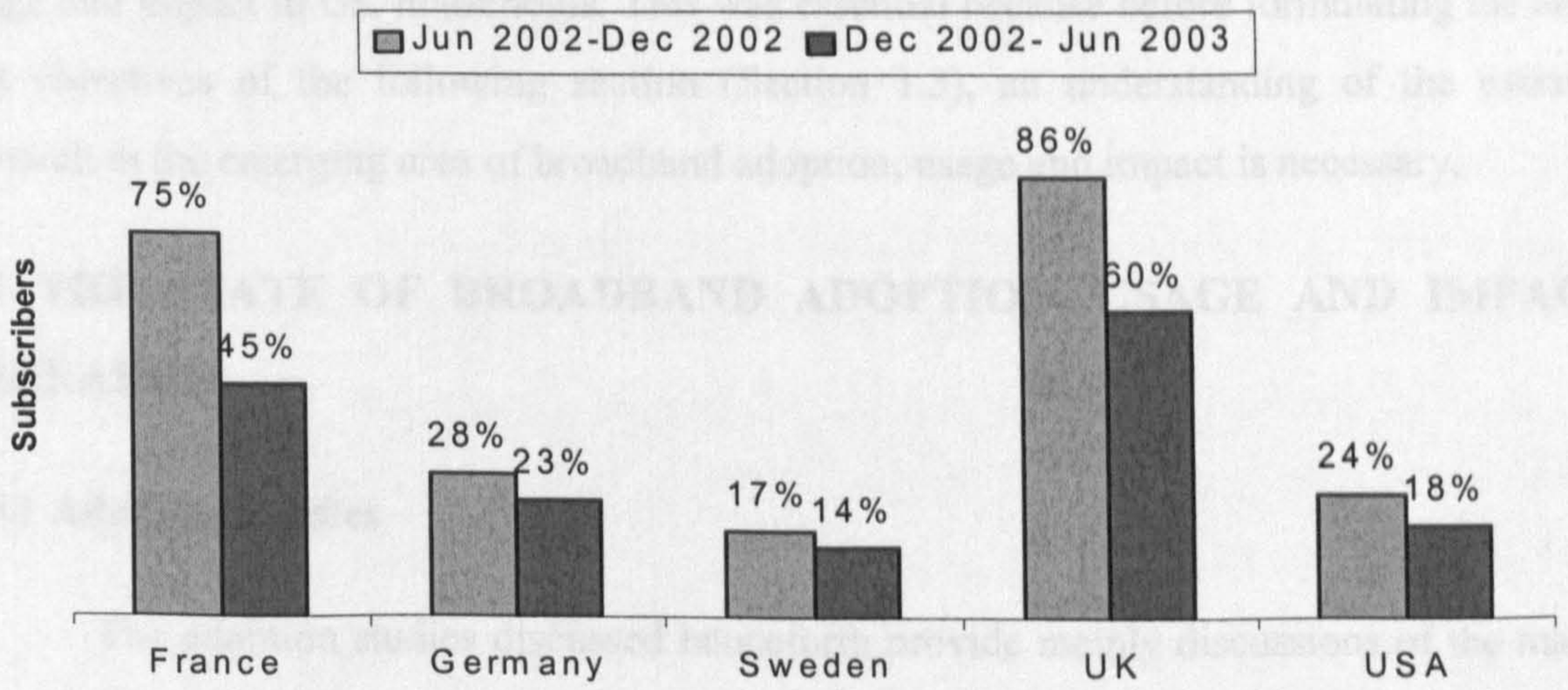

Figure 1.1: Percentage growth in broadband subscriber numbers **(Adopted from Oftel, 2003)**

In the summer of 2005, the UK's incumbent monopolist British Telecommunication (BT) reached 99.6 percent in terms of broadband coverage to the households in the UK; however, the total numbers of reported broadband subscribers have reached only 3.99 million (15% per cent of households) (Ofcom, 2005). This is only a 3 per cent increase since last year, which suggests a further slow down in broadband's adoption rate. A recent BBC news article has found that the market research organisation Point Topic has suggested that there is a "considerable slow-down in the rate at which households adopt the internet" (BBC News, 2005). According to Point Topic's study, the existing net users are upgrading their connections to get more out of it. However, new users are "unlikely to sign up a fast

connection straight away" (BBC News, 2005). Such saturation is already visible in South Korea and Hong Kong (BBC News, 2005). The few recent reports and news have also indicated heterogeneous adoptions, possible digital divides and digital choices in terms of broadband adoption (BBC News, 2005; Dutton *et al*, 2005; Kinnes, 2005). These studies suggest that there are socio-economic factors that are affecting the homogenous adoption of broadband.

Despite the provision of broadband access at affordable prices, the demand for broadband has not increased as expected in many countries around the globe. Researchers are suggesting that the provision of broadband is more 'demand constrained' than 'supply constrained' (Haring *et al*, 2002). This means that in order to enhance the homogenous adoption and use of broadband and to reduce the digital divide, it is appropriate to focus on understanding the factors influencing the decisions of household consumers (Crabtree, 2003; Oh *et al*, 2003; Stanton, 2004). Previous research undertaken on the adoption of technology, such as Personal Computers by residential consumers, has also emphasised the role of the demand perspective (Venkatesh and Brown, 2001). The discussions presented above have provided the motivations for conducting research on the consumer adoption of broadband, its usage and impact in UK households. This was essential because before formulating the aims and objectives of the following section (Section 1.3), an understanding of the existing research in the emerging area of broadband adoption, usage and impact is necessary.

1.3 THE STATE OF BROADBAND ADOPTION, USAGE AND IMPACT RESEARCH

1.3.1 Adoption Studies

The adoption studies discussed henceforth provide mainly discussions of the macro factors that drive the success or slow uptake of broadband deployment. As stated earlier, research on the topic of broadband adoption at the micro level is minimal (Crabtree, 2003; Oh *et al*, 2003; Stanton, 2004). In an initial study of broadband deployment in South Korea, Lee *et al* (2003) identified three major factors comprising public sector actions, private sector actions and the socio-cultural environment factors that explained the high rate of broadband adoption in South Korea. Further research suggested that six success factors are responsible for driving the high penetration rate of broadband within the South Korean residential consumers (Choudrie and Lee, 2004; Lee and Choudrie, 2002). These six key factors consist of the government's vision, strategy and commitment, facilities-based competition, pricing, the PC Bang phenomenon, culture and geography and demographics (Choudrie and Lee, 2004; Choudrie *et al,* 2003ab). To obtain a more balanced view, the UK

perspective was also investigated. Dwivedi *et al* (2003) examined the ISPs views on factors affecting broadband adoption in the UK. This exploratory study suggested that a high price, lack of content and awareness are the factors that are severely affecting the adoption of broadband amongst the residential consumers (Dwivedi *et al,* 2003).

However, now adoption studies on consumers have begun to emerge. Amongst the initial studies is one by Oh *et al* (2003). This study examined the individual level factors affecting the adoption of broadband access in South Korea by combining factors taken from Rogers' diffusion theory and the technology acceptance model (Oh *et al,* 2003). The findings of this study suggest that congruent experiences and opportunities in adopting a new technology affect user attitudes through the three extended technology acceptance model constructs; namely perceived usefulness, perceived ease of use and perceived resources (Oh *et al*, 2003). Stanton (2004) has also analysed the secondary data of the USA consumers in order to study the digital divide and suggested an urgent need to understand the demography and other factors of broadband adopters and non-adopters in order to increase the growth rate of broadband and also to bridge the digital divide (Stanton, 2004).

1.3.2 Usage and Impact Studies

Usage is the other topic of interest in the IS area and is pertinent to this research. Studies in this area have been in the form of user surveys that have examined broadband users' behaviour in comparison to that of narrowband users (Anderson *et al*, 2002; Bouvard and Kurtzman, 2001; Carriere *et al,* 2000; Dwivedi and Choudrie, 2003ab; Horrigan *et al,* 2001). Results from these surveys suggest that internet users behave differently when they have broadband access (Carriere *et al,* 2000; Dwivedi and Choudrie, 2003a). Broadband users use the online facilities on a longer basis, utilise more services or applications and apply them more often (Carriere *et al,* 2000; Dwivedi and Choudrie, 2003a; Horrigan *et al,* 2001). The majority of broadband users rate their online experience as compelling (Anderson *et al*, 2002; Carriere *et al,* 2000; Dwivedi and Choudrie, 2003a; Horrigan *et al,* 2001). In comparison to dial-up users, broadband users spend more total time on electronic media applications such as online music (Bouvard and Kurtzman, 2001). Surveys conducted on broadband users also suggest that these users make more online purchases and procure more varied categories of products in comparison to narrowband users (Carriere *et al,* 2000; Dwivedi and Choudrie, 2003b). Although the aforementioned studies examined the usage of broadband, they lack theoretical underpinnings, as they are led by data and are exploratory in nature (Oh *et al*, 2003). Understanding the impact of broadband usage on the consumers' daily life is still untouched by previous studies.

The aforementioned discussion on broadband adoption and usage suggests that there were few efforts made to examine broadband diffusion from the household consumer perspective. Furthermore, the aforementioned studies were not statistically tested to determine the differences between broadband consumers and narrowband consumers; hence, these studies lack statistical conclusion validity in their findings (Straub *et al*, 2004). Another observation from previous literature analysis suggests that existing studies examined exploratory issues related to either the adoption or usage of broadband. None of them provides a thorough understanding of all three components of broadband diffusion (i.e. adoption, usage and impact) from the household consumer's perspective. Therefore, both discussions on the aforementioned research problem (Section 1.2.3) and the lack of studies on broadband adoption, usage and impact provide the motivation to undertake this study. Before outlining the aims and objectives in Section 1.4, the following subsection defines the scope of the current study.

1.3.3 Scope and Definitions

Whilst studying the diffusion of broadband, there are many stakeholders to consider, including the government, ISPs, business consumers, public organisations and residential consumers (Choudrie *et al*, 2003ab). The previous discussions clearly suggest broadband adoption is demand constrained and existing studies have not yet addressed the issue of consumer adoption, usage and the impact of broadband in UK households. The focus of this study is, therefore, the UK household consumer of broadband. Hence the proposed conceptual model (Chapter 2) will only consider factors and studies that are relevant to the household consumers. As mentioned above, a focus upon the UK household consumers is considered to be imperative for this study, and the two main reasons for this are as follows. First, as existing studies have mainly considered only the supply side stakeholders, there has been little attention paid to the examination of consumers. Second, at this stage of broadband implementation, the supply side factors are not considered to be problems; however, growth is constrained by the demand side as consumers are reluctant to subscribe to the technology in question.

Since the focus of this research is the consumers, at this point the differentiating factor between the terms of consumers and users is provided. According to Rice (1997), 'consumers' are those who pay for services and goods, whilst 'users' are individuals who are affected by or who affect the products or services. In other words, users are those who use the products and services but do not pay for them (Rice, 1997). For example, a child can be categorised as a user since he/she uses broadband for online gaming and to undertake

homework; however, the child does not pay for the service. Contrastingly, the parent can be identified as a consumer as well as a user since he/she pays and uses the service.

For the purpose of this research, the term 'diffusion' is defined as "the process by which an innovation is communicated through certain channels over time among the members of a social system" (Rogers, 1995, pp. 5). The term 'innovation' refers to "an idea, practice or object that is perceived as new by an individual or other unit of adoption" (Rogers, 1995, pp. 11). The meaning of 'newness of an idea' or 'innovation' is likely to differ from consumer to consumer. If the idea seems new to an individual, it is an innovation (Rogers, 1995). For example, broadband may not be an innovation for someone who has already subscribed to it. However, if someone does not know about broadband or has not subscribed to it then, for such a consumer, broadband would be considered as an innovation. Since a large number of UK household consumers have not yet subscribed to broadband, for the purpose of this research it is considered as an innovation. The study of diffusion involves three components: the adoption of a new innovation, its usage and the subsequent impact of its usage (Rogers, 1995). Therefore, this study will examine the constructs relevant to broadband adoption, usage and its impact on household consumers in the UK.

1.4 RESEARCH AIMS AND OBJECTIVES

Researchers in the Information Systems (IS) field have been studying the adoption of Information and Communication Technologies (ICTs) at the organisational level (Venkatesh and Brown, 2001). However, until recently IS research less frequently conducted studies related to household adoption and the impacts of ICT. Due to the advent of the Internet within daily life, ICTs have become an essential part of everyday life (Oh *et al*, 2003). This has led researchers to conduct studies within the household context or, in other words, moving beyond the organisational level. Mingers and Stowell (1997) argued that "Information Systems is much more than simply the development of computer-based business systems- electronic and information technology is now so fundamental within society that IS as a discipline must concern itself with the general evolution of human communication".

In line with this, one of the first studies within the IS field to examine the adoption of Personal Computers (PC) in the household was recently undertaken (Venkatesh and Brown, 2001). To continue the aforementioned research, but within a different context, Anckar (2003) offered an understanding of the drivers and inhibitors to e-commerce adoption within Finnish households. Although such studies are becoming prevalent, they have not yet been extended to examine the adoption of emerging ICTs such as broadband. This is due to the technology in question, broadband, still taking off in the market. It can be

found that the majority of the research associated with the topic of broadband is still exploratory in nature, mainly focusing on the usage of the technology, and provides little insight into consumer adoption or rejection determinants. Sawyer *et al* (2003) argued that "The differential rates of use and growth, suggest that understanding broadband connectivity is a complex milieu". Hence, investigating adoption, usage and impact of broadband in the context of household consumers is expected to make an incremental contribution to Information Systems research.

Bearing the aforementioned discussion in mind, the main aim of this study is to *investigate consumer-level factors affecting the adoption of broadband in UK households.* This study also aims to *understand the usage of broadband and its impact upon household consumers in the UK.* To achieve the overall aim, the following research objectives shall be undertaken:

1. To develop a conceptual model for examining consumer adoption, usage and impact of broadband. This will be achieved by first reviewing the theories and models that focus upon individual and/or consumer adoption, usage and impact of technology. The next step is to select relevant constructs from appropriate theories and models and formulate a research hypothesis in order to examine broadband adoption, usage and impact from the UK household consumer's perspective.

2. To operationalise the constructs included in the conceptual model by developing a research instrument and demonstrating their reliability and validity. The research instrument will be developed and validated utilising content validity, reliability and construct validity approaches.

3. To empirically validate and refine the proposed conceptual model in order to examine broadband adoption, usage and impact in UK households. This will be achieved by collecting and analysing data from the UK household consumers.

4. To provide implications for practice and policy that may encourage consumer adoption and use of broadband. Furthermore, there will be a reflection of the impact of consumer use of broadband.

Based on the aforementioned aims and objectives, Chapter 2 delineates the research questions and hypotheses in order to understand the factors influencing consumer adoption of broadband, its usage and impact in the UK households.

1.5 RESEARCH APPROACH

Since the research object in this study is the household consumer, it can be argued that the survey approach is the most suitable research approach for this study. This is due to issues such as convenience, cost, time and accessibility (Gilbert, 2001). The extent to which a researcher can be a part of the context being studied is an important factor in determining the research approach. Within the household context, it is difficult for a researcher to be a part of the context; therefore the survey approach was more feasible than others such as case study, ethnography and observations. Selection of the approach in this case is also influenced by the type of theory and models employed to examine research related to broadband adoption and diffusion (Chapter 2). A conceptual model proposed in Chapter 2 includes a number of research hypotheses that need to be tested before concluding this study. This requires collecting quantitative data and statistical analysis in order to test research hypotheses. Although there are a number of research approaches available within the category of quantitative positivist research (Straub *et al*, 2005), a survey is the only appropriate research approach that can be employed to conduct such research (i.e. that which requires hypotheses testing and validation of conceptual model) in a social setting, in this instance the household.

Furthermore, the aim of this research is to examine broadband adoption and diffusion across the UK, which is a nationwide perspective. Hence, in order to get an overall picture of the research issue, the collection of data from large numbers of participants from across the UK is essential. It means that employing any other approach, such as ethnography, that utilises an interview or observation as data collection tools, demands huge amounts of financial resources, manpower and time (Cornford and Smithson, 1996). As this is a student research project, all three factors are limited, and this restricted the ability of the researcher in employing them for the investigation of this research. One of the planned contributions of this study is to provide insights to ISPs about the factors that are salient to consumer adoption and non-adoption of broadband, and to establish relationships between factors such as behavioural intention and actual adoption. In order to achieve this, it is vital to collect quantitative data on a number of variables including demographics and to perform a regression analysis that illustrates this relationship. This is another logical reason for adopting the quantitative approach via a survey and collating data that may assist ISPs in understanding the behaviour of household consumers and their demographic characteristics in order to encourage and promote broadband adoption.

The quantitative data was collected from the UK household consumers. In order to collect empirical data from the target population, a self-administered questionnaire via mail

was considered to be the most appropriate data collection method. The reasons for using the self administered questionnaire are: it addresses the issue of reliability of information by reducing and eliminating differences in the way in which the questions are asked (Cornford and Smithson, 1996); it involves relatively low costs of administration; it can be accomplished with minimal facilities; it provides access to widely dispersed samples; respondents have time to provide thoughtful answers; it assists with asking long questions or complex response categories; it allows asking of similar repeated questions; and also the respondents do not have to share answers with interviewers (Fowler, 2002).

The collated data was analysed using SPSS version 11.5. In order to collate the data, it was appropriate to employ the UK-Info Disk V11 database as a sampling frame, stratified random sampling as a basis of sample selection, and a postal (i.e. mail) questionnaire as a data collection tool. Reasons for the aforementioned selection are provided in Chapter 3. Issues relating to data analysis are also discussed in detail in Chapter 3 which suggests that a number of statistical techniques such as factor analysis, *t*-test, ANOVA, χ^2 test, discriminant analysis, linear and logistics regression analysis are appropriate for utilisation in data analyses.

1.6 RESEARCH CONTRIBUTIONS

This research is expected to contribute towards theory, practice and policy. The theoretical contribution of this research is that it integrates the appropriate IS literature in order to enhance knowledge of technology adoption from the consumer perspective. It also contributes towards theory by empirically confirming the appropriateness of various constructs and validating a conceptual model in the context of household consumers. This study also contributes towards theory as it develops and validates a research instrument for data collection. The instrument examines broadband adoption, usage and impact. According to Straub *et al* (2004) it is essential to create and validate new measures or instruments in a situation where theory is advanced; however, prior instrumentation is not developed and validated. Such efforts are considered to be a major contribution to scientific practice in the IS field (Straub *et al*, 2004).

Considering the slow adoption of broadband, it can be learnt that the policy makers and the providers of the innovation - in this case the telecommunications industry - holds a particular interest in the findings of this study. Policy makers are currently investigating how to increase the diffusion of broadband within their own country, and so information on other countries' experiences will be useful. The telecommunications industry is interested in determining how to improve their current strategies. Therefore, for both policy and practice, this study offers an understanding of the broadband diffusion strategies at a household

consumer level. This is particularly useful as there is little research published in the area of consumer adoption, usage and impact of broadband.

1.7 DISSERTATION OUTLINE

This dissertation comprises seven chapters. A brief description of each chapter is provided below and for clarity of illustrations, the structure of this dissertation is summarised in Figure 1.2. **Chapter 1** provides an overview for this dissertation. The chapter first describes the research problem and delineates the scope of this study. Then it analyses the state of research in the area of broadband adoption, usage and impact from a household consumer perspective. This leads to outlining the research aims and objectives that this research will address, followed by a brief description of the research methodology that will be utilised to conduct this research. The chapter then outlines the contributions that this research will make. Finally, a brief description of all seven chapters is provided.

Chapter 2 first reviews and assesses the appropriateness of previous technology adoption models and constructs used to study broadband diffusion. It then provides further theoretical justification for selecting the constructs that are used to study broadband diffusion, formulate the research hypotheses and finally draw a conceptual model of broadband adoption. The chapter also discusses the usage and impact aspect of broadband diffusion and identifies constructs for empirical investigations. Completion of Chapter 2 accomplishes the first objective of this research.

Chapter 3 aims to discuss research approaches in general and also those specific to this research. It will also provide the justification for the chosen research methodology, as well as detailed discussions on the specific methodological approach.

Chapter 4 aims to describe the development of a research instrument that is designed to investigate broadband adoption, usage and impact within the UK household. The chapter describes the following three stages of developing a reliable research instrument: (1) identification of the factors from the literature that are expected to explain the broadband adoption behaviour and determining them by employing an exploratory survey; (2) content validation on items that result from the exploratory survey. The purpose of this step is to confirm the representativeness of items to a particular construct domain; (3) description of a pre-test and a pilot test in order to confirm the reliability of measures. Completion of chapters 3 and 4 will accomplish the second objective of this research.

Chapter 5 presents findings obtained from a nationwide survey that was conducted to examine the adoption, usage and impact of broadband in the UK households. An illustration of these findings comprises of an estimation of response rates, nonresponse bias,

reliability, construct validity, the effect of ordering questionnaire items, descriptive statistics for both items and scale, differences between the adopters and non-adopters of broadband, demographic differences and regression analysis. The chapter also presents findings related to the usage of broadband and its effects on consumers' time allocation patterns on various daily life activities.

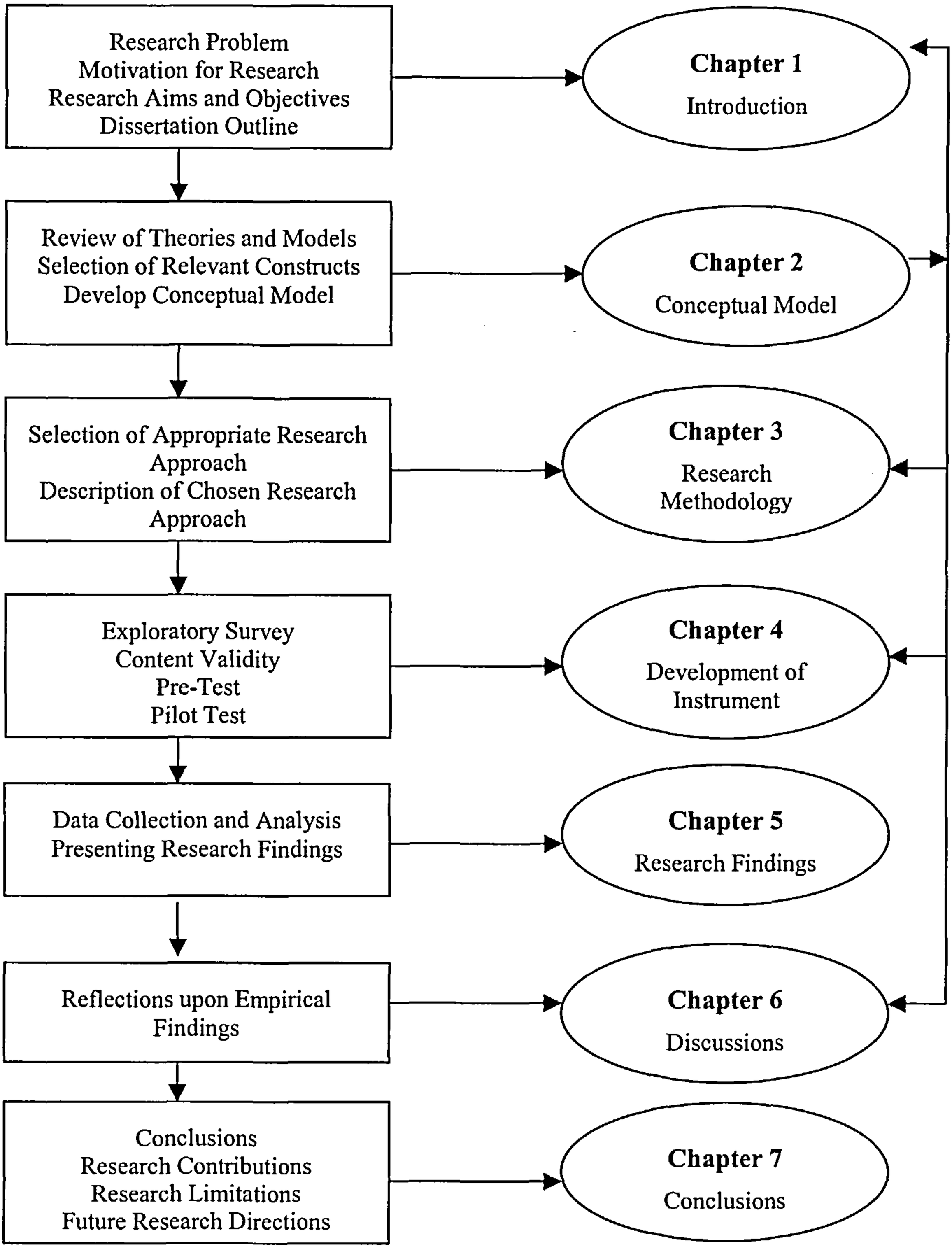

Figure 1.2: Outline of Dissertation

Chapter 6 discusses and reflects upon the findings obtained in Chapter 5 from the theoretical perspectives presented in Chapter 2. It also discusses the empirical issues that have been reported from the survey findings. This chapter first discusses the appropriateness of response rates and issues of the nonresponse bias of this survey, in the light of existing work. Then it discusses the instrument validation process by reflecting upon issues such as content validity, reliability and construct validity. After this, the refined and validated model of broadband adoption is discussed. Finally, the chapter provides a discussion on usage of broadband and how it affects consumers' time allocation patterns on various daily life activities. Completion of chapters 5 and 6 will accomplish the third objective of this research.

Chapter 7 summarises the research findings and provides a discussion of the research contributions and implications of this research in terms of the theory, policy and practice. This chapter also delineates the research limitations and presents future research directions in the area of broadband diffusion and adoption. Completion of Chapter 7 will accomplish the fourth and final objective achieved within this research.

1.8 SUMMARY

This chapter provided an introduction to the research problem that this research encompasses, and established the scope of this study. It discussed the existing research in the area of broadband adoption, usage and impact from a household consumer perspective, and went on to define the research aims and objectives that this research later addresses. A brief description of the research methodology and the contributions that this research will make were then presented. Finally, a brief description of all seven chapters was provided.

A lack of studies on consumer level broadband adoption and diffusion has resulted in a lack of appropriate conceptual models specific to broadband. Therefore, the next chapter will develop a model to understand household diffusion by identifying appropriate constructs from previous theories models on technology adoption; the chapter will also formulate the research hypotheses.

Chapter 2: Conceptual Model

2.1 INTRODUCTION

Examination of previous literature in the Information Systems (IS) area illustrates that researchers have not yet undertaken research on broadband in the areas of consumer diffusion including the adoption, usage and impact in the household (Crabtree, 2003; Oh *et al*, 2003; Stanton, 2004). Instead, most of the research associated with broadband has mainly focused on examining the macro level factors leading to adoption in a country (Crabtree, 2003; Oh *et al*, 2003; Stanton, 2004). Recently conducted studies highlight the need to understand adoption and diffusion of broadband from the household consumer perspective (Crabtree, 2003; Oh *et al*, 2003; Stanton, 2004). The limitation to studying adoption at a micro level has resulted in a lack of appropriate conceptual model specific to broadband. As pursued in previous adoption studies (Davis, 1989; Oh *et al*, 2003; Venkatesh and Brown, 2001), constructing a conceptual model specific to broadband diffusion at the household consumer level necessitates the review, identification and integration of the relevant factors related with adoption, usage and impact of technology that were examined in previous IS studies. Therefore, this chapter first reviews and assesses the appropriateness of previous technology adoption models and constructs to study broadband diffusion. Then this chapter provides further theoretical justification for selecting the constructs that are used to study broadband diffusion, formulate the hypotheses and finally draw a conceptual model of broadband diffusion.

The chapter is structured as follows. Section 2.2 provides a review of the theoretical models of technology diffusion and adoption. Then this section also provides a brief discussion of the models applied to investigate broadband related issues from the consumer perspective. Section 2.3 briefly discusses the foundations of the proposed model and also provides an overall description of the proposed conceptual model. Sections 2.4-2.10 elaborate the broadband diffusion model and respectively justifies the inclusion of the attitudinal, normative, control, behavioural intention, adoption behaviour, usage behaviour and impact constructs, and formulates the hypotheses by presenting theoretical explanations, past empirical findings, and practical examples. Finally, to conclude the chapter, Section 2.11 is provided.

2.2 TECHNOLOGY DIFFUSION AND ADOPTION THEORIES

The study of adoption/acceptance, adaptations and usage of information technology (IT) is considered to be one of the most mature areas of research within the IS discipline (Benbasat and Zmud, 1999; Hu *et al*, 1999; Venkatesh *et al*, 2003). Consequently, over time

a number of theories and models have been adopted from diverse disciplines such as social psychology, sociology and marketing, and have been modified, developed and validated by IS researchers in order to understand and predict technology adoption and usage (Benbasat and Zmud, 1999; Venkatesh *et al,* 2003). Theories and models that have been taken from other disciplines and developed by IS researchers include the Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1975); the Theory of Planned Behaviour (TPB) (Ajzen, 1991; 1988; 1985; Ajzen and Fishbein, 1980; Ajzen and Madden, 1986); the Technology Acceptance Model (TAM) (Davis, 1989; Davis *et al*, 1989); and the Diffusion of Innovation (DI) Theory (Rogers, 1995). According to the needs of IS research, these theories were further modified, extended and integrated. For instance, in order to understand various factors in detail, Taylor and Todd (1995) proposed the decomposed TPB by modifying TPB and integrating the diffusion of innovation constructs within it. Similarly, in order to understand the role of gender and social influence in technology adoption, Venkatesh and Morris (2000) extended TAM by integrating gender and subjective norm constructs with the original TAM model.

For the purpose of understanding technology adoption within the household context, Venkatesh and Brown (2001) modified the TPB to examine drivers and barriers of PC adoption. Due to the large numbers of choices of theories and models (e.g. TRA, TPB, DTP, TAM, DI, MATH), a selection of an appropriate model or various constructs from different models posed to be a problem for the upcoming technology adoption researchers. Venkatesh *et al* (2003) argued that researchers are confronted with a choice amongst a multitude of models and find that they must "pick and choose" constructs across the models, or choose a "favoured model" and largely ignore the contributions from alternative models. This led Venkatesh *et al* (2003) to review, discuss and integrate elements across eight prominent user acceptance models (TRA, TAM, the Motivational Model, TPB, a model combining the Technology Acceptance Model and the Theory of Planned Behaviour, MATH, DI, and the Social Cognitive Theory) that resulted in proposing the Unified Theory of Acceptance and Use of Technology (UTAUT). UTAUT is composed of four core determinants (performance expectancy, effort expectancy, social influence, and facilitating conditions) of intention and usage. This model also consists of four variables such as gender, age, voluntariness and experience that moderate key relationships between the aforementioned four core determinants and intention and usage.

Although aforementioned models and theories are widely tested and validated to explain the usage and adoption of technology from the 'users' perspective, their application is limited to studying the 'consumers'. Realising the potential of emerging information and

communication technologies (ICTs) for household consumers, recently, IS researchers have also begun to investigate the consumer adoption, usage and the impact of technology issues (Anckar, 2003; Oh *et al*, 2003; Venkatesh and Brown, 2001). Since the focus on consumers within the IS field is new (Venkatesh and Brown, 2001), the guiding theories, models and research approaches are in the initial stage of development, testing and validation. Therefore, in order to assist selection of an appropriate model and/or constructs for current research, the following section will review the prominent technology diffusion and adoption models and will highlight their strengths and weaknesses to study the adoption and usage of technology from the consumers' perspectives. The theory and models will be discussed in light of the empirical studies available in the related area. A combination of the various models led this research to propose the model of consumer diffusion of broadband technology and this will be discussed in detail in sections 2.3-2.11.

2.2.1 Diffusion of Innovations

The Diffusion of Innovations theory describes the patterns of adoption, illustrates the process and assists in understanding whether and how a new invention will be successful (Rogers, 1995). The meaning of the terms diffusion and innovation is already provided in a previous chapter (Chapter 1, Section 1.3.3). This theory (Rogers, 1995; Tornatzky and Klein, 1982) has been employed to study a wide range of phenomenon including the adoption and usage of technology. Within the technology adoption and usage area, this theory was used to examine a variety of factors that are thought to be determinants of IT adoption and usage including individual user characteristics (Brancheau and Wetherbe, 1990), information sources and communication channels (Nilikanta and Scammell, 1990) and innovation characteristics (Hoffer and Alexander, 1992; Moore and Benbasat, 1991; Moore, 1987). IS researchers also integrated the intentions and innovations theories combining concepts from the Theory of Reasoned Action (Moore and Benbasat, 1991) and the Theory of Planned Behaviour (Chau and Hu 2001; Taylor and Todd, 1995) with the perceived characteristics of innovations (Rogers, 1995). Since relative advantage as an innovation characteristic is employed in number of studies (Moore and Benbasat, 1991; Tan and Teo, 2000; Taylor and Todd, 1995) and easily integrated with constructs from other theories and models, it is appropriate to consider this particular innovations attribute to examine the diffusion of broadband. The Diffusion of Innovations theory also suggests that demographic factors such as age, education and income represent correlates of innovativeness, which in turn determine the adoption rate of the an innovation (Rogers, 1995). Therefore, this aspect of Diffusion of Innovations theory was considered relevant to investigate broadband adoption.

2.2.2 Theory of Planned Behaviour (TPB) and its Variations

Although the Theory of Planned Behaviour (TPB) (Ajzen, 1985; 1988; 1991; Ajzen and Madden, 1986; Schifter and Ajzen, 1985) has its roots within social psychology, it is widely adopted and adapted by IS researchers to the study of IT adoption, implementation, and use (Benbasat and Zmud, 1999). It is an extended form of the Theory of Reasoned Action (TRA), which was developed to overcome the TRA's limitations that dealt with an incomplete volitional control (Ajzen and Fishbein, 1980; Fishbein and Ajzen, 1975).

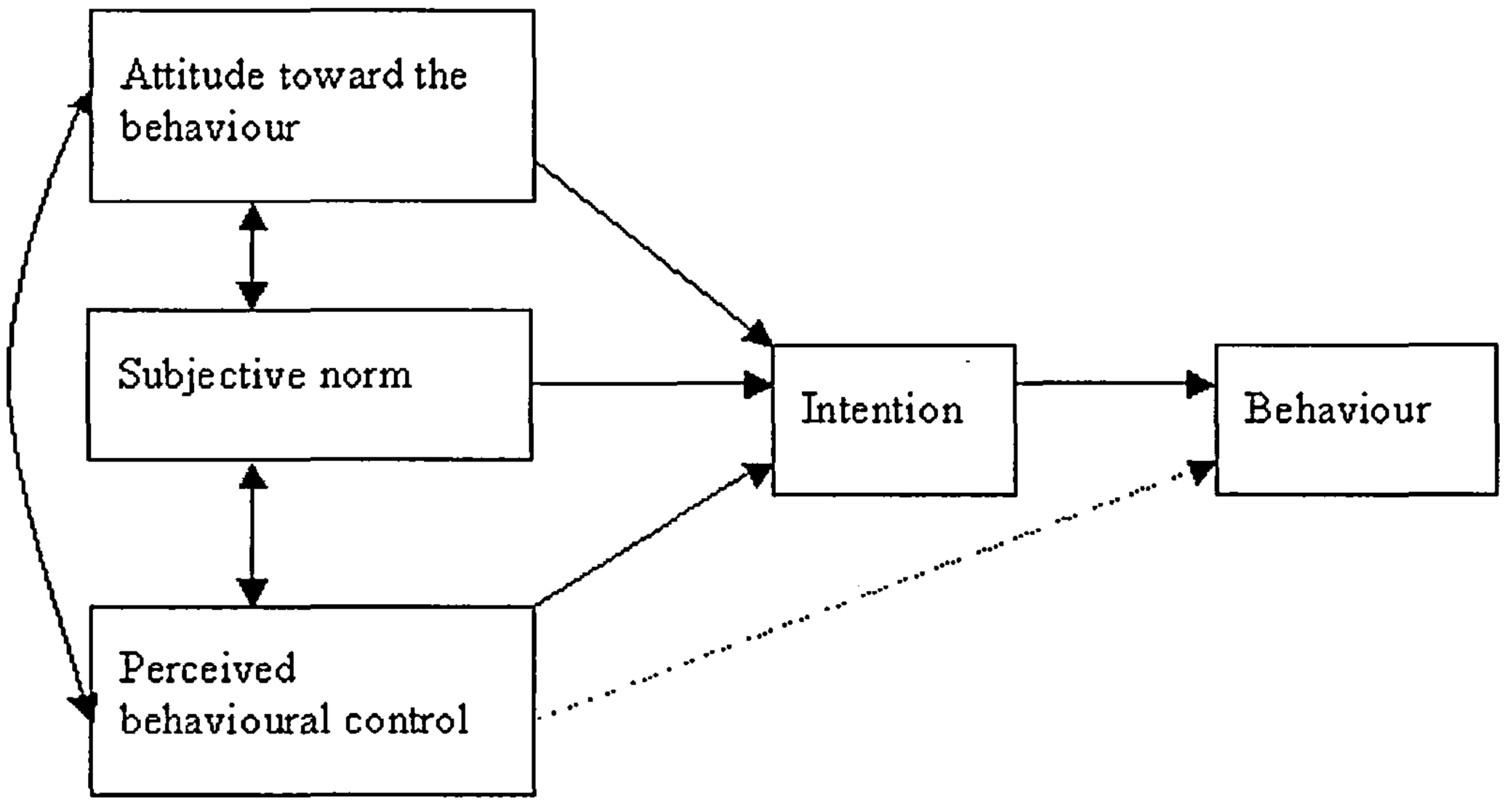

Figure 2.1: The Theory of Planned Behaviour **[Source**: Ajzen, 1991]

According to the TPB, human action such as an individual's adoption or use of a technology (i.e. broadband) is guided by following three types of beliefs: first, behavioural beliefs that create a favourable or unfavourable attitude toward the behaviour; second, normative beliefs that produce perceived social pressure or subjective norms; and third, control beliefs that generate perceived behavioural control (Ajzen, 1988; 1991, 2002). The aforementioned three types of constructs (i.e. attitude toward the behaviour, subjective norms, and perception of behavioural control) lead to the formation of a behavioural intention (Ajzen, 1988; 1991, 2002). The more favourable the attitude and subjective norm and the greater the perceived control, the stronger should be the person's intention to perform the behaviour in question (Ajzen, 1988; 1991, 2002). Finally, if consumers have strong actual control over the behaviour, they are more likely to execute their intentions in favourable circumstances. This suggests that intention is an immediate antecedent of behaviour (Ajzen, 1988; 1991, 2002). In addition to intention, it is also useful to consider perceived behavioural control as a direct antecedent of behaviour. This is because to the extent that perceived behavioural control is stronger, it can serve as a substitute for actual

control; hence, it can contribute to the prediction of the behaviour in question (Ajzen, 1988; 1991, 2002). Figure 2.1 is a diagrammatic illustration of the TPB.

Although the TPB does not describe the process of implementation in a specific context, it has a high degree of predictive validity and can be used to identify areas of concern for a specific context (Benbasat and Zmud, 1999). According to the IS literatures, TPB can serve as an effective diagnostic tool when examining IT adoption or acceptance and usage (Benbasat and Zmud, 1999). Therefore the TPB can be considered as a guiding framework when developing the proposed conceptual model for this research.

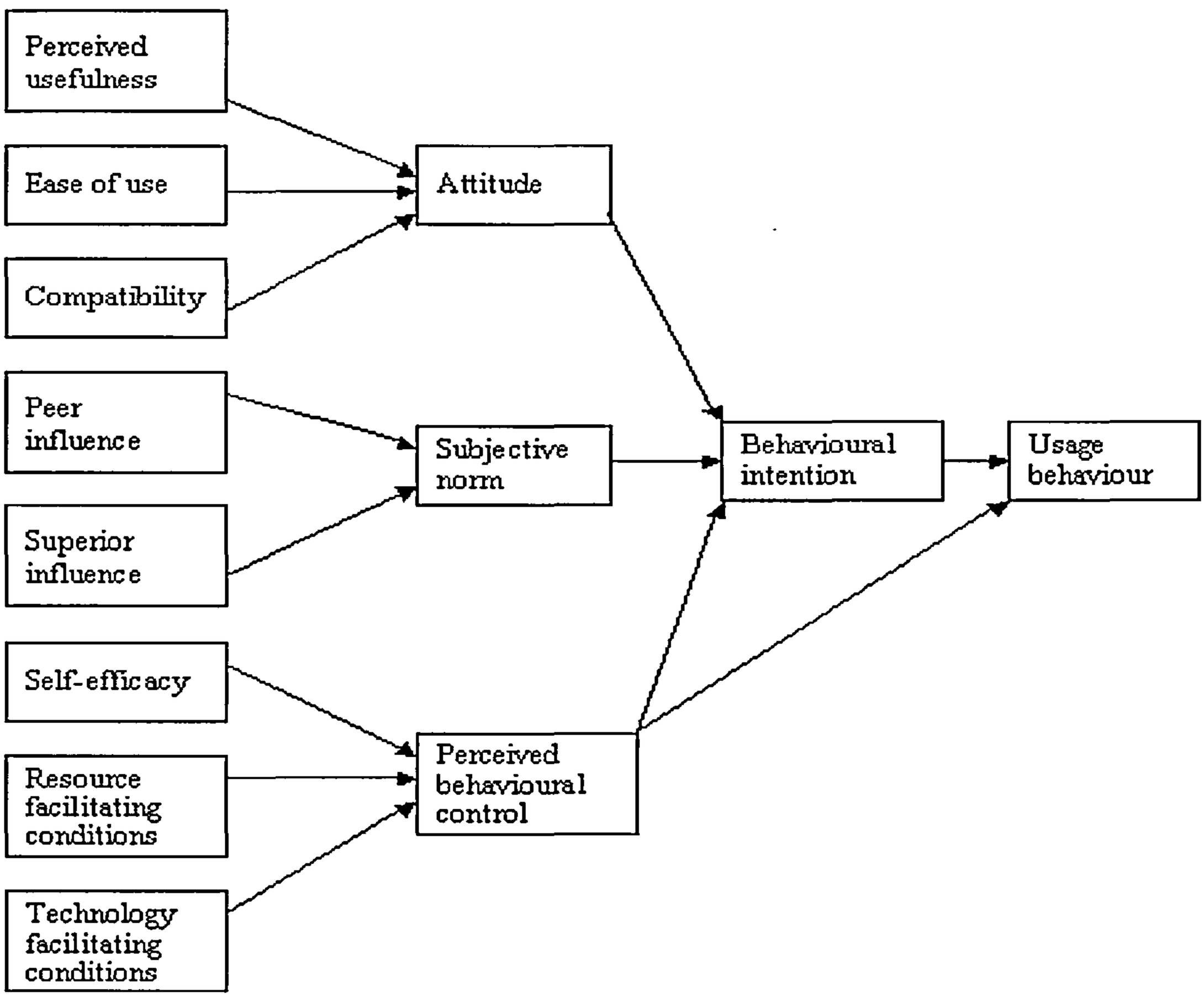

Figure 2.2: The Decomposed Theory of Planned Behaviour [**Source**: Taylor and Todd, 1995]

In order to increase the predictability of TPB, Taylor and Todd (1995) decomposed the attitudinal belief dimensions and included the innovations characteristics (Rogers, 1995) as different dimensions of the attitude construct (Figure 2.2). Taylor and Todd's (1995) study concludes that a decomposed structure helps to increase predictability in comparison to TPB and a more in-depth understanding when compared to TAM. This variant of the TPB is termed as the decomposed Theory of Planned Behaviour (DTPB) (Taylor and Todd, 1995). Bearing the aforementioned reasons in mind, the conceptual model of broadband diffusion

adopted the decomposed structure of attitude, subjective norms and perceived behavioural control constructs. However, the constructs of these are not exactly similar to Taylor and Todd's (1995) study. This is because the context and subject of the two studies are different to one another.

2.2.3 Technology Acceptance Model (TAM)

The Technology Acceptance Model (Figure 2.4) is an adaptation of the Theory of Reasoned Action (Figure 2.3). This model predicts systems usage by employing two factors; namely, the perceived usefulness and perceived ease of use of an IS (Davis, 1989). Perceived usefulness represents the beliefs of users, which is that technology use will enhance performance. These two factors determine the attitude towards the intention to use the system in question. Although TAM is a very successful model in terms of studying the users' intention of adoption and usage of technology, its application is yet to be investigated for consumers within the household context. Therefore, we did not consider the TAM constructs such as those proposed in our model of broadband diffusion.

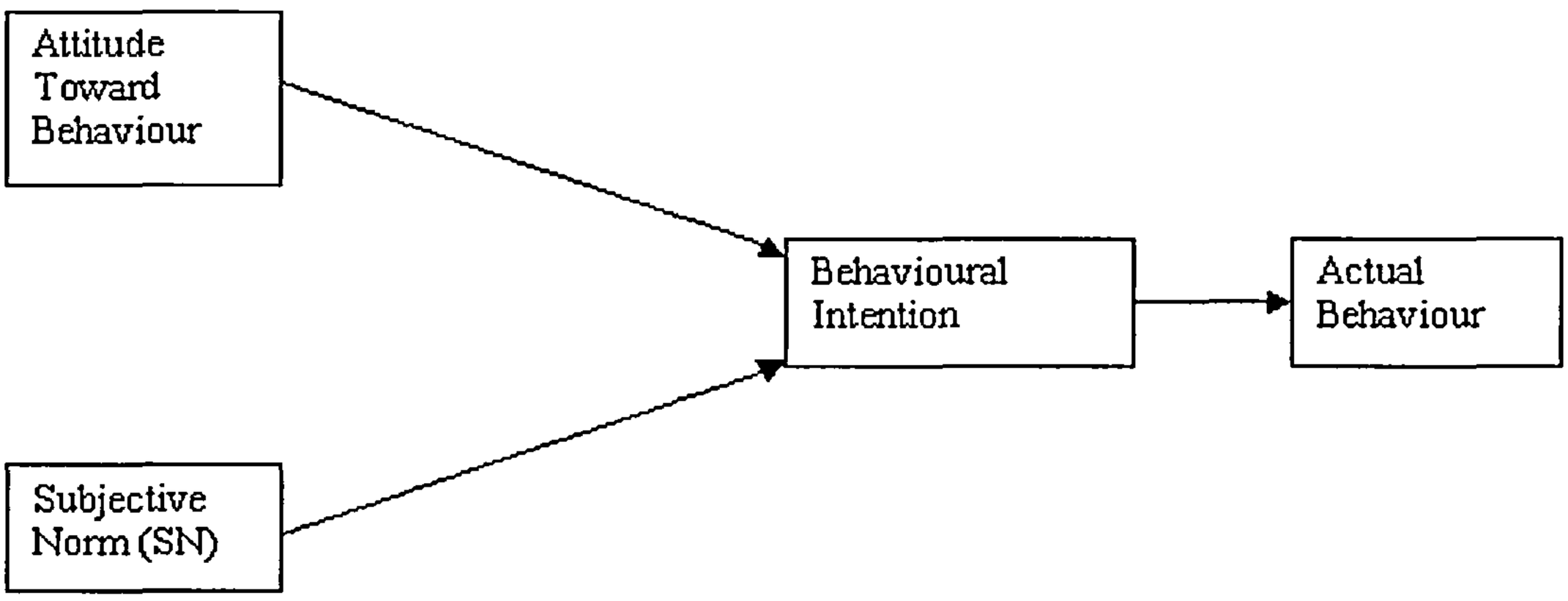

Figure 23: The Theory of Reasoned Action [**Source**: Davis *et al*, 1989]

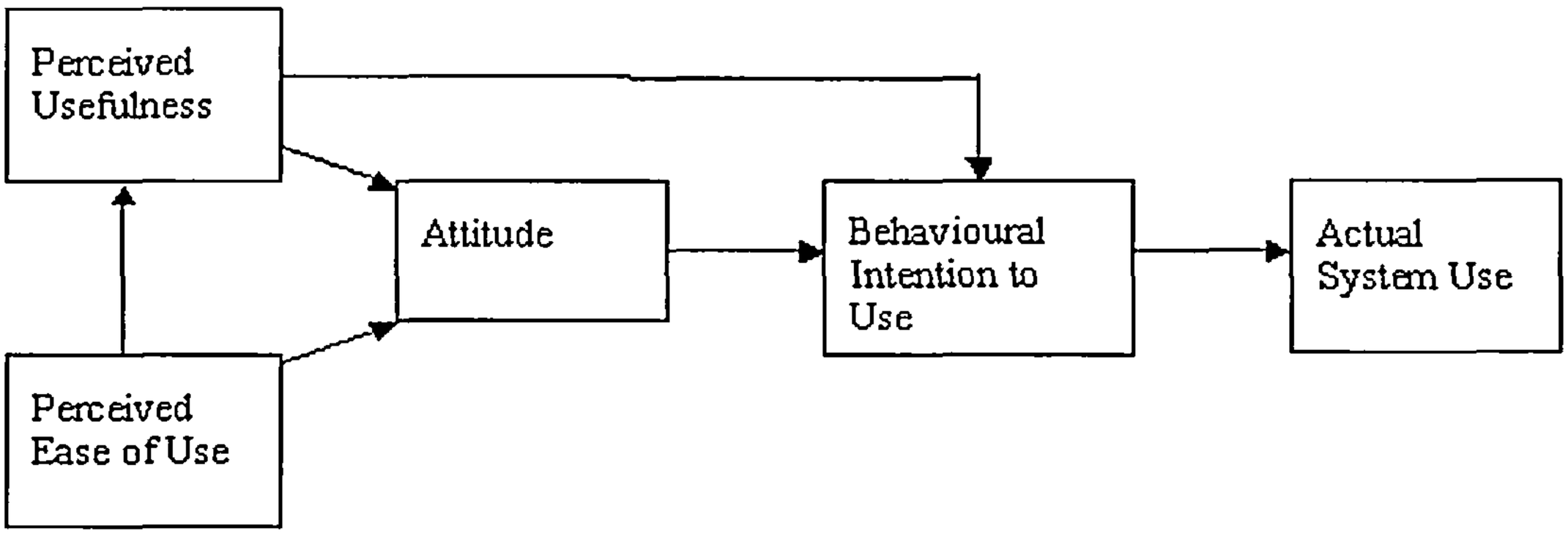

Figure 24: The Technology Acceptance Model [**Source**: Davis, 1989]

2.2.4 Model of Adoption of Technology in Households (MATH)

The Model of Adoption of Technology in the Household (MATH) (Table 2.1) was applied to investigate PC adoption in American households (Venkatesh and Brown, 2001). According to MATH, technology adoption in the household is determined by a number of factors. These include the attitudinal belief structures such as utilitarian outcomes, hedonic outcomes, and social outcomes; normative belief structures such as the influence of friends, family and secondary information sources; and a control belief structure that consists of three barriers, namely knowledge, difficulty of use, and cost (Venkatesh and Brown, 2001).

The majority of the constructs included in this model are also useful to study broadband adoption. However, constructs from this model do not provide insights to the usage and impact of PCs; they only shed light upon the adoption of it (Venkatesh and Brown, 2001). Furthermore, this model was constructed to study PC adoption; therefore a detailed factor (Table 2.1) needs to be adjusted for broadband. Theoretical justification for the selection of each construct is provided in the following sections.

TABLE 2.1
Model of Adoption of Technology in Household (MATH)
[Source: Venkatesh and Brown, 2001)

Belief Structure	Factor	Detailed Factor
Attitude	**Utilitarian Outcomes**	Application for personal use
		Utility for children
		Utility for work-related use
		Reduced utility due to obsolescence of current PC
	Hedonic Outcomes	Applications for fun
	Social Outcomes	Status gains from possessing current technology
		Status losses due to obsolete technology at home
Subjective Norm	**Social Influences**	Influences from friends and family
		Influences of information from secondary sources
Perceived Behavioural Control	**Barriers**	Rapid change in technology
		Declining cost
		High cost
		Ease/difficulty of use
		Requisite knowledge for PC use

2.2.5 Use Diffusion Model (UD)

The Use Diffusion model was developed to investigate technology use in the household context. The model was guided by the following three key components. First, use diffusion (UD) determinants such as household social context, technological dimension, personal dimension and external dimension. Second, UD patterns which are the typology of uses or users consist of two constructs called the variety of use and rate of use. Third, UD outcomes consist of the perceived impact of technology, satisfaction with technology and

interest in future technologies (Shih and Venkatesh, 2004). Since this model focuses upon the usage of technology in the household context, its constructs such as variety of use and rate of use would be useful to determine broadband usage.

2.2.6 Model Applied to Study Broadband Adoption and Diffusion

The discussion in Chapter 1 illustrated that the majority of studies conducted to understand broadband related issues are macro and exploratory in nature. These studies are mostly data driven in nature compared to process driven. Therefore the use of conceptual models or theories is less prominent in initial studies (Anderson *et al*, 2002). However, as the broadband area has matured and adoption rates have increased, researchers have begun to use theory based investigations to study the issue of diffusion (Oh *et al*, 2003), although such research is still in the embryonic stage.

Oh *et al* (2003) integrated innovation attributes, such as compatibility, visibility and demonstrability with technology acceptance constructs, such as perceived usefulness and perceived ease of use (Figure 2.5). Findings of this study suggest that the aforementioned innovation attributes have significant influence on constructs in the extended technology acceptance model such as perceived usefulness, perceived ease of use and perceived resources. On the basis of this study, the implications are that efforts should be made to expand the compatible experience base of broadband Internet in order to facilitate its adoption and use.

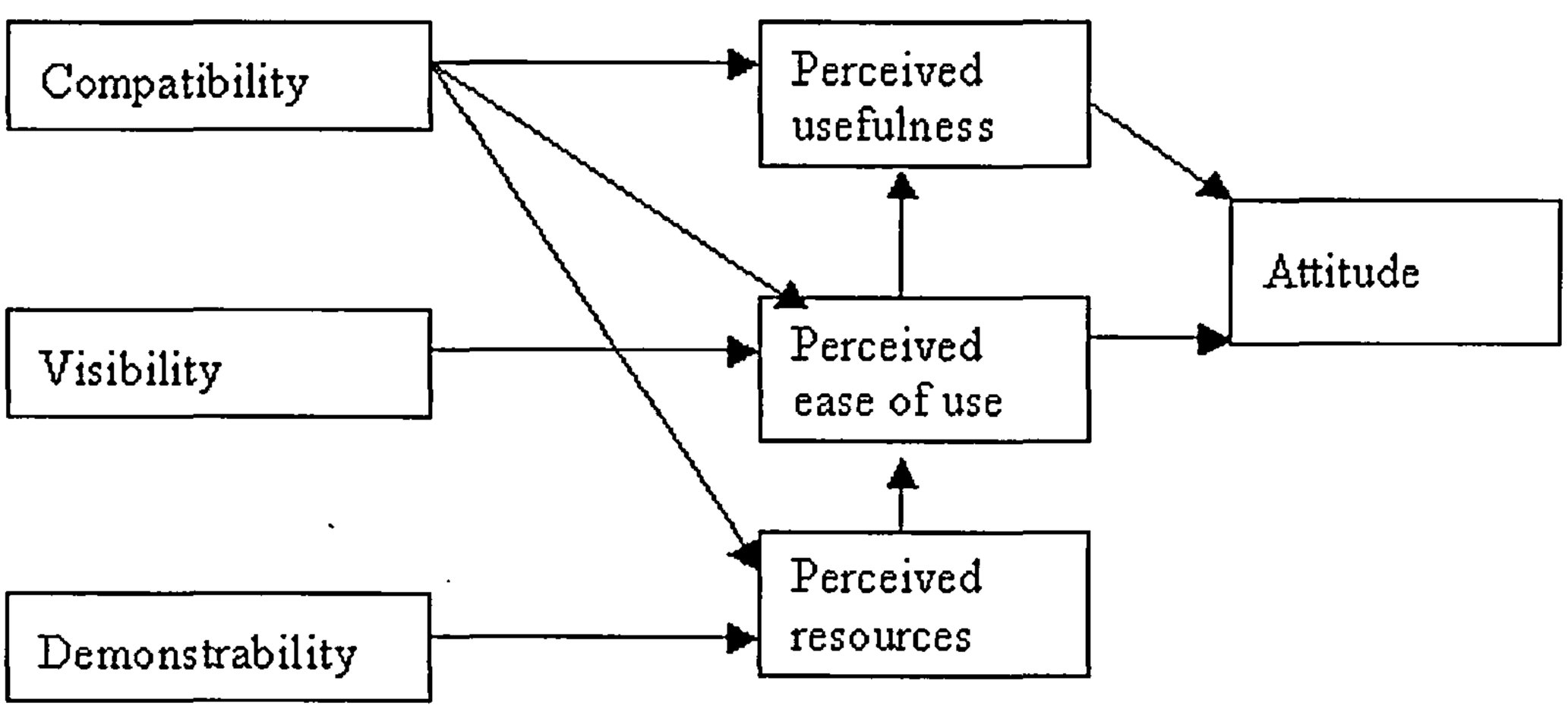

Figure 2.5: Research Model to Study Role of Experience in Building Attitude [Source: Oh *et al*, 2003]

Although Oh *et al's* (2003) study is a good beginning, it is limited when examining broadband adoption behaviour since it does not provide any evidence of how attitude building affects the behavioural intention to adopt or reject the technology in question. Also

the study examined the users of broadband rather than the consumers; therefore the findings are weak as they are only limited to the drivers and inhibitors of broadband adoption. This study identified the following two important limitations: first, the research model did not consider behaviour or behavioural intention constructs; second, the selection and use of statistical tools of data collection (Oh *et al,* 2003). Consequently, a study that will be a refinement of the research model and use of rigorous statistical tools and hypothesis testing were recommended (Oh *et al*, 2003).

Review of the aforementioned technology adoption, diffusion theories and models suggest that MATH is the most appropriate and closest model to the context (i.e. technology adoption in the household consumer) of this current study. MATH itself is based on the principle of TPB and DTPB, and is composed of constructs particularly suited to evaluate the usefulness of technology for household purposes. Therefore, MATH, TPB and DTPB will be utilised as a guiding framework for developing a conceptual model that examines the behavioural intention to adopt broadband and actual broadband adoption and non-adoption. The Diffusion of Innovations theory suggests that socio-economic determinants such as age, gender, income, education and occupation should be included within a study such as this. This allows a distinction to be drawn between the broadband adopters and non-adopters. The aforementioned review also suggests the appropriateness of the use of the diffusion model to study usage and the impact of the broadband within the household context. Considering the limitations of the previously examined constructs for broadband adoption (Oh *et al*, 2003), the current study proposes to include the constructs, which are important to understand, not only towards building attitudes towards adoption, but also the behavioural intention to adopt broadband, its relationship with the actual adoption, sustained adoption, usage and impact. In other words, the conceptual model proposed in the following sections provides a holistic view of broadband diffusion in the household context.

2.3 FOUNDATIONS OF THE PROPOSED CONCEPTUAL MODEL

Before describing the development of the proposed conceptual model for broadband adoption, usage and impact, this section briefly discusses the underlying reasons for considering a guiding theory and model as a foundation for the proposed conceptual model.

Taylor and Todd (1995) identified two main criteria when selecting an appropriate model. First, a model that provides good predictions while using the fewest predictors is preferable; in other words, it is more parsimonious (Bagozzi, 1992; Taylor and Todd, 1995). Second, the model should provide reasonable predictive ability and should also contribute enough in providing an understanding of the phenomenon under investigation (Taylor and

Todd, 1995). Since a broadband diffusion study requires both predictive ability (in the case of adoption) and a contribution to understanding (in the case of usage and impact), the second criteria was adopted when developing the conceptual model. At a conceptual level, the constructs from the various models were included, which may in the future provide insights to an understanding of all the three stages of diffusion. However, after validation of these constructs, to maintain parsimony of the explanatory model the less significant constructs will be eliminated.

Section 2.2 described a number of related theories and models (such as TRA, TPB, DTPB, Diffusion of Innovations and TAM) that are widely applied to study technology adoption from the individual or user's perspectives. However, it was also learnt that their application is limited to study technology adoption from the household perspective (Venkatesh and Brown, 2001). As was already discussed (section 2.2.4), only the MATH model was successfully applied in the household context in order to examine PC adoption in the United States (Venkatesh and Brown, 2001). Therefore, as the household consumer is also the context of this research, MATH was utilised.

The above discussion suggests the appropriateness of TPB, DTPB and MATH to study technology adoption issues from the perspective of the household context. Therefore the conceptual model of broadband adoption (MBA) is an adaptation of MATH (Venkatesh and Brown, 2001) and is based on DTPB (Taylor and Todd, 1995) and TPB (Ajzen, 1985; 1991).

Consistent with TPB, the proposed model of broadband adoption consists of three predictor types, namely attitudinal, normative and control and dependent variables that include behavioural intention (BI) and adoption behaviour. Also the relationship between the dependent and independent variables is hypothesised according to TPB. This is because TPB is a generalised theory and can be applied to a wide variety of contexts for predicting the adoption of different types of IT. Its major constructs reflect the key variables that have been identified as influential in previous implementation research and are flexible enough to subsume situation-specific factors (Benbasat and Zmud, 1999). Therefore, it is considered to be a basic guiding theory for this research. However, TPB does not suggest breaking each of the predictor categories in more than one factor (Taylor and Todd, 1995); therefore it limits the researcher's ability to differentiate between the smaller factors within each category.

DTPB, which is a variance of TPB, allows researchers to decompose the attitudinal, normative and control categories to better understand the reasons of adoption and non-

adoption (Taylor and Todd, 1995). Therefore, the decomposed belief structure for household broadband adoption model is consistent with the DTPB.

Since MATH is directly focused upon investigating technology adoption from the household perspective, the majority of the detailed constructs for attitudinal, normative and control categories are adapted from it (Venkatesh and Browns, 2001). At this point, this research will state why MATH in the original form is not employed to study broadband adoption. An adaptation of MATH was essential because the research objects of the two studies are dissimilar in nature. The research object of MATH was a PC, but for this study it is broadband. These two technologies are not similar in characteristics. Therefore MATH was subjected to the following modifications before it was applied for the examination of broadband adoption.

First, broadband has clear advantages over its predecessor narrowband. Therefore it was felt important to examine the influences that are triggered by the advantages that broadband offers (such as faster access, always-on access, faster download, un-metered access and free home phone line) over narrowband. Roger (1995) suggested the 'relative advantage' term for the perceived advantage of having a new technology over its' predecessor. Taylor and Todd (1995) included the relative advantage attribute of Rogers' Diffusion of Innovation theory as an attitudinal construct to study the adoption of technology. Consistent with Taylor and Todd's (1995) model, this research also included relative advantage as an attitudinal construct.

Second, this research's model also included service quality as an attitudinal construct to evaluate a consumer's favourable or unfavourable perception of service quality. That is, a consumer could determine the quality of service being received from his/her current service provider and how that issue influences him/her to stay with the same provider in the long term or to switch to a new provider. This construct was not included in MATH. A PC (i.e. hardware) is a product that either does not require a seller to provide a consistent service after a product is sold off or it does so to a minimal degree, and this could be a possible reason for not including 'service quality' in MATH.

Third, MATH considered only one construct 'Social Influence' within the normative category. But in the proposed model, social influence is differentiated by two types of influences, which are 'primary social influence' and 'secondary social influence'. This is consistent with Taylor and Todd's approach. The reason for the differentiation is due to the type of influence exerted by the two being different in nature; hence, the triggered influence is different and expected to have an impact on the various stages of adoption. Primary social

influence is direct in nature and exerted by friends, peers, family members and relatives who are expected to have a strong influence when performing certain behaviour. This is then followed by secondary social influence that is caused by the media. Therefore, it was considered to be appropriate to differentiate the social influence construct in the two aforementioned constructs within the normative category.

Fourth, data analysis for the MATH study was only estimated the mean score and standard deviation. This was done in order to assess the importance of each factor; however, no test of statistical significance was reported. In contrast, the current model is based on several hypotheses that will be tested for their significance and will confirm the validity of the model and its predictive ability.

Finally, MATH did not examine if adoption behaviour differ for consumers in terms of the variables of age, gender, income, education and occupation. This research also has a scope to examine this issue.

All this juncture discussion so far provides reasoning for adapting constructs from MATH for developing the conceptual model for this study. The following sections describe the proposed model in detail and provide theoretical justification for the role of the various underlying constructs in determining household broadband adoption and usage behaviour.

2.3.1 Description of the Proposed Conceptual Model

The adoption component of the proposed diffusion model postulates that the behavioural intentions (BI) to adopt broadband are determined by the following three types of constructs (Ajzen, 1991; Rogers, 1995; Taylor and Todd, 1995; Venkatesh and Brown, 2001). These are: (1) **attitudinal constructs** (*relative advantage, utilitarian outcomes and hedonic outcomes*) represent the consumers' favourable or unfavourable evaluation of the behaviour in question (i.e. adoption of broadband); (2) **normative constructs** (*primary and secondary influence*) represent the perceived social pressure to perform the behaviour in question (i.e. adoption of broadband); (3) **control constructs** (*knowledge, self-efficacy and facilitating conditions resources*) represent the perceived control over the personal or external factors that may facilitate or constrain the behavioural performance (Ajzen, 1991; Rogers, 1995; Taylor and Todd, 1995; Venkatesh and Brown, 2001). The predictor variables from the aforementioned three categories are expected to determine and explain the BI to adopt broadband, which in turn is expected to predict the actual broadband adoption behaviour (BAB) (Ajzen, 1991; Rogers, 1995; Taylor and Todd, 1995; Venkatesh and Brown, 2001). Figure 2.6 shows the proposed conceptual model of broadband adoption.

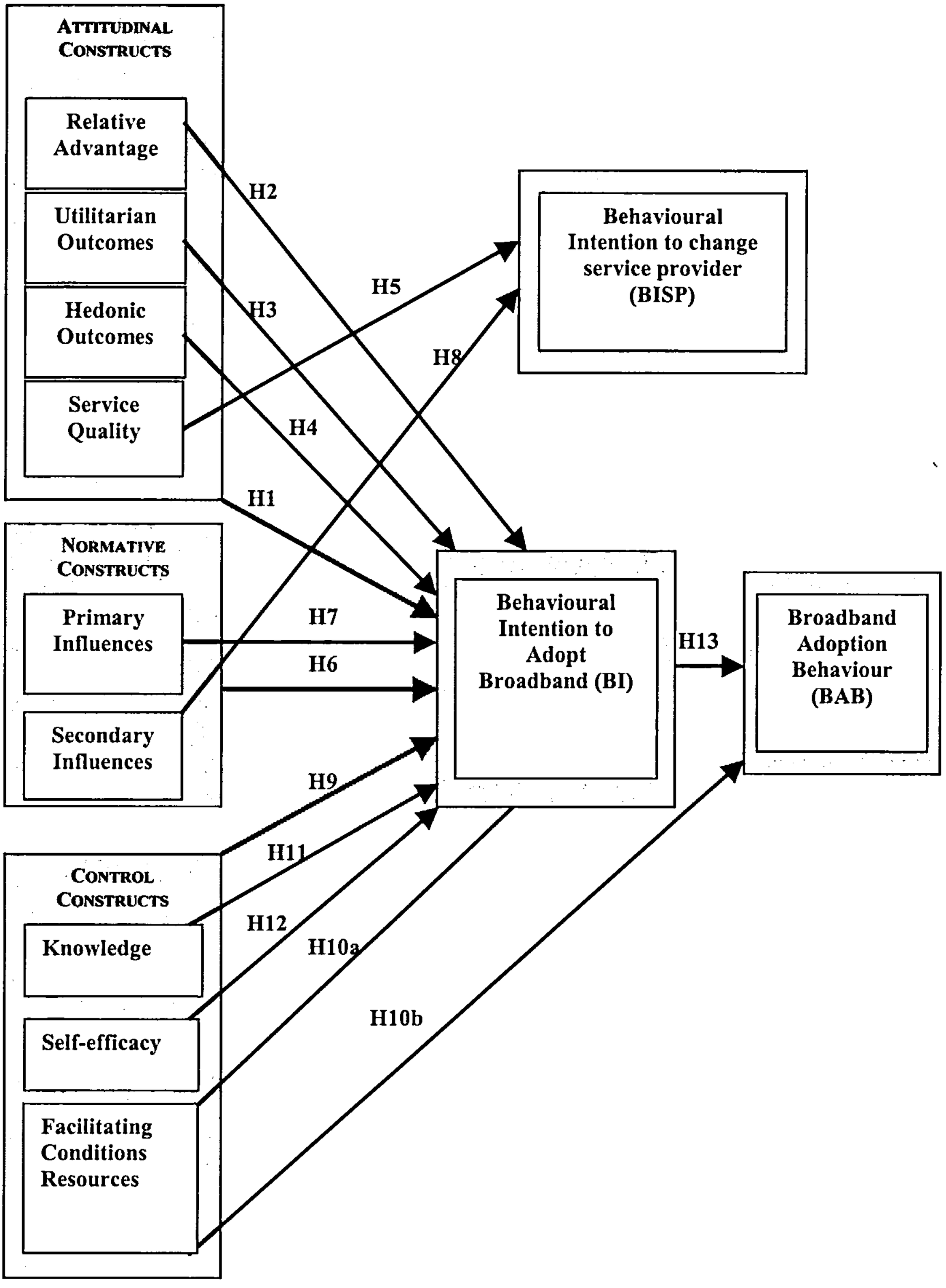

Figure 2.6: Conceptual Model of Broadband Adoption (MBA)

Additionally, this research also postulates that the BAB can also be explained by the demographic characteristics of the adopters and non-adopters in terms of age, gender, education income and occupation. Figure 2.7 shows the effect of demographic variables on broadband adoption.

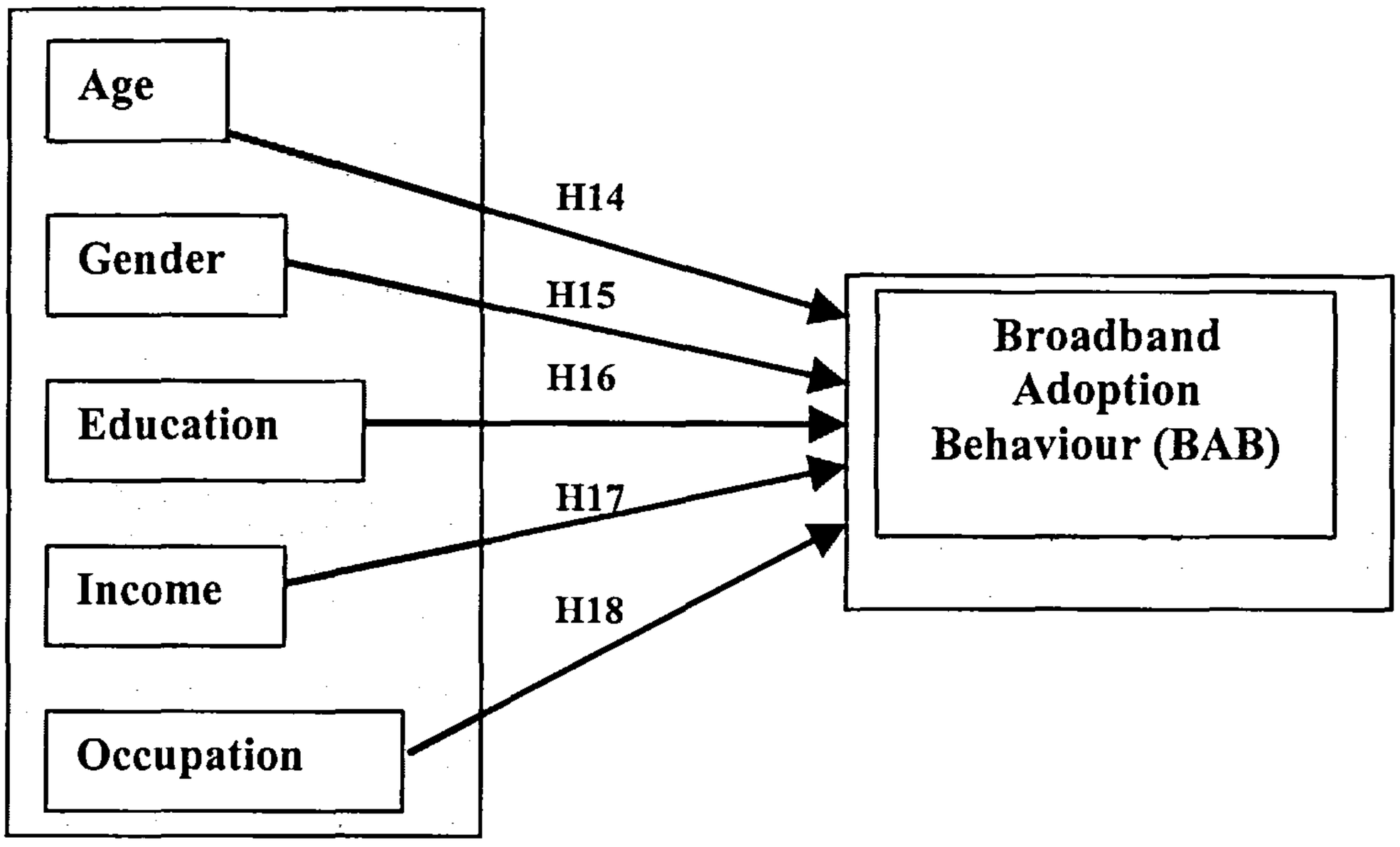

Figure 2.7: Effect of Demographic Variables on Broadband Adoption

The usage and impact components of the proposed conceptual model postulates that the BAB determines the: (1) rate of Internet use, i.e. the total time spent online and the frequency of Internet access, (2) variety of use, i.e. activities performed online. The impact of broadband is postulated as an ultimate outcome of usage of broadband (Shih and Venkatesh, 2004; Vitalari *et al*, 1985). Figure 2.8 shows the constructs and relationships to examine usage of broadband.

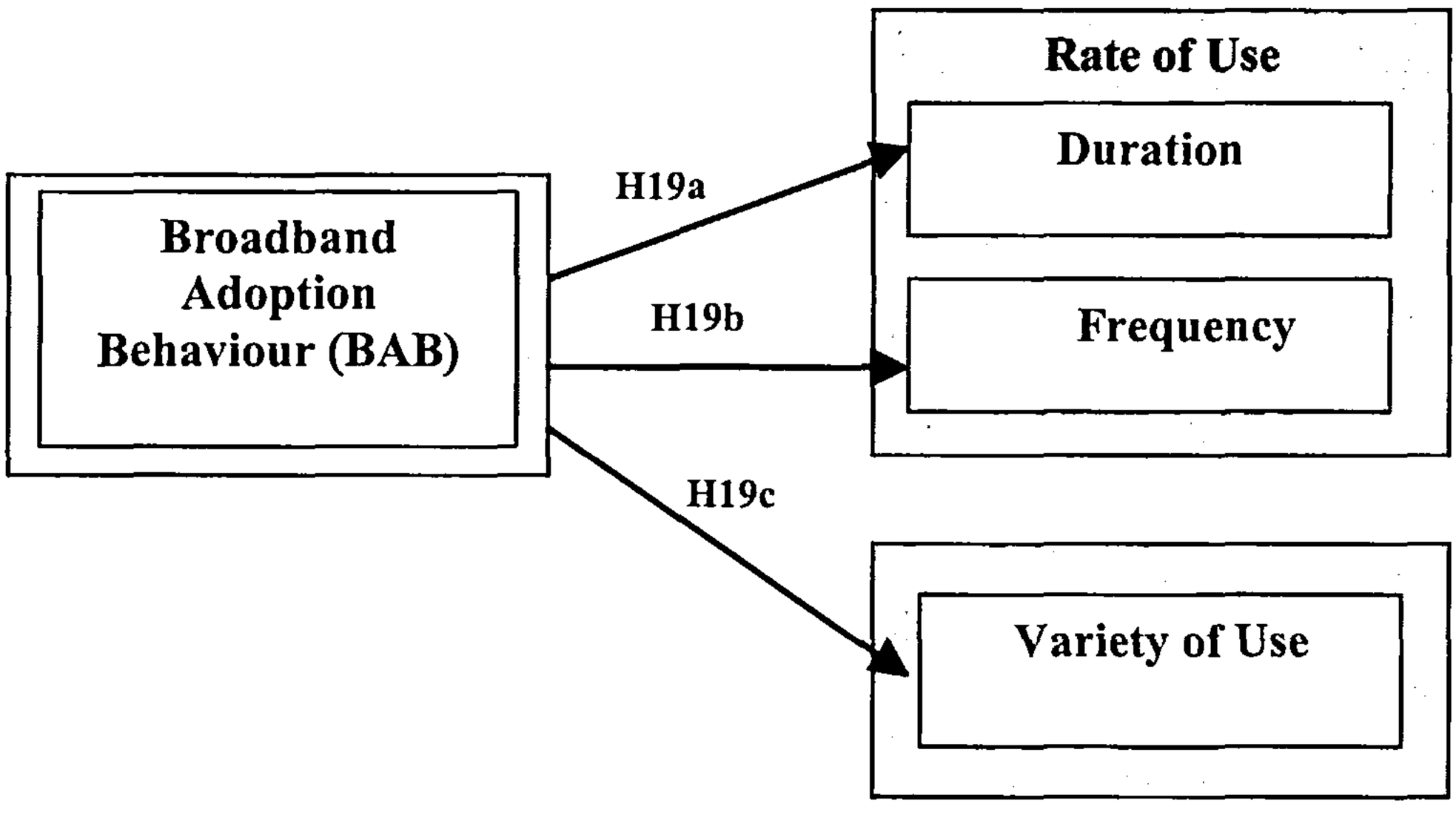

Figure 2.8: Constructs to Examine Usage of Broadband

As described and illustrated above, the TPB, the DTPB and the MATH are utilised as guiding theories in order to determine the relationships amongst the various constructs in the proposed conceptual model that will investigate the following research questions:

RQ 1: *Do attitudinal (relative advantage, utilitarian outcomes and hedonic outcomes), normative (primary influence) and control factors (knowledge, self-efficacy and facilitating conditions resources) influence behavioural intentions when adopting broadband in the UK households?*

RQ 2: *How strongly do attitudinal (relative advantage, utilitarian outcomes and hedonic outcomes), normative (primary influence) and control factors (knowledge, self-efficacy and facilitating conditions resources) influence behavioural intentions when adopting broadband in the UK households?*

RQ 3: *Do behavioural intentions and control factors influence the actual adoption of broadband in the UK households?*

RQ4: *Do demographic factors (i.e. age, gender, education, income and occupation) influence the adoption of broadband in UK households?*

RQ 5: *Do service quality and secondary influence affect the behavioural intentions when changing current service provider?*

RQ 6: *Does the rate of internet usage differ for the broadband and narrowband users?*

RQ 7: *Do broadband users access more online activities than narrowband users?*

RQ 8: *Does the use of broadband affect the time spent on various daily life activities?*

A list of constructs, summaries of hypotheses are presented in Table 2.2. A definition of each construct is provided in **Appendix 2.1**. The following sections also provide detailed descriptions of each construct and the theoretical justification for including them in the proposed conceptual model.

TABLE 2.2
Summary of Research Hypotheses

HN	Independent Variables	Dependent Variables
H1	Overall Attitudinal Constructs	Behavioural Intention to adopt broadband (BI)
H2	Relative Advantage	Behavioural Intention to adopt broadband (BI)
H3	Utilitarian Outcomes	Behavioural Intention to adopt broadband (BI)
H4	Hedonic Outcomes	Behavioural Intention to adopt broadband (BI)
H5	Service Quality	Behavioural Intention to change service providers (BISP)
H6	Overall Normative Constructs	Behavioural Intention to adopt broadband (BI)
H7	Primary Influence	Behavioural Intention to adopt broadband (BI)
H8	Secondary Influence	Behavioural Intention to change service providers (BISP)
H9	Overall Control Constructs	Behavioural Intention to adopt broadband (BI)
H10a	Facilitating Conditions Resources	Behavioural Intention to adopt broadband (BI)
H10b	Facilitating Conditions Resources	Broadband Adoption Behaviour (BAB)
H11	Knowledge	Behavioural Intention to adopt broadband (BI)
H12	Self-efficacy	Behavioural Intention to adopt broadband (BI)
H13	BI	Broadband Adoption Behaviour (BAB)
H14	Age	Broadband Adoption Behaviour (BAB)
H15	Gender	Broadband Adoption Behaviour (BAB)
H16	Education	Broadband Adoption Behaviour (BAB)
H17	Income	Broadband Adoption Behaviour (BAB)
H18	Occupation	Broadband Adoption Behaviour (BAB)
H19a	Duration	Broadband Adoption Behaviour (BAB)
H19b	Frequency	Broadband Adoption Behaviour (BAB)
H19c	Variety of Use	Broadband Adoption Behaviour (BAB)

2.4 ATTITUDINAL CONSTRUCTS

Attitude is defined as an individual's positive or negative feelings when performing target behaviour such as adoption of broadband (Ajzen, 1985; 1991; Fishbein and Ajzen, 1975; Taylor and Todd, 1995). Overall, the technology adoption/acceptance theories and models including TRA, TAM, TPB, and DTPB illustrate relationships between the attitude or attitudinal factors and behavioural intentions. If the attitude of individuals towards the technology in question is positive then they are likely to form an intention to perform the behaviour (Tan and Teo, 2000). Following TPB it can be assumed that if the perception of the respondents regarding the attitudinal factor is positive, then it is more likely that it will have a positive influence on the behavioural intention. Thus, this leads to the formulation of the hypothesis:

> ***H1***: *Overall attitudinal factors will have a positive influence on the behavioural intention to adopt broadband.*

In order to gain an in-depth and better understanding, attitude construct has been decomposed in several studies (Tan and Teo, 2000; Taylor and Todd, 1995; Venkatesh and Brown, 2001). For example, in order to gain an in-depth and better understanding Taylor and Todd (1995) decomposed attitude into five constructs represented by the five perceived innovation attributes (i.e. relative advantage, compatibility, visibility, risk and complexity) from Rogers' Diffusion of Innovation theory. Following Taylor and Todd, Venkatesh and Brown (2001) also decomposed the attitudinal belief to study the adoption of PC into three types of constructs; namely, utilitarian outcomes, hedonic outcomes, and social outcomes.

Following the aforementioned discussion (Taylor and Todd, 1995; Venkatesh and Brown, 2001) this research decomposed attitude into four constructs, namely hedonic outcomes, utilitarian outcomes (Venkatesh and Brown, 2001), relative advantage (Rogers, 1995) and service quality (DeLone and McLean, 2003; Parasuraman *et al*, 1991).

Three constructs, namely relative advantage, utilitarian outcomes, and hedonic outcomes, are expected to provide measures of attitude towards the behaviour of broadband adoption in the household. Apart from the aforementioned constructs, this study also included service quality as one construct of attitude for those consumers who already had broadband. This construct of service quality will be helpful to predict if the adopters are contracted or obligated to the same broadband provider. Alternatively, it will help predict whether the adopters switch to another provider if they are not satisfied with the obtained service. The aforementioned attitudinal factors relevant to this study are discussed below in detail. Thereafter the related hypotheses are formulated.

2.4.1 Relative Advantage

Rogers' (1995) Diffusion of Innovations theory suggests that the perceived relative advantage of an innovation is positively related to its rate of adoption. Several previous empirical studies have found that perceived relative advantage is an important factor for determining the adoption of an innovation (Tan and Teo, 2000; Taylor and Todd, 1995; Tornatzky and Klein, 1982). Similarly, when compared to narrowband, broadband offers faster, un-metered, always-on access to the Internet, and provides a number of advantages, conveniences and satisfaction to its users. Considering the advantages that broadband offers, it would be expected that individuals who perceive broadband as advantageous would also be more likely to adopt the technology. Therefore, the above theoretical argument leads to the following hypothesis:

***H2**: Relative advantage will have a positive influence on behavioural intention.*

2.4.2 Utilitarian Outcomes

The perceived usefulness construct (Davis, 1989) is one of the strongest predictors used to examine the adoption and usage of workplace technology. Venkatesh and Brown (2001) proposed and validated the utilitarian outcomes factor that can be used to examine the adoption and usage of technology in a household setting. Utilitarian outcomes are the extent to which using a PC enhances the effectiveness of routine, household activities, such as budgeting, homework and work (Venkatesh and Brown, 2001). It has been suggested that broadband can offer a more flexible lifestyle (BSG, 2004). For instance, many people subscribe to broadband in order to work at home instead of travelling to the office; broadband can assist children with their homework, and many more household activities can be performed conveniently using the faster access of the Internet offered via broadband. Therefore, it is expected that the greater the perception of broadband's usefulness for work or household related activities, the more likely that broadband technology will be adopted in the home. Thus, the hypothesis is:

***H3**: Utilitarian outcomes will have a positive influence on behavioural intention.*

2.4.3 Hedonic Outcomes

The Venkatesh and Brown (2001) study found that hedonic outcomes is one of the factors that influences PC adoption in the home. Venkatesh and Brown (2001) defined hedonic outcomes as pleasure derived from PC use; for example, games, fun and entertainment. Heijden (2004) described hedonic information systems as self-fulfilling and strongly connected to the home and leisure activities, focused on the fun aspect of using

information systems, and encouraged prolonged rather than productive use (Heijden, 2004). Empirical findings from the Venkatesh and Brown (2001) study established that, when adopting a technology, the role of entertainment (PC games, Video games) was important as a factor for consideration on the consumer decision-making process (Venkatesh and Brown, 2001). Previous studies suggest that the entertainment potential of a PC offers a possibility to escape reality and become immersed in a new environment. Such characteristics are consistent with a hedonic perspective (Foxall, 1992; Venkatesh and Brown, 2001). Hence, the entertainment potential of a PC is much more enhanced by the advent of the Internet. It offers the opportunity of playing online games, downloading music and video, chat and sending online messages. However, this potential was severely hampered by the slow speed of dial-up Internet.

The barrier of slow speed was overcome by broadband technology, which offered benefits in terms of data, faster download speeds and streaming capabilities to Internet users; hence more convenient and compelling environments. Recent studies (Lee *et al*, 2003, Lee and Choudrie, 2002) suggest that one of the most important factors that was responsible for broadband adoption in South Korea is the PC bang phenomenon. Similarly, a study by Anderson *et al* (2002) suggests that broadband users are more likely to use the Internet for fun and entertainment in comparison to narrowband users. Considering the entertainment potential that broadband offers, it is expected that individuals who perceive broadband as a good entertainment medium will also be likely to adopt the technology. Therefore, the underlying hypothesis is:

H4: *Hedonic outcomes will have a positive influence on behavioural intention.*

2.4.4 Service Quality

Marketing research developed the construct service quality 'SERVQUAL' in order to measure a consumer's perception of service quality (Parasuraman *et al*, 1991; Parasuraman *et al*, 1988). However, only a limited number of studies have recently included it to measure the successful adoption of technology. DeLone and McLean (2003) extended a decade old IS success model (DeLone and McLean, 1992) by integrating a new construct called service quality. Service quality was included to evaluate the fact that an IS department also plays a role in facilitating end-user computing via the services it offers to business personnel wishing to develop their own systems (Rosemann and Vessey, 2005). McCalla and Ezingeard (2005) have progressed to develop a data collection protocol that measures the relationship between technology use, emotional expression and service quality perception. Yang *et al* (2005) developed and validated an instrument that measured a user's perceived

service quality of information presented on web portals. Parasuraman *et al* (2005) have recently developed a multiple-item scale for assessing electronic service quality. Therefore, it can be deduced from the aforementioned studies that there is a growing need and importance of the service quality construct within IS research.

However, this construct was not employed in the case of PC adoption studies. This is because when purchasing PCs (i.e. hardware) consumers have only one opportunity to make a choice; that is, to purchase or not to purchase. And once a PC is sold to consumer, the seller is least expected to provide any further after purchase service and/or customer support. However, the case of broadband subscription is different to PC purchase. That is, the consumers sign an annual contract and during this period if the provided service is not satisfactory, then they can/will discontinue the broadband subscription. Alternatively, if consumers have a choice of providers then they might transfer to the competitors. Therefore, it is important to understand whether consumers are satisfied with their current providers and provided services. Hence, the underlying hypothesis is:

> ***H5**: Service quality will have a negative influence on the behavioural intention when changing from a current service provider.*

2.5 NORMATIVE CONSTRUCTS

Subjective norms are defined as a consumer's perception that most people who are important to him/her think that s/he 'should or should not perform the behaviour in question' (Ajzen, 1985; 1991; Fishbein and Ajzen, 1975, Tan and Teo, 2000; Taylor and Todd, 1995; Venkatesh and Brown, 2001). A subjective norm in its original form in the TRA and TPB is employed as a single construct and is considered directly related to the behavioural intention. This is because a consumer's behaviour is based on their perception of what others think of what they should be doing (Tan and Teo, 2000). Following the guidelines of the TPB, it can be assumed that the stronger the perceived social influence more likely that consumer develops a stronger intent to subscribe to broadband. Thus, this led to the hypothesis:

> ***H6**: Overall the normative factors will have a positive influence on the behavioural intention when adopting broadband.*

Following the suggestion from various studies (Burnkrant and Page, 1988; Oliver and Bearden, 1985; Shimp and Kavas, 1984), Taylor and Todd (1995) decomposed the normative belief structure into two groups; namely, the peer and superior influences. In terms of consumer-oriented service, relevant references such as the adopter's friends, family and colleagues/peers may influence the adoption decision (Tan and Teo, 2000). Rice *et al* (1990) defined such influence as social influences where members of a social network

influence others' behaviour. Venkatesh and Brown (2001) have considered the social influence of family, friends, TV and newspapers as one construct that can be used to measure the subjective norms. The findings of Venkatesh and Brown (2001) suggest that social influences are significant determinants of the purchasing behaviour of PCs. Similarly, it is expected that households with broadband connections are likely to influence their relatives and friends by telling and demonstrating to them the benefits and convenience offered by broadband. Therefore, it is appropriate to consider social influences as a measure of the subjective norm for broadband adoption in the household. By using previous studies (Fulk and Boyd, 1991; Fulk *et al,* 1987; Salancik and Pfeffer, 1978), Venkatesh and Brown (2001) suggested that 'Social influence is exerted through messages and signals that help to form perceptions of a product or activity'. Measures that influence adopters can appear in two forms that are termed as primary and secondary influences. Consistent with the DTPB and MATH, this study considered two constructs in the normative category. These two constructs are separated and defined below. Subsequently, the underlying hypotheses are proposed.

2.5.1 Primary Influences

For the purposes of this research, a social influence from friends, colleagues/peers and family members that takes the form of a conversation, messages and assists in forming perceptions of broadband adoption is considered to be a primary influence (Venkatesh and Brown, 2001). Considering the findings from previous studies (Venkatesh and Brown, 2001; Taylor and Todd, 1995), this research assumes that if broadband adopters are influenced by their social networks with positive messages, they are more likely to have a strong behavioural intention to adopt broadband. Thus, the hypothesis proposed from this discussion is:

> ***H7*: *Primary influences will have a positive influence on the perceived behavioural intention to adopt broadband.***

2.5.2 Secondary Influences

Previous studies suggest that messages disseminated using mass media, such as the television (TV) and newspaper advertisements (secondary sources of information) are likely to influence an adopter's intentions (Rogers, 1995; Venkatesh and Brown 2001). For the purposes of this research, it is expected that secondary sources of information will affect those consumer who have already adopted broadband but are not satisfied with service quality; hence, if advertisements viewed on TV or read in a newspaper advertisement about

broadband packages that are economical and offer a better quality service, then they are more likely to cause adopters to contract with the new provider. Therefore, the hypothesis is:

> ***H8**: Secondary influences will have positive influence on perceived behavioural intention to change current service providers.*

2.6 CONTROL CONSTRUCTS

The TPB suggests that presences of constraints can inhibit both the behavioural intention to perform behaviour and the behaviour in question itself (Ajzen, 1991; 1985), which is referred to as the perceived behavioural control (PBC). Support for this theoretical argument is obtained from the empirical findings in several studies that illustrate that the higher the perception of an individual's control over their internal and external constraint, the more likely that s/he will adopt the technology in question (Ajzen, 1991; Tan and Teo, 2000). However, if the individual's control over the external and internal constraints is low, then besides having a strong behavioural intention, s/he is less likely to adopt the technology (Ajzen, 1991; 1985). Consistent with TPB, this research therefore formulates the following hypothesis:

> ***H9**: The overall control factors will have a positive influence on the behavioural intention to adopt broadband.*

To develop a better understanding, subsequent studies have decomposed PBC into three constructs: knowledge, facilitating conditions resources/technology (Taylor and Todd 1995; Mathieson, 1991) and self-efficacy (Taylor and Todd 1995). To study PC adoption in the household, Venkatesh and Brown (2001) split PBC into five specific barriers that can inhibit the adoption of PC, including a rapid change in technology, declining costs, the high cost of PCs, ease/difficulty of use and a requisite knowledge of the use of PCs.

Since the subscription cost of broadband access is stable and technology is not changing rapidly, the declining cost and rapid changes in technology were considered irrelevant factors for the adoption of broadband technologies, and are hence not included in this research. Consistent with DTPB and MATH, the current study considered the constructs that are barriers to the adoption of broadband as measuring high costs (i.e. facilitating conditions resources), the ease/difficulty of PCs and Internet use (i.e. self-efficacy) and the lack of knowledge of broadband's benefits. In the next section, the justification for including the aforementioned three constructs as a decomposed control constructs and the hypotheses are provided.

2.6.1 Facilitating Conditions Resources

The South Korean government's vision recognised an affordable monthly cost of broadband for middle-income households as one of the most important factor that led to the high rates of adoption (Choudrie and Lee, 2004; Lee and Choudrie, 2002). An exploratory study on broadband adoption in the UK also suggests that a high monthly cost is a major barrier that is inhibiting the adoption of broadband in the household (Dwivedi *et al,* 2003). Therefore, it is expected that if the perceived cost of obtaining broadband is high, then adoption will be slow. Broadband technology is not compatible to the specifications of old PCs and necessitates either an upgrade or purchase of a new PC. However, PCs are not easily replaceable devices for the medium and lower income households. Therefore, an economic barrier in the form of costs that are incurred when upgrading or purchasing new personal computers inhibits the adoption of broadband in the household. Therefore, the hypotheses are:

***H10a*:** *Facilitating conditions resources will have a positive influence on the behavioural intention to adopt broadband.*

***H10b*:** *Facilitating conditions resources will have a positive influence on the adoption of broadband.*

2.6.2 Knowledge

The level of knowledge regarding an innovation, its risks and benefits affect the adoption rate (Rogers, 1995). The greater the awareness of the benefits of the innovation amongst the consumers and users, the more likely it is that the innovation will get adopted. Lee and Choudrie's (2002) research suggested that, in South Korea, consumers knew what the potential of broadband were. The consumers were aware of the benefits of faster Internet access, which was essential to satisfy their needs. It is assumed that the adoption of broadband requires a clear message of its usage and benefits amongst overall population. Also, if consumers are not aware of the benefits of adopting a particular innovation, then it is expected that they are more likely to reject the decision to make a purchase due to the lack of the perceived needs. Therefore, the underlying hypothesis is:

***H11*:** *Knowledge will have a positive influence on the behavioural intention to adopt broadband.*

2.6.3 Self-efficacy

Since the use of broadband also requires using a PC and the Internet, the ease or difficulty of use and requisite knowledge of a PC and Internet use are expected to have an impact upon broadband adoption. The South Korean government deployed a variety of promotion policies (Choudrie and Lee, 2004; Lee and Choudrie, 2002). "The Ten Million Program" was designed to boost Internet use amongst housewives, the elderly, military personnel, farmers and excluded social sectors such as low-income families, the disabled and even prisoners. This promotion of providing PC and Internet skills in the year 2000 contributed towards the adoption of the Internet. A total of 4.1 million new online users, including one million housewives, occurred as a result of such initiatives (Choudrie and Lee, 2004; Lee and Choudrie, 2002). Therefore, it is expected that household users with basic PC and Internet skills are more likely to adopt broadband. Hence, the hypothesis is:

> ***H12***: *Self-efficacy will have a positive influence on the behavioural intention to adopt broadband.*

2.7 DEMOGRAPHIC VARIABLES

Key socio-economic variables such as age, gender, education, income and occupation (Burgess, 1986) provide important information regarding the characteristics of the population under investigation. These socio-economic variables have been widely applied to investigate a number of devices and issues within the IS discipline including the computer, telephone, internet, software and e-learning technologies. For example, these variables have been included in previous studies that examined the adoption of ICTs, such as the computer (Al-Jabri, 1996; Carveth and Kretchmer, 2002; Venkatesh *et al*, 2000; Vitalari *et al*, 1985), the telephone (Anderson *et al*, 1999), the Internet (Anderson and Tracey, 2001; Carveth and Kretchmer, 2002) and broadband (Anderson *et al*, 2002) in households, and its subsequent impact on users. Further, the aforementioned social variables have also been applied to investigate software piracy (Solomon and Brien, 1990; Wood and Glass, 1995), technology adoption (Chen *et al*, 2001; Harris *et al*, 1996; Morris and Venkatesh, 2000; Venkatesh *et al*, 2003; Venkatesh and Morris, 2000), e-government adoption (Huang *et al*, 2002) and demographic differences amongst IS professional (Holmes, 1997). Additionally, the previous studies also emphasised the role of several external variables such as, demographic characteristics on the decomposed belief structure and, ultimately, adoption and usage (Venkatesh and Brown, 2001). The moderating effects of the demographic variables have been successfully applied to previous studies that examined gender

differences in the perception and use of the email (Gefen and Straub, 1997), and relationships between organisational culture and computer efficacy (Pearson *et al*, 2002).

Since home computers, the telephone, and access to the Internet (both dial-up and broadband) can be placed in the same technology cluster (Rogers, 1995), the socio-economic variables that have been employed to study one technology can also be used to study others (Rogers, 1995). Therefore, the socio-economic variables such as age, gender, education, occupation, and income that were utilised to examine home computer adoption in the households can also be employed to study broadband adoption.

The aforementioned socio-economic variables (i.e. age, gender, income, education, occupation) have also been widely studied within the marketing discipline. There are other demographic and geographic variables such as disability, ethnicity, marital status and geographic locations that may provide useful information (Rice, 1997) on adoption. However, due to feasibility reasons (face-to-face interviews would have been required, but this is beyond the scope of this research) these variables were not included in this study. The study of the aforementioned variables was termed as segmentation, which involves the breakdown of the total broad and varied markets into homogenous, distinct, accessible, stable and large groups (Gilligan and Wilson, 2003; Rice, 1997). Segmentation serves the following two important functions in marketing. First, to target marketing messages to appropriate segments, and second, to develop modified products that fit specific segments of the market (Gilligan and Wilson, 2003; Rice, 1997). Therefore, a study of the demographics of broadband consumers may assist the policy makers and ISPs providers by identifying the various segments' specific needs and constraints.

2.7.1 Age

Finch (1986) argued that age can be employed as a factor or independent variable to explain a particular social grouping, social process, or piece of individual or collective behaviour. Within the IS area a number of studies have found evidence that explains the significant, direct and moderating effect of age on the behavioural intention, adoption and usage behaviours (Harris *et al*, 1996; Morris and Venkatesh, 2000; Pearson *et al*, 2002; Venkatesh *et al*, 2003). A study by Venkatesh *et al* (2000) suggests that the majority age group adopting computers in the USA is 15-17 years, which is then followed by the 26-35 years. Similarly, Lee and Choudrie (Lee *et al*, 2003; Lee and Choudrie, 2002; Choudrie and Lee, 2004) found that in South Korea, the group that increased the adoption of broadband via the PC Bangs, was the younger aged one (i.e. school attending age). In turn, the younger generation's usage of broadband exerted a substantial influence on the parents' decisions for

subscribing to broadband as parents considered broadband to be imperative for educational and entertainment purposes. Carveth and Kretchmer (2002) found that in many West European countries, the older demographic groups are less likely to use the Internet compared to the younger ones. According to this study, in the UK, 85 per cent of those aged 16-24 have Internet access compared to just 15 per cent in the 65-74 age range, and 6 per cent over the age of 75 (Carveth and Kretchmer, 2002). A study by Anderson *et al* (2002) also suggests that the demography of dial-up users is different to the broadband one. Therefore, significant age differences are expected in terms of the broadband adopters and non-adopters. The younger and middle age groups are expected to be more apathetic to adoption, whilst the older age group is expected to be more relevant to the non-adopters. Hence, this forms the following hypothesis:

> ***H14***: *There will be a difference between the adopters and non-adopters of the various age groups.*

2.7.2 Gender

According to Morgan (1986), gender, as a key variable, is one of the most common variables in social investigations. Jackson and Scott (2001) defined gender as a hierarchical division between women and men embedded in both social institution and social practices. Gender is therefore a social structural phenomenon but is also produced, negotiated and sustained at the level of everyday interaction (Jackson and Scott, 2001). Morgan (1986) argued that gender can be employed as a descriptive variable as well as an explanatory variable (Morgan, 1986). A number of studies have investigated the role of gender in the adoption and usage of ICTs (Al-Jabri, 1996; Anderson *et al*, 1999; Choudrie and Lee, 2004; Gefen and Straub, 1997; Holmes, 1997; Harris *et al*, 1996; Lacohee and Anderson, 2001; Morris and Venkatesh, 2000; Pearson *et al*, 2002; Venkatesh *et al*, 2003; Venkatesh and Morris, 2000; Venkatesh *et al*, 2000; Wood and Glass, 1995). The findings of the previous studies revealed that gender has an important role when considering technology adoption and usage in both the organisational and household contexts. A study by Venkatesh *et al* (2000) illustrated that male users use a computer more than females and suggested gender as one of the most important variables when examining PC adoption in the household. Anderson *et al* (1999) also suggest that there exist clear gender differences in the usage of computers and telephone calls. Lacohee and Anderson (2001) also emphasised the differences between the men and women in terms of the usage of a telephone. Hence, the hypothesis is:

> ***H15***: *The adopters of broadband will be more from male than female gender.*

2.7.3 Education

Previous studies suggest that individuals with educational qualifications are more likely to adopt new innovations (Burgess, 1986; Rogers, 1995). Past research on technology (PC) adoption suggests a positive correlation between the level of education, technology ownership and usage (Venkatesh *et al*, 2000; Vitalari *et al*, 1985). Venkatesh *et al* (2000) found that people with higher educational qualifications use computers more than the less educated ones. Education has also been identified as an important driver of broadband adoption in South Korea (Choudrie and Lee, 2004; Lee *et al*, 2003). Anderson *et al* (2002) suggest that household consumers with secondary or tertiary education are more likely to have Internet access. From the previous research undertaken both in theory and empirical research, it is suggested that education can be considered as an independent variable that explains the differences between broadband adopters and non-adopters. This is because broadband is considered to be useful for educational purposes and performing job related tasks. Therefore, it is expected that household consumers with higher educational attainment or working towards higher educational attainment, i.e. degrees or postgraduate degrees, are more likely to adopt broadband. Hence, the derived hypothesis is:

> ***H16:*** *There will be a difference between the adopters and non-adopters of broadband in different levels of education.*

2.7.4 Income and Occupation

As in the case of education, Rogers (1995) described socio-economic status (income and occupation) as a correlate or antecedent of innovativeness. The Diffusion of Innovation theory suggests that new technologies are initially adopted by those with more resources (Rogers, 1995). The adaptive structuration theory found that IT has the potential to increase the resources of both those who had them prior to its adoption and those who possessed fewer resources prior to its adoption (DeSanctis and Poole, 1994; Mason and Hacker, 1998). The findings of a longitudinal study using the USA census data found a positive correlation between income and computer ownership (Venkatesh *et al*, 2000). This study further suggests that a considerable gap persists between the lower and higher income groups (Venkatesh *et al*, 2000). A study by Anderson *et al* (1999) also confirmed that income and occupation drive the general pattern of ICT ownership and usage. Anderson *et al*'s study found a strong correlation between social class and ownership of PCs, telephones and television (Anderson *et al*, 1999). Similarly, Carveth and Kretchmer (2002) suggested that in the USA, the higher income families and households are more likely to own a computer and use the Internet. A similar pattern was suggested for West European countries including the

UK. Carveth and Kretchmer's study suggested that only 23 per cent of lower income groups in comparison to 68 per cent of the higher income groups in the UK use the Internet (Carveth and Kretchmer, 2002). A recent study focused upon the determinants of the global digital divide, also confirmed the importance of per capita income in explaining the gap between computer and Internet use (Chinn and Fairlie, 2004).

The aforementioned theoretical arguments and empirical evidence support the inclusion of both income and occupation as an independent variable that explains the difference between broadband adopters and non-adopters in the household. Thus, the hypothesis is:

> ***H17**: There will be a difference between the adopters and non-adopters of different levels of household annual income.*

Similar to income, occupation is also likely to differentiate between the adopters and non-adopters of broadband. This is because broadband is useful for performing job related tasks; therefore, respondents with higher skilled occupation categories such as 'A', 'B' and 'C1' are more likely to adopt broadband, which is not expected for the lower occupation categories such as 'C2' and 'D', but not including category 'E'. The aforementioned occupation categories were derived from the marketing literature where mainstream professionals, such as doctors, lawyers, and judges with the responsibility of more then 25 staff are classified as occupational category 'A' (Gilligan and Wilson, 2003; Rice 1997). The aforementioned occupations with a responsibility of less then 25 staff and academics are grouped as social grade 'B'. Skilled-non-manual workers fall within the occupational category 'C1' and 'C2'. Unskilled manual workers belong to the occupational category 'D'. Finally, housewives, retired individuals, students and unemployed citizens were placed in category 'E' (Gilligan and Wilson, 2003; Rice 1997). As broadband provides a function to students and unemployed people who are engaged in job hunting, these groups are more likely to adopt broadband although they belong to the lower occupation category 'E'. This led to the formulation of the following hypothesis:

> ***H18**: There will be a difference between the adopters and non-adopters of different types of occupation.*

2.8 DEPENDENT VARIABLES: BEHAVIOURAL INTENTION (BI) AND BROADBAND ADOPTION BEHAVIOUR (BAB)

The TPB (Ajzen, 1991) considered two independent variables, namely BI and behaviour in question. The majority of technology adoption and usage research has utilised

the aforementioned two dependent variables to predict technology adoption and usage (Ajzen, 1991; Davis, 1989; Venkatesh and Brown, 2001). The TPB and findings from previous empirical studies suggest BI is a mediating variable between the predictors and actual behaviour. Therefore, BI is considered to have a direct influence on adoption or usage (Ajzen 1991). Apart from BI, previous studies have also employed a control factor (i.e. available resources) as a direct predictor of behaviour (Ajzen, 1991; Venkatesh and Brown, 2001). Previous studies have reported a strong correlation between control factor and behaviour (Ajzen, 1991). Findings from a number of technology adoption and usage studies within the IS field suggest BI (Morris and Venkatesh, 2000; Venkatesh *et al,* 2003; Venkatesh and Brown, 2001; Venkatesh and Morris, 2000; Venkatesh *et al,* 2000) and control (Taylor and Todd, 1995) as being good predictors of actual adoption or usage behaviour. Consistent with previous studies and the guiding theory, the current study considered BI as a mediating dependent variable and adoption behaviour as an ultimate dependent variable. The following hypothesis illustrates the relationship between BI and BAB.

> ***H13*:** *Behavioural intention and facilitating conditions resources will have an influence on the adoption of broadband.*

2.9 USAGE AND IMPACT OF BROADBAND

The proposed conceptual model of this research considered a variety of broadband use and rate of use as dependent variables. It is expected that the independent variable broadband adoption behaviour will differentiate between the variety and rate (Shih and Venkatesh, 2004) of Internet use between broadband and narrowband users. Following the previous study on technology usage (Shih and Venkatesh, 2004), we postulate the following hypotheses on broadband use:

> ***H19a*:** *The adopters of broadband will spend more time online than non-adopters.*
>
> ***H19b*:** *The adopters of broadband will access the Internet more frequently than non-adopters*
>
> ***H19c*:** *The adopters of broadband will access a higher number of online activities than the non-adopters.*

2.10 IMPACT OF BROADBAND

Time allocation patterns are considered to be an important variable for understanding the role of computing and the impact of ICTs in households (Vitalari *et al,* 1985). This is due to the total available time being finite and the time spent upon using a technology being likely to influence the distribution of time upon other activities. Therefore,

the use of new technology does indirectly rearrange the social actions and user behaviour (Vitalari *et al*, 1985). Vitalari *et al* (1985) have demonstrated the impact of personal computers upon the time allocation of various routine activities and have also considered the implications of this action. Although broadband is expected to affect several aspects of daily life in the household (BSG, 2004; Carriere *et al,* 2000), research that understands the impact of broadband on time allocation patterns has not been undertaken. This was a motivating factor for including this construct.

According to the diffusion literature, new innovations such as broadband are likely to change the associated behaviours of users, which are termed as the perceived consequences or impact of new innovations (Rogers, 1995; Shih and Venkatesh, 2004). As described above, previously researchers have demonstrated the impact of various technologies (e.g. automobiles, telephone, computers and Internet) on a user's daily life (Anderson *et al*, 2001; Vitalari *et al,* 1985). Since broadband offers an alternative way of work and entertainment, and consumes time that traditionally has been spent on other activities, it is likely that broadband will alter the time allocation pattern of a user's daily activities.

The homeostasis relationship between technology and time change (Robinson, 1977) was considered most appropriate for examining the impact of broadband on household consumers. This was because this relationship was proposed for the context of household technology and time change, and was successfully applied to investigate the impact of computer use in the household (Vitalari *et al*, 1985). Two underlying principles were adopted from Robinson (1977) which state that: (1) a natural system like a household tends to be at an equilibrium; and (2) any new change due to equilibrium disturbance caused by triggers such as the use of new technology is adjusted by similar but already existing factors in the system, thereby restoring the equilibrium condition (Robinson, 1977; Vitalari *et al*, 1985). The aforementioned two principles were utilised to propose the homeostatic model of the effect of computer use on household time allocation patterns (Vitalari *et al,* 1985). This model suggests three possibilities that may occur after introducing new technology in the household. These three possibilities are: absence of change in the existing patterns of household behaviour due to the non-use of the computer; short-term perturbations in household behaviour, and changes that signal long-term impacts (Vitalari *et al*, 1985). This model also suggests that consumer activities that are affected the most are internal. Examples of internal activities include watching television and hobbies, as opposed to external activities such as sports, eating, socialising with friends (Vitalari *et al*. 1985). This is a brief

account of the homeostatic model; however, for a detailed discussion the reader may refer to the original source published by Vitalari *et al* (1985).

The model of homeostasis discussed above was utilised to conceptualise the impact of broadband on the time allocation patterns of households. Similar to the previous study (Vitalari *et al*, 1985), the model begins with an equilibrium state, where households do not have an Internet connection at home. Subscribing to the Internet at home, may affect a consumer in one of the following three possible ways. First, there is a lack of change in the existing pattern of behaviour. This is because the characteristics of household users such as age are such that they elicit a low level of interest in the Internet. Second, there are short-term changes in the behaviour of household. Third, there are long-term changes in the household's behaviour. Both short-term and long-term changes can affect time allocation patterns on both cognate activities such as television watching and reading, and differentiated activities such as sports and outdoor recreation (Vitalari *et al,* 1985). This research postulates that the magnitude of both short-term and long-term changes are dependent upon the type of Internet connection, i.e. narrowband or broadband, rate of use and length of Internet subscription in the household.

It is also assumed that the decrease in online shopping or the decrease in telephone conversations require time to develop trust and become habitual; therefore, the length of Internet subscription is likely to affect this for the long- term. Activities such as working at home, working in the office and commuting in traffic are interconnected and are more likely to be affected by the type of internet connection. Households with broadband connections are more likely to contain individuals who work at home in comparison to narrowband consumers. It can be argued that short-term changes may become long-term if internet use is continued over time. For example, online shopping may be an initial instance of a short-term change in consumer behaviour; however, if there is continuous use of the Internet and a consumer develops trust and routine, then it may become a long-term change in household behaviour. Therefore, this research will answer the following research question:

> **RQ8**: *Does the use of broadband affect the time spent on various daily life activities?*

With this question, the discussion on the theoretical aspects surrounding this research is drawn to a close. The next section summarises and concludes this chapter.

2.11 SUMMARY AND CONCLUSIONS

Firstly, this chapter reviewed the various technology adoption and diffusion related theories and models including the DI, TRA, TPB, DTPB, TAM, MATH and UD. The analysis suggests that although none of the aforementioned theories and models could be as such applied to examine the broadband adoption, usage and impact, integrating the constructs across the models will be more appropriate and will assist in providing a coherent understanding of the research problem. Therefore, the most appropriate theories and models such as MATH, TPB, DTPB and DI have been considered to be guiding frameworks for current research.

Second, this chapter has identified the factors that are expected to predict the BI to adopt broadband, which ultimately explains the broadband adoption behaviour. Also the broadband adoption behaviour is expected to differentiate between the rate and variety of Internet use between the broadband and narrowband users. Using these factors a conceptual model of broadband diffusion was developed. The proposed conceptual model is based on the assumption that the attitudinal, normative and control factors listed in Table 2.2 are responsible for influencing the BI to adopt broadband, which in turn is expected to predict broadband adoption behaviour. The proposed model also includes constructs to investigate whether broadband users differ from narrowband users when determining the usage and impact of the Internet. Whilst discussing the aforementioned factors, the underlying hypotheses (Table 2.2) were also proposed that need to be tested in order to verify the model. In order to test the underlying hypotheses that can verify the proposed conceptual model, the next step was to determine the relevant research method. Following that, it was essential to develop a reliable data collection instrument that could be utilised to collect empirical data from the household consumers. Completion of the aforementioned work led the research to refinement and validation of the proposed conceptual model of broadband diffusion.

In the following chapters, the proposed conceptual model will be utilised as a basis for empirical investigation. Chapter 3 begins with a discussion of the chosen research method. Following that, Chapter 4 will provide a detailed discussion on the instrument development.

Chapter 3: Research Methodology

3.1 INTRODUCTION

The previous chapter formed a conceptual model that is aimed at examining broadband adoption, usage and impact from the context of household consumers. This chapter aims to provide an overview of the research approaches utilised within information systems (IS) field, which leads to selection of an appropriate research approach for guiding the validation of the conceptual model.

To understand the research topic, validate and understand the conceptual model and to obtain required data, a quantitative research was employed. The philosophical foundation utilised for guidance is positivism. A survey research approach was employed. The data collection technique utilised to collect the data was the questionnaire. Reasons for the aforementioned selection of the philosophical underpinning, type of research approach and data collection method are explained and justified within this chapter.

This chapter is structured as follows. Initially, Section 3.2 provides an overview of the underlying epistemologies and then provides justifications for the preferred one. This is followed by an overview discussion on various issues related to the available research approaches in the IS field and a justification for the selection of a survey as the research approach in Section 3.3. Section 3.4 provides an overview of the overall design of this research. A detailed account of the various aspects of the survey approach is offered in Section 3.5. Issues relating to data analyses are outlined in Section 3.6. Finally, Section 3.7 offers a conclusion to the chapter.

3.2 UNDERLYING EPISTEMOLOGY

According to Mayers (1997), epistemology refers to the assumptions about knowledge and how it can be obtained. Within IS, there are three underlying epistemologies that researchers can select in order to guide a particular research. These are positivism, interpretivism and critical research (Chua, 1986; Mingers, 2001; 2003; Orlikowski and Baroudi, 1991) (Figure 3.1).

A large variation is reported in terms of the percentage use of these underlying epistemologies within IS research. Orlikowski and Baroudi's (1991) study found that amongst the three IS epistemologies positivism emerged in 96.8% of studies. Contrastingly, only 3.2% of studies employed interpretive epistemology and at the extreme end none of the studies could be placed within critical epistemology (Orlikowski and Baroudi, 1991). However, more than a decade has passed since the Orlikowski and Baroudi (1991) study and the percentage use of underlying epistemologies within IS research has slightly changed. A Mingers (2003) study suggests that 75% of the IS research employs a positivist approach,

17% interpretivist and only 5% critical research (Mingers, 2003). The statistics suggest that positivism is a most favoured underlying epistemology within IS research.

Orlikowski and Baroudi (1991) defined research as positivist if there was evidence of formal propositions, quantifiable measures of variables, hypothesis testing, and the drawing of inferences about a phenomenon from the sample to a stated population (Orlikowski and Baroudi, 1991). Straub *et al* (2005) described positivism from the statistical point of view to suggest that the objective of statistics (mainly T, F, and Chi-square statistics) employed by the Quantitative Positivist Research (QPR) is to falsify the null hypothesis, which is the assumption that the data in the dependent variable are not affected by the data in the independent variable(s). Since each theoretical hypothesis (the hypothesis as stated in the theory) should be the exact opposite of its null hypothesis by predicting a difference in the dependent variable, it follows logically that if the null hypothesis is rejected, then presumably the theoretical hypothesis is supported (Straub *et al,* 2005).

Since this research provides evidence of propositions (Chapter 2), quantifiable measures of variables (Chapter 4), hypothesis testing and the drawing of inferences about a phenomenon from the sample to a stated population (chapters 5 and 6), the positivist epistemology was considered to be appropriate for this research. A further discussion on this issue is provided in last paragraph of this section. However, the next two paragraphs briefly discuss the relevance of the other two epistemologies for this research.

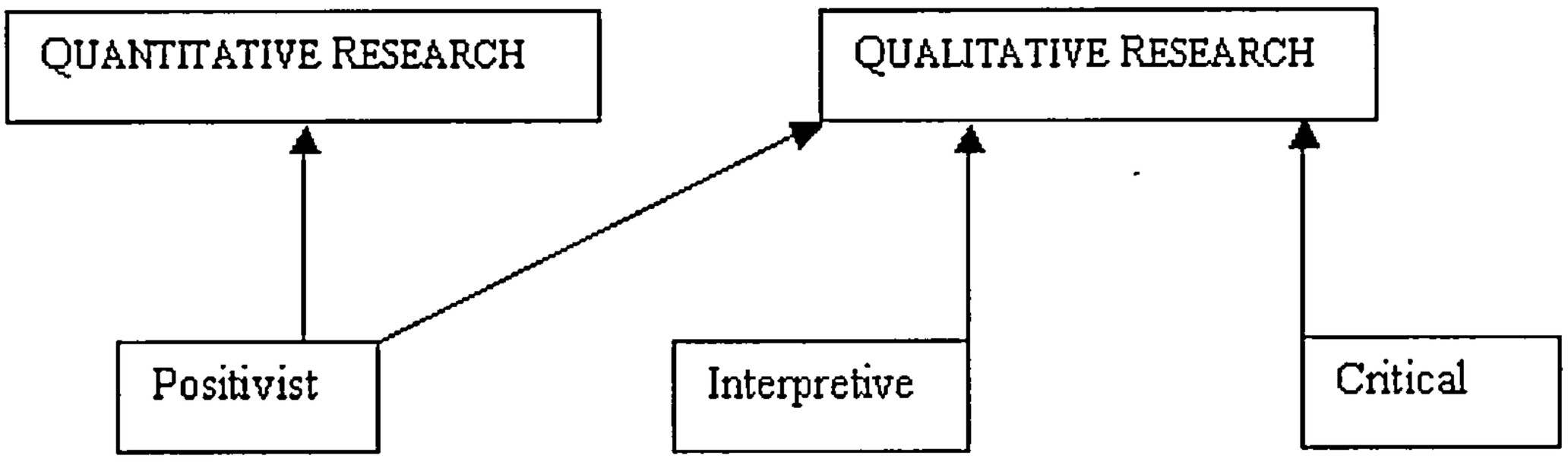

Figure 3.1 Epistemological Assumptions for Qualitative and Quantitative Research (**Source:** Adopted from Straub *et al,* 2005)

Mayers (1997) suggested that interpretive researchers start out with the assumption that access to reality (given or socially constructed) is only through social constructions such as language, consciousness and shared meanings. Boland (1985) suggested that hermeneutics and phenomenology are the philosophical basis of interpretive research. According to Walsham (1993), the aim of interpretive studies is to "understand the context of the IS, and the process whereby the information system influences and is influenced by the context". In contrast to positivist research, the focus of interpretivist research is on the full complexity of

human sense making as the situation emerges (Kaplan and Maxwell, 1994). Since interpretivist epistemology focuses upon the complexity of human sense making, it was necessary to pursue research employing qualitative data collection (Mayers, 1997; Straub *et al*, 2005) with very limited respondents. The purpose of this research was to gather evidence in a quantitative manner; hence interpretivist epistemology was considered to be less relevant for this research.

According to Mayers (1997), "critical researchers assume that social reality is historically constituted and that it is produced and reproduced by people. Although people can consciously act to change their social and economic circumstances, critical researchers recognize that their ability to do so is constrained by various forms of social, cultural and political domination". The main task of critical research is seen as being one of social critique, whereby the restrictive and alienating conditions of the status quo are brought to light (Mayers, 1997). Critical research focuses on the oppositions, conflicts and contradictions in contemporary society, and seeks to be emancipatory, i.e. it should help to eliminate the causes of alienation and domination (Mayers, 1997). The critical epistemology was considered to be less appropriate for undertaking this research. This is because the purpose of the current research is not to focus upon the oppositions, conflicts and contradictions, instead it investigates factors that at this particular point of time are affecting the adoption of broadband. An additional reason is that the purpose of this research was to gather evidence in a quantitative manner, which critical epistemology does not facilitate.

After considering all the three underlying epistemologies, this research that examines broadband adoption within UK households adopted positivist epistemology. This is because technology adoption and diffusion is considered to be one of most mature areas within IS research. Due to its long tradition of research, a number of theories and models have been developed and validated for examining a variety of technological objects. Consequently, a variety of constructs (dependent and independent variables) suitable for diverse situations are available which can rationally be adapted to examine the adoption and diffusion of new technologies (Venkatesh *et al*, 2003). This was the basis for developing a conceptual model of broadband adoption and formulating the research hypotheses presented in Chapter 2. Following Straub *et al's* (2005) description of positivism, this research will employ statistics, such as the T, F, and Chi-square test, to determine if this data supports the research hypotheses (Straub *et al*, 2005). This research does not suggest that the other two epistemologies cannot be applied to this research. It is argued that for this research context, positivism is much more appropriate and feasible.

3.2.1 Quantitative and Qualitative Data

According to Myers (1997) qualitative data is derived from various sources that include observation and participant observation (fieldwork), interviews and questionnaires, documents and texts, and the researcher's impressions and reactions. Qualitative data are useful means to understand people and the social and cultural contexts within which they live (Myers, 1997). Cornford and Smithson (1996) described quantitative data as metrics (numbers) that can be used to describe the phenomenon (objects and relationships) under study. Straub *et al* (2005) argued that the numbers come to represent values and levels of theoretical constructs and concepts and the interpretation of the numbers is viewed as strong scientific evidence of how a phenomenon works (Straub *et al*, 2005). Sources of quantitative data in the social sciences include survey methods, laboratory experiments, formal methods (e.g. econometrics) and numerical methods such as mathematical modeling (Myers, 1997; Straub *et al*, 2005). Since data utilised in this research were collected employing survey methods (Myers, 1997) and represent values and levels of theoretical constructs (Myers, 1997; Straub *et al*, 2005) such as relative advantage, utilitarian outcomes, hedonic outcomes, service quality, primary influence, secondary influence, self-efficacy, knowledge, facilitating conditions resources and behavioural intentions, the data collected in this research belongs to the quantitative category than qualitative.

3.3 RESEARCH APPROACHES

3.3.1 Taxonomy of IS Research Approaches

When conducting any research, selecting an appropriate method is a critical issue. In the IS area, several attempts have been made to review and classify research approaches (Galliers, 1992; Galliers and Land, 1987; Mingers, 2001; 2003; Nandhakumar and Jones, 1997; Orlikowski and Baroudi, 1991; Walsham, 1995a; 1995b). Early work was undertaken by Galliers (1992), who provided a taxonomy of prevalent IS research approaches. This taxonomy considered a range of *positivist* and *interpretive* research approaches including experiments, surveys, case studies, theorem proof, forecasting, simulation, reviews, action research, futures research, and role/game playing (as shown in **Appendix 3.1**). The other early research was by Orlikowski and Baroudi (1991), who offered a philosophically reflective paper with a North American perspective. In this work, the emphasis was on categorising published IS research according to the used epistemologies, and it was found that although positivism was prevalent, *critical epistemology* (Orlikowski and Baroudi, 1991) was also beginning to emerge. Similar to Orlikowski and Baroudi (1991), a recent classification by Minger (2003) also categorised IS research approaches into three

categories, including critical research. Straub *et al* (2005) have divided positivist research in two categories, namely quantitative positivist research (QPR) such as lab and field experiment and field study, and non-quantitative positivist research (Non-QPR), for example case study and participative research. A list of the IS research approaches is offered in **Appendix 3.1**.

The extant IS literature suggests that different terms are used for the same research methods (Mingers, 2003). For instance, the terms 'survey' and 'questionnaire' are used indistinguishably (Mingers, 2003). Contrastingly, the terms 'case study' and 'interviews' are used synonymously, although they are distinct from each other (Mingers, 2003). Bearing this in mind, it was felt that it was necessary to clarify the various terms that are used for different types of research approaches. For this purpose, we adopted Mingers' classification and description of research approaches (Mingers, 2003). This classification was followed for two reasons: first, Mingers' research is the most recently published work; second, it encompasses a variety of research approaches associated with all three epistemological standpoints, namely *positivist, interpretivist* and *critical*. As a reminder, positivist research methods include observations, measurements, surveys, questionnaires, instruments, laboratory and field experiments, statistical analysis, simulations, and case studies. Interpretivist research methods consist of interviews, qualitative content analysis, ethnography, grounded theory, and participant observation. Finally, the critical standpoint involves intervention and change, employing the methods of action research, critical theory, and consultancy (Mingers, 2003). The detailed descriptions of the aforementioned research approaches are provided in **Appendix 3.2**.

3.3.2 Trend of Research Approaches Use in Information Systems

Mingers (2001; 2003) conducted a review of all the papers published during 1993-1998, in two leading American journals (*MIS Quarterly (MISQ)* and *Information Systems Research (ISR)*) and four European ones (*European Journal of Information Systems (EJIS), Information Systems Journal (ISJ), Journal of Accounting, Management and IT (JAMIT),* and *Journal of Information Technology (JIT)*). The findings of this study suggest that about 80% of the evaluated papers contain some form of empirical research, where surveys, interviews, experiments and case studies are the dominant approaches. Alternatively, approaches like participant observation, grounded theory and soft systems methodology are rarely used.

The aforementioned studies provide evidence that although several research methods are suggested (Galliers, 1992; Orlikowski and Baroudi, 1991; Minger, 2003), only surveys, experiments, interviews, and case studies are predominantly used within the IS area.

3.3.3 Trend of Research Approaches Use within Technology Adoption Research

Previous studies have been focused upon examining the trends of IS research approaches in general. However, little information is available for the trends of the research approaches used for the specific research domain, such as technology adoption and diffusion. Therefore, an examination of the literature was conducted to ascertain the research approaches employed in the area of technology adoption and diffusion. This was pursued by examining the following:

(i) Since focus of this research is broadband adoption and use, prevalence of different research approaches in the area of technology adoption were examined.

(ii) Since the context of this research is the household, the prevalence of different research approaches in the area of technology adoption and use within the household context were examined.

(iii) In order to determine an appropriate research approach for examining household consumers, the relationship between the research approaches used and the types of *unit of analysis* (i.e. users, consumers, organisations) was examined.

To explore the above, a review of articles was undertaken, selecting from those published within peer-reviewed and highly rated journals including *MISQ, EJIS, ISJ, ISR*, and other relevant publications. Since Mingers' (2003) method was used, the sample selection used in this research was very close to this study. Since aforementioned journals were examined in Mingers' (2003) study, they were also selected for this study. To avoid any bias and to obtain a common perspective, two American and two European IS Journals were examined to review trends of research approaches in the technology adoption and usage area.

A total of 633 published articles appearing during the 1992-2003 period in four IS journals were examined to select the empirical papers addressing the issue of technology adoption and usage. This research followed Mingers' definition of an empirical paper, which states that a paper is empirical if it reports on new data (of any kind) that has been generated by the underlying research and the resultant analysis is a substantive part of the paper's contribution (Mingers, 2003). Empirical papers focusing on the aforementioned area were then studied and their research approach was recorded (**Appendix 3.3**). Since IS research on technology adoption focuses on *users* as research artefacts, another wider search of the relevant literature was conducted. This was done in order to examine the approaches used to study adoption and usage of technology in the *household* context (**Appendix 3.4**).

From the 633 examined articles, 31 articles (4.9%) addressed issues related to technology adoption. This proportion in specific IS journals were as follows: *MISQ* (6%), *ISR* (5.15 %), *EJIS* (5%) and *ISJ* (2.63%).

The analysis of the articles suggests that the researchers investigating technology adoption used two main research approaches, namely the *survey* and *case study*. 74% of the articles employed the survey approach, which suggests that it is the most widely used approach in technology adoption research. This then led this research to consider the survey approach.

Further support was obtained from previous findings and evidence that the survey approach is more dominant in the IS area (Farhoomand, 1992; Mingers, 2001; 2003; Orlikowski and Baroudi, 1991). The remaining 26% of the research employed the case study method. No other approaches were employed to investigate the use or adoption of technology. Another interesting observation is that the case study approach was exclusively employed to study the organisational adoption of technology, while surveys were used to study a range of contexts. For example, surveys were used to study technology adoption within the context of technology users, household and online consumers, senior executives and small firms. Although technology adoption is a common topic within the IS area (Venkatesh *et al,* 2003), the research approaches used are of very limited diversity.

The review of the previous articles also suggests that research on technology adoption in the context of the household has just begun to emerge. IS researchers have mainly focused on organisational issues. Therefore, another attempt was made to identify publications, which addressed technology adoption issues in the household context. For this purpose, articles were extracted from both the IS and non-IS journals including *Advances in Consumer Research, American Behavioral Scientist, Journal of Marketing, Management Science,* and *Journal of Economic Psychology*.

Analysis of the selected articles indicated that the survey approach is once again dominant in the study of consumer adoption of technology in the household context. The survey approach was employed in 63% of the articles. The range of tools employed to conduct a survey include the postal service, telephone, face-to-face interviews and web questionnaires. 25% of the research reported was conducted using a multi-method approach, whereby a combination of the survey with either an interview or time-use diary was employed. Other methods used were the ethnographic study and analysis of secondary data obtained from census figures. For the purpose of investigating the *adoption* of technology (especially ICTs) within the household, the survey approach seemed to be the most predominant. Other approaches including the multi-method, ethnographic study, and

secondary data analysis were employed mostly for investigating the *usage* of technology in the household.

The findings suggest that the survey was the most widely used approach to examine the technology adoption issues both in the context of the organisations and households. The case study approach was employed only for investigating technology adoption issues in the organisational context, particularly when the *unit of analysis* was the organisation rather than the individual users. This approach was not employed in the household context. Other approaches such as the ethnographic study and time-use diaries were employed in the household context, but not in the organisational context. The justification for this is provided below.

3.3.4 Justification for Survey as a Preferred Research Approach

From the findings of the above section it can be concluded that although a range of research approach is available to IS researchers, the survey as a research approach is most widely employed for examining technology adoption related issues. The choice of approach seems to correspond with the unit of analysis. When the researchers considered the organisation as a unit of analysis, the case study approach was favoured. In studies related to individual users or consumers, the survey approach was favoured. This can be attributed to issues such as convenience, cost, time and accessibility (Gilbert, 2001). The extent to which a researcher can be a part of the context being studied is also a factor that plays an important role for determining a research approach. Within the household context, it is difficult for a researcher to be a part of the context; therefore the survey approach would be more feasible than others, such as ethnography and observations. Furthermore, the aim of this research was to examine broadband adoption and diffusion across the UK or using a nationwide perspective. Hence, in order to get an overall picture of the research issue, collecting data from a large number of participants from across the UK is required. This means employing any other approach such as ethnography that utilises an interview or observation, as data collection tools demand huge amounts of financial resources, manpower and time. As this is a student research project, all three factors limited the ability of the researcher when investigating this research issue.

Selection of the approach in this case was also influenced by the type of theory and models employed to examine broadband adoption and diffusion research (Chapter 2). The conceptual model proposed in Chapter 2 includes a number of research hypotheses that need to be tested before concluding this study. This requires collecting quantitative data and statistical analysis in order to test research hypotheses. Although a number of research approaches are available within the category of quantitative positivist research (Straub *et al*,

2005, **Appendix 3.1**), a survey is the only appropriate research approach that can be employed to conduct such research (i.e. that require hypotheses testing and validation of the conceptual model) in a social setting, in this instance the household. One of the planned contributions of this study is to provide insights to the Internet service providers (ISPs) about the factors that are salient to consumer adoption and non-adoption of broadband and to establish a relationship with behavioural intention and actual adoption. In order to achieve this, it was essential to collect quantitative data on a number of variables including demographics and thereafter perform a regression analysis to identify a relationship. This was again a logical reason for adopting the survey as a research approach and collect quantitative data that may help ISPs to understand the behaviour of household consumers and their demographic characteristics, in order to encourage and promote broadband adoption.

On the basis of the aforementioned reasoning, it was decided that the survey is one of the most appropriate and feasible research approaches to conduct this research. The next section provides details on the strategy that was used to execute this research, followed by a detailed discussion on various aspects of the survey approach in the context of broadband adoption, usage and impact related issues.

3.4 RESEARCH STRATEGY

Figure 3.2 illustrates the research strategy followed to conduct a survey research approach for examining broadband adoption, usage and impact in the UK households. The research strategy of this research (Figure 3.2) is similar to previous survey research conducted in the IS field (Davis, 1989; Moore and Benbasat, 1991; Taylor and Todd, 1995). Developing a conceptual model and formulating hypotheses (Chapter 2) guided the selection of the survey research approach. Since the context of this study was different to previous studies from which constructs were adopted, it was essential to validate the survey instruments before data collection. Therefore, development of an instrument was considered as the next step in this research, which was performed in three stages, namely exploratory survey, content validity and pre and pilot test. Gradual development and validation in these stages aimed to overcome the limitations and improve the content and reliability of the survey instrument (Davis, 1989; Moore and Benbasat, 1991). Other critical issues are sample selection, instrument administration and data analysis. These issues are discussed and detailed justifications are provided in the remaining sections of this chapter. After determining the sample, the development and validation of the survey instrument occurred (Chapter 4). This was followed by the data collection and analysis (Chapter 5) and the

confirmation of the hypothesis and refining the conceptual model (Chapter 6). Finally, the conclusion, contributions and limitations are outlined in Chapter 7.

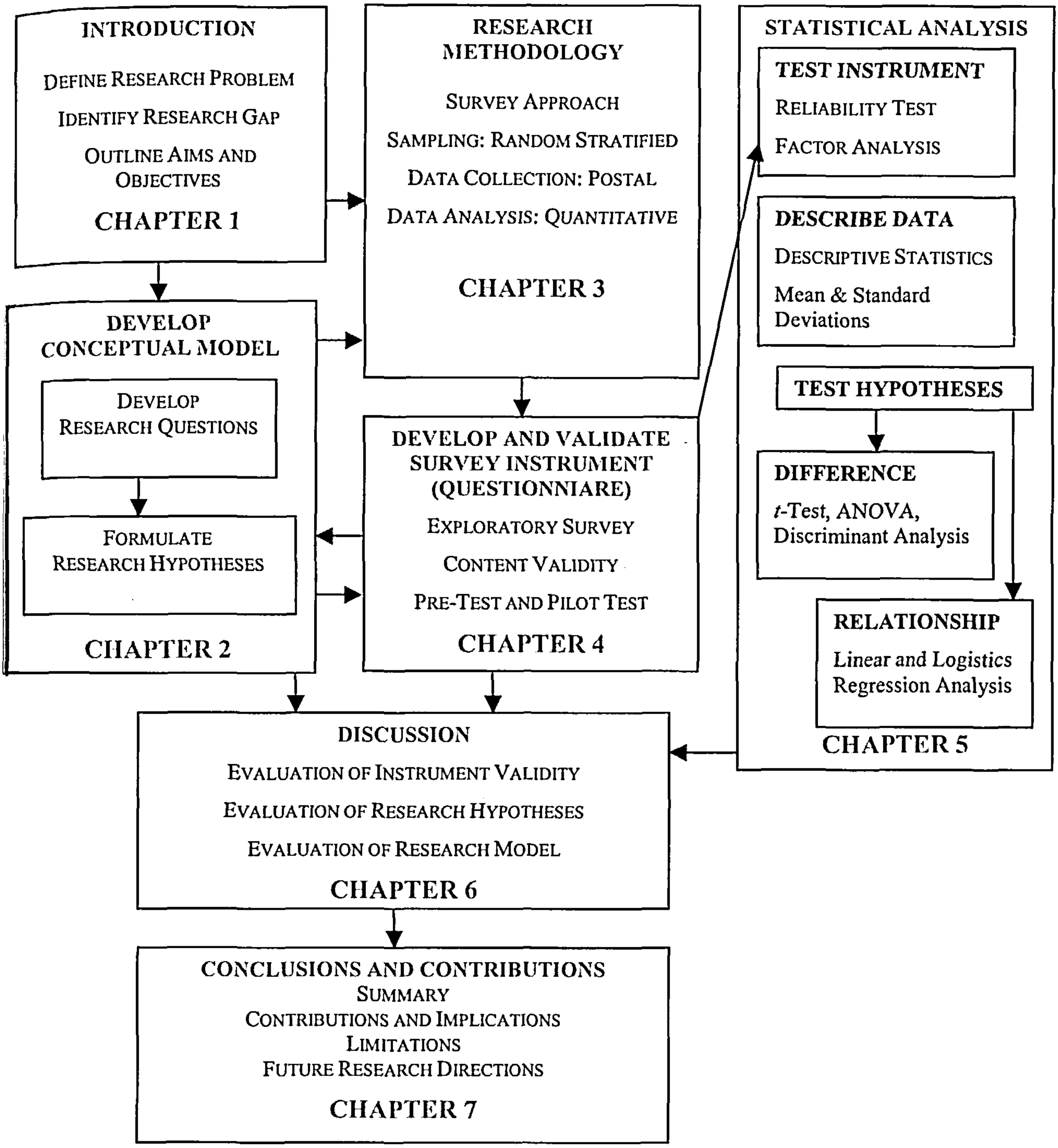

Figure 3.2: Research Strategy to Examine Broadband Adoption, Usage and Impact in UK Households

3.5 SURVEY RESEARCH APPROACH

Before proceeding further into detail about various aspect of the survey, it is important to clarify the term 'survey'. The majority of IS research approaches'

classifications (Galliers, 1992; Galliers and Land, 1987; Mingers, 2001; 2003; Nandhakumar and Jones, 1997; Orlikowski and Baroudi, 1991) have employed the term 'survey' as an approach within which a number of data collection techniques, such as mail, telephone and interviews are available and can be utilised for data collection purposes. However, Straub *et al* (2005) have denoted the term 'survey' as a data collection technique along with others such as interviews within the field study as a research approach. This study adopts the first view that denotes the survey as a research approach (Galliers, 1992; Galliers and Land, 1987; Mingers, 2001; 2003; Nandhakumar and Jones, 1997; Orlikowski and Baroudi, 1991). This is because the survey as a research approach is the most widely accepted view and is older in its acceptance within the research community. Therefore, hereafter, within this study the term 'survey' represents a research approach that is utilised to conduct this study. The data collection technique in this research is also referred to as a questionnaire or research instrument. To provide more information on the survey, the following subsections discuss various aspects of the survey research approach.

There are three essential components of the survey research approach, which are sampling, data collection and instrument development (Fowler, 2002). Fowler (2002) suggested that it is obligatory for a good survey design to combine all the three aforementioned components. The first component, sampling, involves the selection of a small subset of a population that is representative of the whole population. The most important thing to consider in a good sample is applying a technique that gives all or nearly all the population members the same chance of being selected (Fowler, 2002). The data collection can be conducted employing techniques such as in-person, telephone, mail and the Internet; however, the selection should be made after evaluating the advantages and disadvantages from the perspective of a particular research context (Fowler, 2002). Therefore, in order to evaluate the advantages and disadvantages from the perspective of this research, various aspects of sampling and data collection are discussed below. The third component, 'instrument development', is briefly introduced below and a detailed description is provided in the next chapter (Chapter 4).

3.5.1 Sampling

Fowler (2002) has suggested following five critical issues with regards to sampling. These issues consist of: (1) the choice of whether or not to use a probability sample; (2) the sample frame (those people who actually have the opportunity to be sampled); (3) the size of the sample; (4) the sample design (the particular strategy used for sampling a household consumer); and (5) the rate of response (the percentage of those sampled from whom the

data are actually collected). The first four issues are discussed within this section and the last one, 'response rate', will be discussed in the Section 3.5.2.

3.5.1.1 The Sample Frame

According to Fowler (2002), in a sample selection procedure, people who have a chance of being included among those being selected constitute the sample frame, and that is considered to be primary step towards evaluating the quality of a sample. Three ways a sample selection can be made are as follows (Fowler, 2002): (1) from a more or less complete list of individuals in the studied population; (2) from a set of people who go somewhere or do something that enables them to be sampled; and (3) in this method, sampling is done in two or more stages: the first stage involves creating a list of individuals and the second sample selection step is made from created list.

Three characteristics comprising comprehensiveness, probability of selection and efficiency of the sample frame need to be evaluated in order to select an appropriate sample frame (Fowler, 2002). If any sample frame excludes some proportion of the selected population then it is considered to be less comprehensive. Such a sample frame is less preferred when considering the selection of sample frame (Fowler, 2002). Probability of selection is referred to in that each individual should appear once and only once in a good sample frame in order to provide an equal chance for every entry in the selection process. It means that the sample frame should be checked for repetitions of entries. If some entries are repeated more than once in a sample frame then they have more chances to be selected than others. Therefore, such sample frames should be avoided or less preferred. When a sample frame does not include units that are not among those that the researcher wants to sample, then it considered as an efficient sampling frame (Fowler, 2002).

Similar to the above, Rice (1997) suggested six criteria of a good sampling frame comprising completeness, accuracy, adequacy, being up-to-date, convenience and non-duplication. *Completeness* refers to all the members of the population included in a list who have reliable addresses and information (i.e. *accuracy*). *Adequacy* is similar to completeness and refers to a sampling frame covering the entire population. *Up-to-date* simply refers to information included in sampling frame that is regularly updated. *Convenience* refers to a sampling frame that is readily accessible. Finally, *non-duplication* refers to each member of the population appearing on a list only once (Rice, 1997). A recommended sample frame that satisfies all but one aforementioned criterion for the UK population is the *Electoral Register* (a list of individuals) (Rice, 1997). This sample frame is readily available but, due to recent changes in the Data Privacy Act, the UK government prohibits access and use of the electoral role for research and marketing purposes.

In an email communication with the British library it was suggested that an alternative to the Electoral Register is a commercially available CD Rom called 'UK-Info Disk V11' that consisted of a degree of similar comprehensiveness, accuracy, adequacy, and up-to-date and non-duplicated information. The added advantages of this sample frame are that it is legally accessible/available for purchase and its mailing list can be prepared faster as there is no need to type addresses; instead this can be achieved just by copying and pasting relevant records. Therefore, due to the inaccessibility of the Electoral Register, it was decided that it is appropriate to utilise an alternative sample frame such as the 'UK-Info Disk V11' for the UK population. The UK-Info Disk V11 contained 31 Million Electoral Register records, i.e. addresses of UK citizens (www.192.com).

3.5.1.2 Sampling Techniques

After determining that the UK-Info Disk V11 was a cost-effective, comprehensive and efficient sample frame, the next step was to decide upon a selection technique for respondents to be included in the final study. Fowler (2002) suggests a number of techniques that can be utilised for selecting respondents from a sample frame. Amongst them the probability sampling techniques include simple random, systematic and stratified sampling. This research has utilised stratified random sampling as a sampling technique. A brief account on simple random, systematic and stratified sampling is provided and then the reasons for its selection of stratified sampling are discussed below.

Conducting a simple random sampling required a numbered list of the target population with each entry appearing once and only once. Then the required amount of random numbers needed to be generated within a specified range of numbers. This could be done utilising a computer program, a table of random numbers or some other generator of random numbers. Entries corresponding to the total amount of random numbers selected then constitute a sample random sample of the target population (Fowler, 2002).

Since ordering and numbering a large target population can be cumbersome, laborious and time consuming, an alternative to replace this technique is systematic sampling. Systematic sampling is not only mechanically easier to create but it also allows obtaining the benefits of stratification more easily without compromising the precision of sampling. Creating a systematic sample involves determining the total number of entries in a sample frame and then selecting a number of entries from the list. A division of latter values by the former one will produce a fraction. This estimated fraction is utilised as an interval every time a number is drawn and the composite of which makes the systematic sample (Fowler, 2002).

When a sample frame is divided by a number of subgroups on the basis of the characteristics of the target population and the total number of entries differing in the subgroups, then it is not considered appropriate to apply either simple random sampling or systematic sampling. For example, the UK population is divided into various boroughs that differ in terms of their total population; therefore, it is not appropriate to apply both simple random and systematic sampling. This is due to the difference in the size of subgroups and the fact that entries from the larger subgroups would have more chances to be selected than the smaller ones. In this situation it is appropriate to apply the stratified random sampling techniques. The initial step of this sampling technique involves estimating how many entries need to be selected from each subgroup according to its total size. This can be achieved by dividing the total number of entries in a subgroup from the total sample size. Once the numbers of entries for all the estimated subgroups are obtained, the selection can be made from each subgroup according to the sample random or systematic sampling process. Thereafter, combining all the entries selected from the various subgroups offers a stratified random sample (Fowler, 2002).

Of the three sampling techniques discussed above, the structure of the sample frame (i.e. UK-Info Disk V11) of this research necessitated the adoption of the third approach 'stratified random sampling'. This is because within the UK-Info Disk V11 database, the entire UK population was alphabetically listed by family name. The number of entries varied according to the alphabet. Therefore to obtain a sample in equal proportion from the entire alphabet, it was most suitable to adopt the stratified sampling approach. Initially, in order to draw a stratified random sample a respondent address from each letter of the alphabet was extracted. Then the sample size for each alphabet was determined according to the total sample size. Thereafter, a unique random number for each alphabetical letter was generated using the research randomiser software. Respondents to the corresponding random numbers were then selected for data collection from the sample frame (i.e. UK-Info Disk V11).

3.5.1.3 Sample Size

This is a most commonly encountered issue in a survey research where researchers look for a basis to determine the sample size. There are three commonly used approaches to determine the sample size, but Fowler (2002) suggested that they are not an appropriate way to determine the sample size. These three commonly used approaches include determining the sample size based on the total size of the target population, deciding it on the basis of a recommended standard size, and determining it based on how large a margin of error can be tolerated in a research.

The first approach of determining a sample is based on an inappropriate reasoning that the adequacy of a sample depends heavily on the fraction of the population included in that sample; in other words, a large fraction will make a sample more credible (Fowler, 2002). However, since the fraction of the population included in the sample is not a component of sampling error estimation (i.e. a measure of the precision of the sample), this approach is not an appropriate basis to determine the sample size (Fowler, 2002).

The second frequently used approach for determining a sample size is to derive it on the basis of the sample size in existing studies; which is inappropriately termed as a standard survey study (Fowler, 2002). As Fowler (2002) suggests, although it is alright to consider the sample sizes of a particular population that competent studies have considered appropriate, the sample size decision must be determined on a case-by-case basis. The consideration should be based on the variety of goals to be achieved by a particular study and other related aspects of research design (Fowler, 2002).

The third approach of inappropriate determination of the sample size is based on the consideration to the margin of error that is acceptable in a particular research, or the amount of precision expected from estimates (Fowler, 2002). Fowler (2002) argued that in theory there is nothing wrong with this approach; however, practically this approach provides little help to researchers in sample determination due to the following reasons. The majority of survey studies involve several estimations and the desired precision for these estimates is likely to vary; therefore, it is not appropriate to make a sample size decision on the need for precision of a single estimate (Fowler, 2002). Furthermore, it is a less possible situation to specify an acceptable margin of error in advance.

This approach also assumes that errors only emerge from sampling and ignores the fact that there are several other sources of error such as response bias. Therefore, Fowler (2002) suggested that the calculation of precision based solely on the sampling error is an unrealistic oversimplification, hence forming decisions based on the sample size is inappropriate (Fowler, 2002).

According to Fowler (2002) the prerequisite for determining a sample size is a data analysis plan. Data analysis of the current study required utilising a number of statistical techniques such as the principal component analysis (PCA), regression analysis, *t*-test and chi-square test. The following section (3.6) provides a detailed discussion for using the statistical techniques in this research.

It has been suggested that in order to perform rigorous statistical analysis such as the principal component analysis, the sample size should be above 300 (Stevens, 1996). Therefore, keeping the statistical analysis plan in mind, it was decided that the total sample

size should be large enough to obtain a minimum of 300 responses. A rough estimate of the total sample size was determined by using the pilot response rate as a basis of the final survey.

Total sample size = [Total responses required X 100] / Pilot response rate

= 300 X 100 / 20 = **1500**

As illustrated above, a sample size of 1500 was required to achieve 300 responses. To compensate for any shortfalls in the 300 responses that may occur due to any undelivered and partially completed responses, the sample size was further increased from 1500 to 1600. Therefore, a total sample size of 1600 was considered for this study.

3.5.1.4 Sampling Error

Two major categories of errors, the sampling error and nonresponse bias error, are possible sources of unreliability in survey estimates (Fowler 2002). This subsection describes the sampling errors found in this research and the next section (Section 3.5.2) will discuss the errors achieved as a result of the nonresponse bias.

Fowler (2002) defined sampling errors as chance variations that occur due to collecting data based upon a sample of a population. Hence the sampling error is considered to be a random result of sampling in contrast to other bias that are systematically introduced in survey estimates. The size of sampling errors is determined by the size and design of a probability sample along with a distribution of what is being estimated (Fowler, 2002).

The statistic that is frequently utilised and recommended for the purposes of estimating the sampling error is termed to be a *standard error* of a mean. This is the *standard deviation* of the distribution of sample estimates of means for an infinite number of samples of a given size (Fowler, 2002). The standard error of a mean is calculated from the variance and size of the sample from which it was estimated.

The value of standard error for 95% of samples of a given size should fall within a range of plus (+) and minus (-) 1.96 standard errors that are reported as the confidence intervals around a sample estimates. However, only 67% of the mean of samples of a given size is expected to fall within the range of ±1 standard error of the true population mean. The estimates of standard error of means vary according to the variable and sample size (Fowler, 2002). This means that different variables included in a study are likely to be characterised by different values of standard errors. This suggests that the values for sampling errors for the various demographic and key variables of this study are likely to differ from each other.

Table 3.1 illustrates the standard error of the mean of variables included in this study. The standard error estimates obtained for the various variables suggest that, at a 95%

confidence, the margin of sampling error there are variations from ±4 percentage points for internet access at home to ±18 percentage points for the duration of Internet access and secondary influence. The sampling error for all the other variables is between the two aforementioned values at 95% confidence and 0.67 probability.

TABLE 3.1
Sampling Error

Variables	**N**	**SE of Mean (At *Probability* of .67)**	**SE of Mean (At 95% Confidence)**
Age	357	.07	14
Gender	355	.03	6
Internet access at home	358	.02	4
Type of connection	308	.03	6
Length of subscription	304	.06	12
Frequency of Internet access	354	.07	14
Duration of Internet access	352	.09	18
Behavioural Intention	358	.08	16
Relative advantage	358	.05	10
Utilitarian Outcomes	358	.06	12
Hedonic Outcomes	358	.08	16
Service Quality	308	.08	16
Primary Influence	358	.08	16
Secondary Influence	358	.09	18
Knowledge	358	.07	14
Self Efficacy	358	.06	12
Facilitating Conditions Resources	358	.07	14

3.5.2 Non-response Bias and Response Rate

3.5.2.1 Non-response

A non-response can be either of the following two types: (1) non-response to individual questions, i.e. not answering a few questions; and (2) not answering any questions or not even returning the questionnaire at all. Occurrence of the first type of non-response is frequently low (Fowler, 2002) and does not contribute much towards an error. However, when its occurrence is high, it has the potential to affect a survey estimate. The reported occurrence of the second type of nonresponse is more frequent and Fowler (2002) identified three categories of respondents that can be selected to be included in a sample, but who do not complete or return questionnaires. This includes: (1) respondents whom the data collection procedures do not reach, thereby not providing such respondents with an opportunity to complete the survey questionnaire; (2) those respondents who requested to complete the questionnaire but refused to do so; and (3) those respondents who were not able to complete the questionnaire for several reasons including a language problem, illness and lack of the necessary writing skills to complete a self-administered questionnaire.

3.5.2.2 Non-response Bias

Regardless of the mode that contributed to the non-response, the likely effect of it is that it will produce a bias sample. A bias sample can be defined as a sample that is systematically different to the population from which it was drawn (Fowler, 2002). The following subsections first estimates the response rates of this research and then discusses the non-response bias in detail.

According to Fowler (2002), the nature of bias associated with a non-response depends upon the data collection method (i.e. mail, interview or telephone). Since the data collection method of this research is postal survey, further discussion on the non-response bias is specific to postal surveys.

There are arguments that suggest that, in the instance of postal surveys, people who have particular interests in the subject matter or the research itself are more likely to return the mail questionnaire than those who are less interested (Fowler, 2002). The other consistent bias in mail surveys is that better-educated people often return completed questionnaires at a faster rate than respondents with less education. Fowler (2002) suggests that there is lack of information to reliably predict when and how much non-response will affect the survey estimates. Therefore, efforts to ensure that the response rates reach a reasonable level, and to avoid procedures that systematically produce differences between respondents and nonrespondents, are important ways to build confidence in the accuracy of survey estimates (Fowler, 2002). The following subsection explains the measures that were undertaken to reduce non-response in this research.

3.5.2.3 Reducing Non-response

Fowler (2002) suggested the following three important measures to reduce a non-response in mail surveys: (1) the layout should be clear, so it is easy to see how to proceed; (2) the questions should be attractively spaced, easy to read and uncluttered; and (3) the response tasks should be easy to undertake. There should not be open-ended questions. The response tasks should be a check, a box or circling of a number. The aforementioned three measures were followed whilst developing and validating the instrument through the exploratory survey, content validity, pre-test and pilot test. In order to evaluate above three criteria, questionnaires of the pilot study (Chapter 4) were included four explicit questions. The majority of respondents from the pilot study were satisfied with the length, layout and easiness to read (Table 4.5), which means that there were minimal chances of non-response due to the nature of the data collection tool (i.e. postal survey) employed in this research.

3.5.2.4 Correcting Non-response

Since non-response is inevitable, Fowler (2002) has suggested three approaches including proxy respondents and resurveying a sample of non-respondents in order to minimise the resulting error contributed due to the non-response. First, an approach that collected data from proxy respondents was considered inappropriate for this research. This is because such an approach is suitable for the interview and telephone data collection methods where any other member of a household can replace designated respondents. Therefore, the second approach, which is 'resurveying a sample of non-respondents' was considered appropriate for this research.

In the resurveying approach, a sample of nonrespondents should be re-contacted, either employing the same data collection method (i.e. mail) or, if the research budget allows, replacing the postal approach with a telephone survey (Fowler, 2002). Due to the following three reasons, it was decided to contact the non-respondents utilising the same data collection method, i.e. mail. The first and foremost reason for re-contacting the non-respondents via mail was the length of the survey instrument. The length of the survey instrument was six pages, which consisted of 41 likert scale type questions, 41 usage related questions, 20 impact related questions, and a number of demographic questions. Such a questionnaire was not appropriate for data collection via the telephone method. This is because respondents prefer not to answer a long questionnaire on the telephone (Fowler, 2002). The second reason was that the sample frame utilised to select the respondents only consisted of the postal addresses of the respondents and not their telephone numbers or email addresses. The third and final reason was that this research is a student project constrained by resources that did not allow replacing a mail survey with a telephone survey in order to re-contact the sample of non-respondents. More details of resurveying the non-respondents are provided in the next section 'response rate estimation', and the *t*-test results to examine if the responses of non-respondents differ from those of the respondents, are provided in Chapter 5 (Section 5.2).

3.5.2.5 Response Rates

The response rate is a way of determining the success of a data collection effort and also obtaining an initial idea about the quality of the collected data. Fowler (2004) defined the response rate as the number of obtained responses divided by the number of sampled respondents, including all respondents in the study population who were sent the survey, but who did not respond (Fowler, 2002). The response rate of this study calculated below followed the aforementioned definition.

Of the overall 1600 sent questionnaires, 300 questionnaires replies were received within the specified periods, which was from Jan 2005 to March 2005. Of these, 280 questionnaires were usable and 20 were both undeliverable and incomplete questionnaires. This implies that a response rate of 17.5 percent was obtained. To test the response bias, 200 questionnaires were sent to randomly selected non-respondents from the original sample in mid-March 2005. Of this, 40 questionnaire replies were received that included 38 usable and two partially completed questionnaires. The findings obtained from the response bias test are presented in Chapter 5 (Table 5.1 & Section 5.2.1), which illustrates that there were no significant differences in the number of variables between the original respondents and a sample of non-respondents. The responses received from non-respondents were added to the original responses. The reasoning for this is that, as Fowler (2002) suggests, 'if the new round of data collection (i.e. data collected for the non-response bias test) replicates questions in the initial survey, the results can be added to the initial sample data set'. After combining the original response of 280 and responses from the non-response bias, that is 38, an adjusted response rate was calculated employing the following formula (Fowler, 2002, pp 52). The obtained adjusted response rate was 33.2%.

> **Adjusted Response Rate= [OR** (280) + **W** (6.6) * **RNRS** (38)] / **OTES** (1600)= 33.2 **[Legend: OR**=Original Responses, **W**= this weighted factor suggest that only 200 of the 1320 non-respondents followed up, **RNRS**=Responses from the non-response sample, **OTES**= Original Total Eligible Sample]

As Fowler (2002) suggests, the pilot responses can also be included in the final analysis if the final questionnaire is similar to the pilot and substantial changes were not made to it. Following this suggestion, since no substantial changes were made in the final questionnaire after the pilot, it was decided to include the pilot responses in the main study. The pilot questionnaires were sent to an overall total of 200 respondents. A total of 42 replies were received within the specified periods of time. The total usable responses were 40 and the remaining two were not fully completed; therefore, they were excluded from the analysis. This led to a response rate of 20% being obtained. Therefore, the total responses including the pilot were 358. Thus, the final response rate is = 33.2 + 20/2 = **26.6 %**

3.5.3 Justification for Choosing Mail (i.e. Postal) as a Data Collection Method

The recommended data collection methods for a survey research approach include postal mail, telephone, personal interview, group administration and the Internet (Cornford and Smithson, 1996; Fowler, 2002; Straub *et al*, 2005). According to Fowler (2002), the selection of a data collection method is a matter of complex decisions as it is based on a number of issues such as sampling, question form, question content, response rate, costs, available facilities and length of data collection. In turn, these factors are unique to the

context of a particular study (Fowler, 2002). For example, if collected data requires asking open questions, then it is more appropriate to employ face-to-face interviews than other methods. However, if questions are closed ended in nature and available resources is limited, then postal questionnaire would be a better choice than other methods.

In terms of sampling, it has been suggested that the choice of data collection method should be based on reliability and the comprehensiveness of information that a sample frame offers. If the mailing addresses in a sample frame are not complete and updated, then it is not appropriate to employ postal mail as a data collection method. Such guidelines also apply to other data collection methods such as telephone (Fowler, 2002). Since the sample frame of 'UK-Info Disk V11' provided this research with a comprehensive and reliable mailing list that is updated annually, it was considered appropriate to employ mail as a data collection method. With regards to the population characteristics, it is suggested that if the reading and writing skills of the target population are low then other methods of data collection, such as the telephone or face-to-face interview are more appropriate than a self-administered questionnaire (Fowler, 2002). Since the adult literacy rate in the UK is 99% (economywatch.com), the reading and writing skills were not considered to be a barrier for selecting a self-administered questionnaire as a data collection method.

The self-administered method of data collection (i.e. mail) was also preferred over the interview and telephone due to ease of contact. This is because many people are busy in their daily lives and work schedules and due to this, the researcher would have encounter problems when arranging a suitable time for face-to-face or telephone interviews (Fowler, 2002). Contrastingly, if the contact information is correct, questionnaires can reach respondents who can then respond at a time that is convenient for them. In terms of the question format, Fowler (2002) suggests that self-administered procedures can have an advantage if the instruments comprise only closed ended questions that can be answered by simply ticking a box. When a researcher wants to ask many questions that are similar in form, then having an interviewer face-to-face or over the phone reading a long list can be awkward and tedious (Fowler, 2002). This was most relevant to this research as there were many similar types of closed ended questions that required answers; therefore, it was considered more appropriate to employ the self-administered mail method rather than the telephone or face-to-face interview.

The nature of the questionnaire's contents can also influence the answers obtained from respondents. Respondents do not want to provide answers to sensitive questions over the telephone or in an interview. For this reason also, the self-administered method was found to be most suitable data collection method (Fowler, 2002) for this research. In addition to the above, other important factors that affect data collection method are the costs

and available facilities for data collection. Self-administered mail is considered to be less expensive than telephone or face-to-face interviews and requires minor involvement of additional people and other resources (Fowler, 2002). Since this research was a student project, the available resources and faculties were highly limited. Therefore, a self-administered questionnaire via mail was considered to be the most appropriate method to collect large amounts of data with the available resources and facilities.

After careful consideration of all the aforementioned factors and in order to collect random data from the target population, a self-administered questionnaire via mail was considered to be the most appropriate data collection method. To summarise aforementioned discussion, the reasoning for using the self administered questionnaire was that: it addresses the issue of reliability of information by reducing and eliminating differences in the way by which the questions are asked (Cornford and Smithson, 1996); it requires relatively low costs of administration; they could be accomplished with minimal facilities; it provides access to widely dispersed samples; respondents have time to provide thoughtful answers; it helps in asking questions with long or complex response categories; it allows the asking of similar repeated questions; and also the respondents do not have to share answers with interviewers (Fowler, 2002). Therefore, the final questionnaires were sent using the postal service as a larger sample population was obtained in a cost-effective manner (Fowler, 2002). A covering letter and a self-addressed prepaid return envelope were also administered to a total of 1600 heads of households in the UK. This activity was undertaken in the period between January and March 2005. In the middle of March 2005, questionnaires were also sent to 200 nonrespondents in order to assess the nonresponse bias.

3.5.4 Instrument Development and Validation

According to Fowler (2002), 'a defining property of social survey is that answers to questions are used as a measure which is a critical dimension of the quality of survey estimates'. This critical dimension depends upon reliability (i.e. providing consistent measures in comparable situations) and validity (i.e. answers correspond to what they intend to measure) of questions asked to survey respondents. Therefore, both the issue of reliability and the validity of the research instrument are of utmost importance for this survey-based research (Fowler, 2002; Straub *et al*, 2004). Due to the criticality of the instrument in the precision of survey estimates, Straub *et al* (2004) recommended that if a previously validated instrument is available for efficiency reasons, researchers should prefer utilising it rather than developing a new one. However, at the same time researchers should not avoid previous validation controversies and, if significant changes are made in the existing instrument, it is

most important to revalidate the content, construct and reliability of the modified instrument (Straub *et al*, 2004).

In a situation where no existing instrument is available, and if the development of a new instrument for established theoretical constructs and testing of the robustness is required, then all validities must be applied in greater detail (Straub *et al*, 2004). According to Straub *et al* (2004), this step is the 'heart of the demonstration of the usefulness of the new instrument' and represents 'a major contribution to scientific practice in the field' (Straub *et al*, 2004). Although the constructs utilised in this research belong to established theories and models, they require the development of new measures for this research. This is because the unit of analysis for this research, broadband, is different to previous technologies such the PC, for which there is an existing instrument. Therefore, examining broadband in household contexts demands creating new items or making significant changes in the existing items and employing subsequent validating measures. Given the emphasis of the impact of a survey instrument on the reliability and validity of survey estimates or findings, it was decided to develop and validate the survey instrument for this research before proceeding to data collection. Since developing and validating an instrument is a long and stepwise process that includes exploratory survey, content validity, pre-test and pilot test, a complete chapter (Chapter 4) is devoted to providing a description of its development and validation. To avoid any repetition, no further details on this issue are provided within this section.

3.6 DATA ANALYSIS

The collated data was analysed using SPSS version 11.5. The reason for selecting the SPSS statistical package is that it facilitates the calculation of all essential statistics, such as descriptive statistics, reliability test, factor analysis, t-test, discriminant analysis, ANOVA and linear and logistic regression analysis, required for data analysis and present findings. Furthermore, SPSS is easily available and user friendly so it can be learnt within a short period of time. An added reason is that a number of books are available to familiarise oneself with the SPSS application to present and interpret the data.

3.6.1 Statistical Techniques for Validity Test

Straub *et al* (2004) recommended that a new survey instrument should be validated employing statistical techniques such as a reliability test in order to confirm the internal consistency of measures and factor analysis in order to confirm the construct validity, including both convergent and discriminant validity (Straub *et al,* 2004). According to the recommended guidelines, a survey instrument possesses a high internal consistency (i.e. it is reliable) if the estimated Cronbach's alpha is above 0.70. Construct validity (both

discriminant and convergent) exists if the latent root criterion (i.e. eigenvalue) is equal to or above 1, with a loading of at least 0.40; and no cross loading of items above 0.40. (Straub *et al,* 2004). Following the above guidelines, the aforementioned statistical techniques are employed to validate the survey instrument of this research (chapters 4 and 5).

3.6.2 Statistical Techniques for Testing Relationship

In order to explain the relationship between the independent and dependent variables to test the conceptual model of broadband adoption, linear and logistic regression analysis will be utilised. The purpose of performing linear regression analysis is to examine whether significant relationships exist between the independent variables (i.e. attitudinal, normative and control constructs) and dependent variable (behavioural intention). Multiple linear regression is a commonly used technique to explain the relationship if the nature of both the independent and dependent variables is ordinal or scale (Brace *et al*, 2003; Davis *et al,* 1989; Oh *et al,* 2003; Stevens, 1996; Taylor and Todd, 1995). However, linear regression cannot be applied if the dependent variable is nominal or categorical in nature (Brace *et al*, 2003). The suggested alternative for this situation is logistic regression analysis, which allows testing the relationship even if the dependent variable is nominal in nature (Brace *et al,* 2003). Logistic regression analysis is utilised in this research to explain the relationship between aggregate measure of independent variables (i.e. behavioural intention and facilitating conditions resources) and the categorical dependent variable (i.e. broadband adoption).

3.6.3 Statistical Techniques for Testing Differences

In order to analyse nominal variables such as demographics, usage rate and impact of broadband, calculation of the response frequencies and percentages was undertaken. The reasoning for using the aforementioned statistics is due to previous Information Systems (IS) researchers employing such tools for analysis and to present the research findings using response frequencies and percentages (Webster, 1998; Venkatesh and Brown, 2001). To test the statistical significance of nominal variables such as demographic differences of the adopters and non-adopters of broadband, the chi-square (χ^2) test was considered to be the most appropriate method (Brace *et al*, 2003).

3.6.3.1 Overall Scale Construction and Parametric Test for Difference

If all items for a construct are internally consistent (i.e. illustrate high reliability) and load on one factor in the factor analysis (i.e. demonstrate construct validity) then they can be utilised to construct a scale (i.e. aggregate measure) in the following two ways (Moore and Benbasat, 1991). The first is to construct a scale that involves summing or averaging the

mean of the items that load highly on a factor (Gorsuch, 1988; Moore and Benbasat, 1991). The second is to construct a scale (i.e. aggregate measure) that necessitates considering the score of factors (Moore and Benbasat, 1991). Moore and Benbasat (1991) argued that since the relative weight of an item in a scale is based on its loading on the factor, its scores may be considered more exact than averaging means.

However, employing factor scores for constructing scales (i.e. aggregate measures) is the less preferred method (Moore and Benbasat, 1991). This is because factor scores are often less interpretable and generalisable than using the first approach that involves summing or averaging the mean of items (Moore and Benbasat, 1991). Since a number of studies (Brown *et al*, 2002; Karahanna *et al*, 1999; Koufaris, 2002; Moore and Benbasat, 1991; Oh *et al*, 2003; Olson and Boyer, 2003; Taylor and Todd, 1995) have employed averaging the mean of items as a means of constructing aggregate measures, and its application is reported to be entirely adequate (Moore and Benbasat, 1991; Tabachnik and Fidell, 1989), therefore averaging responses to the individual items will be utilised to develop aggregate measures for each of the constructs in this research. Once the scale is created, it will be in a ratio instead of being ordinal and then it will be appropriate to apply a parametric test (*t*-test and ANOVA) to examine the differences. Such an approach was followed by Karahanna *et al*, (1999) who applied a parametric test (*t*-test and ANOVA) on the constructed aggregate measures by averaging the mean of individual items.

It is appropriate to apply an independent *t*-test to this research in order to determine whether two means can be obtained from two independent respondent groups that are significantly different from each other (Brace *et al*, 2003; Hinton *et al*, 2004). In this research, groups may constitute a broadband and narrowband respondent group in order to examine the mean differences with regards to a connection type, or a male group and a female group when examining the mean differences with regards to gender. A *t*-test will also be utilised to test the response bias and the effect of ordering the questionnaire items. When more than two conditions or groups of an independent variable are compared, ANOVA is more appropriate to apply than a *t*-test (Brace *et al*, 2003; Hinton *et al*, 2004). It is relevant to apply ANOVA to determine whether means that are obtained from more than two independent respondent groups are significantly different from each other (Brace *et al*, 2003; Hinton *et al*, 2004). In this research, ANOVA will be applied to test the scale mean differences when test variables possess more than two independent groups.

3.7 SUMMARY AND CONCLUSIONS

This chapter provided an overview of the research approaches that have been utilised within the IS field and then selected an appropriate research approach for guiding this particular research. To validate and understand the conceptual framework, it was found that a quantitative research would be more appropriate than a qualitative one. An overview of the underlying epistemology was provided in order to decide that positivism should be the philosophical foundation for this research. Following this, an overview discussion on the various issues on the available research approaches in the IS field and a justification for the selection of the survey as a research approach is provided. Once it was decided that a survey is an appropriate approach to conduct this research, a detailed account of the various aspects of the survey approach was offered. It was found that for the purpose of this research, it is appropriate to employ the UK-Info Disk V11 as a sampling frame, and stratified random sampling as a basis of sample selection.

The data collection tool used in this research was the postal method (i.e. mail). The reasons for the aforementioned selection were also provided in a detailed manner. Issues relating to data analysis were then discussed in detail. It was concluded that a number of statistical techniques such as factor analysis, *t*-test, ANOVA, χ^2 test, discriminant analysis, linear and logistics regression analysis are appropriate to be utilised for data analysis purposes. This chapter thoroughly covered two of the three essential components of survey research approach. However, the third 'instrument development' was briefly introduced. The following chapter (Chapter 4) will describe the development and validation of the survey instrument that is considered essential for a reliable data collection.

Chapter 4: Survey Instrument

4.1 INTRODUCTION

Chapter 2 described the proposed conceptual model that is used to understand the adoption, usage and impact of broadband from the household consumer perspective. Chapter 3 described the appropriate research approach for testing the hypotheses and to validate the proposed conceptual model. From Chapter 3 it was concluded that the survey research approach is most appropriate to investigate the issue of broadband diffusion. Further suggestions that were provided in Chapter 3 are that before conducting the final data collection a reliable survey instrument should be developed and validated. Validating an instrument is a critical step before testing a conceptual model (Boudreau *et al*, 2001; Straub *et al*, 2004). This is due to the rigour of findings and interpretations in positivist research that are based on the solid validation of the instruments used to gather data (Boudreau *et al*, 2001; Straub *et al*, 2004).

Therefore, this chapter aims to describe the development of a survey instrument that was designed to investigate broadband adoption, usage and impact within the UK household. The following three stages led to the development of a reliable instrument: (1) To explain broadband adoption behaviour some initial factors were identified from the literature and then a decision upon how to determine them in an exploratory survey approach needed to be made; (2) content validation was performed on the itemed pools that resulted from the exploratory survey. The purpose of this step was to confirm the representativeness of items to a particular construct domain; and finally, (3) a pre-test and a pilot test were conducted utilising the obtained instrument after content validation was undertaken in order to confirm the reliability of measures.

The next section briefly re-introduces the conceptual model and provides a list of the constructs included in the various stages of the validation process. Following that, an overview of the instrument development process is provided in Section 4.3. Then the first stage of the validation process (i.e. the exploratory survey) is presented and discussed in Section 4.4. This is followed by the content validation process in Section 4.5. The instrument testing process that includes the pre and pilot test is described in Section 4.6. Finally, the summary and conclusions are presented in Section 5.7.

4.2 CONCEPTUAL MODEL

Although the conceptual model was already described in Chapter 2, a brief account of the constructs is provided in this section. The constructs included in this study were adapted from the Model of the Adoption of Technology in Households (MATH) (utilitarian outcomes, hedonic outcomes and knowledge) (Venkatesh and Browns, 2001), diffusion of

innovations (relative advantage) (Rogers, 1995) and the Theory of Planned Behaviour (TPB) (behavioural intention, social influence, facilitating conditions resources, self-efficacy) (Ajzen, 1991; Taylor and Todd, 1995).

The proposed model assumed that the dependent variable 'behavioural intention' towards broadband adoption is influenced by several independent variables that include the attitudinal (relative advantage, utilitarian outcomes, and hedonic outcomes), normative (primary influence), control factors (knowledge, self-efficacy and facilitating conditions resources) and demographic variables (age, gender, income, education and occupation). Although a detailed discussion of each construct is not possible within the scope of this chapter, a list of the constructs included at each stage of validation is illustrated in Table 4.1. These constructs were defined and discussed in Chapter 2 and the relationship between them is illustrated in Figures 2.6-2.8 (Chapter 2).

Straub *et al* (2004) suggested that if content is adapted from an existing instrument then there is less need to validate it; however, if there are changes made in an instrument then the adapted measures should be subjected to a rigorous validation process (Straub *et al*, 2004). Following the reasoning provided by Straub *et al* (2004) the adoption related items are to be subjected to all four stages of validation.

The usage items were not included in the first stage but subjected to validation in the remaining three stages. In the case of the usage of broadband, there was no modification required in content but it was not certain if the list is exhaustive or not; therefore, this construct was considered from the content validity stage and onwards. Since the impact items are adapted from a previous instrument (Horrigan and Rainie, 2002) that examined impact of broadband on consumers from the United States, they were only included in the last stage of validation (i.e. pilot test) (Straub *et al*, 2004).

TABLE 4.1
List of Constructs Included in the Various stages of Instrument Validation

Constructs	Exploratory Survey	Content Validity	Pre-Test	Pilot Test
Behavioural Intention	No	Yes	Yes	Yes
BISP	No	Yes	Yes	Yes
Relative Advantage	Yes	Yes	Yes	Yes
Utilitarian Outcomes	Yes	Yes	Yes	Yes
Hedonic Outcomes	Yes	Yes	Yes	Yes
Service Quality	No	Yes	Yes	Yes
Primary Influence	Yes	Yes	Yes	Yes
Secondary Influence	Yes	Yes	Yes	Yes
Facilitating Conditions Resources	Yes	Yes	Yes	Yes
Knowledge	Yes	Yes	Yes	Yes
Self-efficacy	Yes	Yes	Yes	Yes
Usage (Online Activities)	No	Yes	Yes	Yes
Impact	No	No	No	Yes

4.3 INSTRUMENT DEVELOPMENT PROCESS

Since the instrument for the broadband adoption study is developed from the basics, a number of stages were followed that included the selection and creation of items, an exploratory survey, content validity, a pre-test and a pilot test. Straub *et al* (2004) argued that there is a lack of a standard validation approach. Various studies have employed different methods and techniques of validation (Straub *et al,* 2004). Therefore, keeping this in mind this study adapted a validation approach similar to the IS studies (For example, Davis, 1989; Moore and Benbasat, 1991) that were focused upon the instrument development process and widely cited by researchers. Since the aforementioned studies developed an instrument in a stepwise manner, this research also followed an approach of developing and validating the instrument in several stages, including an exploratory survey, content validity, pre-test and pilot test. A detailed discussion on each stage is provided henceforth.

4.4 STAGE 1: THE EXPLORATORY SURVEY

4.4.1 Research Method

The purpose of the exploratory survey was to determine the items or factors that are affecting the adoption and non-adoption behaviours. Then, in subsequent stages, the important factors that can be modified to measure perceptions were identified. This was undertaken bearing in mind that the broadband adopters were asked to answer only the attitudinal and normative related questions (**Appendix 4.1**). Contrastingly, the broadband non-adopters were asked to complete questions related to only the control constructs (**Appendix 4.1**). A number of appropriate items were collated, created and modified to suit the definition of the related attitudinal, normative and control constructs. However, it is important to mention here that one attitudinal construct, namely 'Service Quality' and its related items, were not included at this stage. Further explanations on this issue are provided at the end of this section. A definition for all the constructs is provided in **Appendix 2.1**. A list of constructs included in the exploratory survey and related items are provided in Table 4.1 and **Appendix 4.2** respectively.

The data for the exploratory survey were collected from the household consumers living in the local vicinity of the London Borough of Hillingdon. The selection of the target population was made according to the availability of the sample frame. Since a reliable sample frame - that is the electoral register - was not easily available for the whole of London or the UK population, it was decided to conduct a survey within the London Borough of Hillingdon. The structure of the sample frame (the electoral register) necessitated the adoption of a stratified random sampling approach that collected the representative data

from the target population. The whole locality was divided into various wards and sub wards in the electoral register. The sample size for each sub ward was determined according to the total population. Thereafter, unique random numbers for each sub ward were generated using software titled 'research randomiser'. The respondents' corresponding random numbers were then selected for data collection from the sample frame (the electoral register).

In order to collect random data for the target population and within a limited time frame and resources, a self-administered questionnaire was considered to be an appropriate primary survey instrument. This is because it addresses the issue of reliability of information by reducing and eliminating the differences the way that the questions are asked (Cornford and Smithson, 1996).

The questionnaire used in the exploratory survey contained a total of 13 questions **(Appendix 4.1)**. These questions were divided into three broad categories: (1) multiple choice questions addressing the social attributes (demographic variables) including age, gender, education, and income; (2) Likert scale (1-5) questions that were designed to address the issues related to the factors of broadband adoption; and (3) an open-ended question that asked respondents if they would like to mention any other factor that was not included in the questionnaire regarding their decision of subscribing to broadband or not.

The final questionnaire was sent using the postal service. A covering letter and a prepaid return envelope were administered to a total of 700 household heads in the London Borough of Hillingdon during August and September 2003. The collected data was analysed using SPSS version 11.5. The analysis was focused upon calculating the importance of the attitudinal, normative and control factors utilising the means and standard deviations. In order to measure the internal consistency of the items, the reliability of scale (Cronbach's α) was also calculated.

4.4.2 Findings

Of the overall 700 questionnaires, 200 replies were received within the specified periods. Of these, 172 questionnaires were usable for the analysis, whilst 28 were both undelivered and uncompleted questionnaires. This yielded a response rate of 25.6%.

4.4.2.1 Descriptive Statistics

Attitudinal Constructs

Amongst the attitudinal constructs, relative advantage was rated most strongly, followed by utilitarian outcomes (**Appendix 4.2**). The hedonic outcome construct was considered least important with a mean score of 2.34 and a standard deviation of 1.85.

Of the four relative advantage items, faster access was rated most strongly (M=4.88, SD= 0.33), followed by un-metered access (M=4.49, SD= 0.83). The provision of a free home phone line was considered least important (M=3.22, SD=1.7)]. The remaining two items, which were always-on access (M=4.13, SD=1.0) and faster file downloads (M=4.12, SD=1.25) were rated as almost equally important (**Appendix 4.2**).

The second strongest construct was utilitarian outcome that had a rating of M=2.89, SD=0.87 amongst the attitudinal category that consisted of six items. Amongst the six items, obtaining educational material (M=3.31, SD=1.22) was considered to be the most important reason for subscribing to broadband. This was followed by performing job related tasks (M=3.05, SD=1.55) and communication with family and friends (M=3.04, SD=1.46). The factor of helping children with homework (M=2.33, SD=1.49)] was considered least important within this category. The other two items of utilitarian outcomes, performing home business (M=2.62, SD=1.45) and performing personal and household activities (M=2.96, SD=1.35) were rated as moderate (**Appendix 4.2**).

The third construct from the attitudinal category 'hedonic outcomes' was rated below average (M=2.34, SD=1.850) on a 1-5 point Likert scale. This construct consisted of only two items, of which one item was for entertainment, such as downloading, viewing and listening to music and movies, which scored an above average score (M=2.90, SD=1.45), and the second was for playing online games and was rated below average (M=1.78, SD=1.15) (**Appendix 4.2**).

Normative Constructs

The normative dimension consisted of only two constructs: primary and secondary influences. Three items represented the first construct 'primary influence' (M=2.47, SD=1.7) and the second 'secondary influence' consisted of only one item that was rated slightly above average (M=2.60, SD=1.78). Amongst the items of the primary influence construct, 'influence from family members and relatives' was considered most important (M=2.56, SD=1.88), followed by the influence from friends (M=2.38, SD=1.77). The least rated item was 'influence from kids' (M=2.28, SD=1.94) (**Appendix 4.2**).

Control Constructs

The control category was composed of mainly three constructs: facilitating conditions, knowledge and skill. However, there were two items placed in the category of 'other items'. The other items did not fit in with the definition of the above three constructs; therefore, it was decided to examine them separately.

The construct 'facilitating condition' was represented by two items. The findings illustrated in **Appendix 4.2** suggest that high monthly cost was a key barrier preventing the

consumers from subscribing to broadband (Mean= 4.25 on a five point scale and SD=1.18). The second item of this construct related to the cost of purchasing a new computer or upgrading the existing one (M=2.94, SD=1.64), which was also considered to be an important factor for not adopting broadband.

The second construct in the control category, 'knowledge', consisted of two items and was considered overall as less important (M=2.35, SD=1.37). A lack of knowledge about the usage and benefits of broadband were considered more important (M=2.33, SD=141) than the second item that referred to the lack of knowledge on broadband (M=2.28, SD=1.37) **(Appendix 4.2)**.

A single item represented the third construct of 'self-efficacy', which was the lack of skills when using the computer and the Internet (M=1.95, SD=1.41). Self-efficacy was considered less influential in terms of preventing respondents from subscribing to broadband **(Appendix 4.2)**.

The first item that was placed in the 'other' category was the lack of needs when subscribing to broadband. This was considered quite important when inhibiting the adoption of broadband (M=3.83, SD=1.25). The second item within the 'other' category was the lack of content and applications with the existing broadband packages (M=2.55, SD=1.25), which was rated less influential than the first one **(Appendix 4.2)**.

4.4.2.2 Reliability Test

To test the internal consistency of measures, a reliability test was performed. The Cronbach's α values for all but two constructs are listed in **Appendix 4.2**. The value of reliability (alpha) varies for the different constructs. Since two constructs' secondary influence and self-efficacy were represented only by one item each, it was not possible to calculate their reliability. Of the remaining seven constructs, only three constructs attained an alpha above 0.60 **(Appendix 4.2)**, which is the minimum acceptable level for the exploratory study (Straub *et al*, 2004, pp 411).

Amongst the attitudinal constructs, the minimum value of reliability (0.24) was associated with the relative advantage construct. This was followed by the hedonic outcomes measure (0.54). The maximum value of reliability within this category was 0.66, which was for the utilitarian outcomes construct. This suggests that only one attitudinal construct satisfied the criteria of internal consistency.

For the two normative constructs, only one construct, namely primary influence, allowed the Cronbach's α value to be calculated. The construct attained a reliability of 0.84, which is considered acceptable (Straub *et al*, 2004, pp 411).

Amongst the four control constructs, knowledge attained the highest value (α=0.94) for reliability. This was followed by facilitating conditions with α=0.50. The third construct of 'self-efficacy' did not satisfy the criteria for calculating the α value. The fourth construct achieved a α value of 0.34. As for the attitudinal and normative constructs, only one construct of the control category 'knowledge' satisfied the criteria of internal consistency.

4.4.2.3 Limitations and Further Improvement

For stage 1, the major limitation was the lack of previous studies that had developed and utilised the scale to measure broadband adoption for the aforementioned attitudinal, normative and control constructs. Such unavailability compelled the researchers to develop an instrument from the initial stages, which instigated several issues. The following are the issues that emerged from the exploratory survey and were dealt with in two stages: content validity and instrument testing.

1. Need of New Construct

A number of respondents with narrowband connections commented that they were not satisfied with their quality of service, which included the required speed, security and customer or technical support. If these issues were not dealt with in a narrowband context, consumers stated that they would switch to a broadband connection. However, a majority of the respondents with narrowband connections also commented that they were satisfied with the quality of service that they were receiving from their current service providers, hence they would not switch to a broadband connection. Some of the respondents with a broadband connection provided similar comments to the narrowband ones and declared that they were also not receiving the quality of speed and support that was affirmed before subscribing to the services; therefore, they had considered transferring to other Internet Service Providers (ISPs). Considering the aforementioned comments from the survey respondents, it was felt appropriate to include a new construct for the purpose of measuring the attitudes towards the service of quality being received from the current ISPs. Therefore, a new construct named 'Service Quality' was included in the content validity stage. A definition of this construct is provided in **Appendix 2.1** and the related items are listed in Table 4.6.

The other limitation to the exploratory survey was the lack of a dependent variable that could be utilised to measure the intentions of respondents when subscribing to broadband. This variable is also important when examining how independent variables (attitudinal, normative and control constructs) affect a respondent's intention to adopting broadband in the home. This necessitated the researchers to include an additional construct called 'Behavioural Intention' from the Theory of Planned Behaviour (Ajzen, 1991).

2. Need for New Items

The two constructs, 'secondary influence' and 'self-efficacy' were composed of only one item each (**Appendix 4.2**). This caused problems when calculating the reliability of the construct. Therefore, this limitation was also considered during the content validity test and one more additional item was added to each construct (Table 4.7).

3. Problem of Low Reliability

From the exploratory study findings and the aforementioned discussion it was found that although the estimated mean value of many constructs (e.g. relative advantage) was high, the reliability (alpha) was low (**Appendix 4.2**). Contrastingly, the estimated mean value of the social influence construct was low, but its reliability value was higher than any other construct. These variations in estimated values necessitated a further validation of the instrument content. In order to further validate the survey instrument and to determine how representative the items for a particular construct are (Straub *et al*, 2004), it was decided to adopt the content validity approach. The IS literature suggests that it is an important and highly recommended practice to conduct content validity in instances of new instrument development and also even if existing scales have to be applied for the establishment of any new object (Straub *et al*, 2004). Since this condition applies to this research as well, this was an added reason for conducting content validity. Content validity followed the exploratory study and its application in this research is described in the next section.

4.5 STAGE 2: CONTENT VALIDATION

Content validity is defined as the 'degree to which items in an instrument reflect the content universe to which the instrument will be generalised' (Straub *et al*, 2004). Generally, content validity involves the evaluation of a new survey instrument. This is to ensure that the survey instrument that aims to measure broadband adoption, usage and impact includes all the essential items and eliminates undesirable items within a particular construct's domain (Boudreau *et al*, 2001; Kitchenham and Pfleeger, 2002; Lewis, 1995; Straub *et al*, 2004).

Although only two approaches that comprise judgements and statistics are available when determining content validity, their application is unique to each study (Emory and Cooper, 1991; Torkzadeh and Dhillon, 2002). The application of content validity differs in terms of when it is utilised, how it is conducted and how many experts evaluated the content. The judgement approach to establish content validity involves literature reviews and then follow-ups with evaluation by expert judges or panels. The validation of the items is based on a high degree of consensus amongst expert panels or judges on the items in question; therefore, it is judgemental in nature (Boudreau *et al*, 2001; Davis, 1989; Kitchenham and

Pfleeger, 2002; Moore and Benbasat, 1991; Smith, 1996; Storey *et al*, 2000; Straub *et al*, 2004; Torkzadeh and Dhillon, 2002). Lawshe (1975) introduced an empirical or quantitative approach of content validity. This approach involves estimating the statistical validity ratio (Lawshe, 1975; Lewis, 1995).

The procedure of judgemental approach of content validity requires researchers to be present with experts in order to facilitate validation. Therefore it is also sometimes known as 'face validity' (Wacker, 2004). However, it is not always possible to have many experts of a particular research topic at one location, which was the case in this research. Contrastingly, a quantitative approach allows researchers to send content validity questionnaires to experts working in different locations; therefore, distance is not a problem faced by research. In order to perform content validity for broadband diffusion research, a quantitative approach was considered to be more suitable in comparison to a judgemental approach (Lawshe, 1975; Lewis 1995). Since broadband diffusion studies are still emerging in nature, there are still few academic experts. Furthermore, the experts are located in different places. Therefore, bearing these issues in mind, the quantitative approach pursued in this research is described in the next section.

4.5.1 Research Method

The content validity of the broadband diffusion instruments was performed employing a quantitative approach (Lawshe, 1975). In terms of IS research, such an approach has been successfully applied when validating information resource management instruments (Lewis *et al*, 1995). In order to validate the content of the constructs, the quantitative approach (Lawshe, 1975; Lewis *et al*, 1995) was undertaken in the following manner.

- First, relevant items from the existing literature on technology adoption and diffusion were identified. This led to the construction of the questions and the content validity questionnaire.
- Second, a content evaluation panel, consisting of experts from academia and/or industry who were related to the desired research area, was selected.
- Third, each member of the panel was then provided with the questionnaire formed in step 1. The panel members were requested to respond independently to each item in relation to a particular construct on a three-point scale where: "1= not necessary", "2= useful but not essential" and "3=essential".
- Fourth, the responses from the overall panelists were then pooled. This step also included counting responses that indicated 'essential' for each item.

- Fifth, the content validity ratio (CVR) for each item was estimated utilising the formula **CVR=(n-N/2)/(N/2)** (Lawshe 1975), where **N** is the total number of respondents and **n** is the frequency count of the number of panelists rating the item as "3=essential".

- Finally, the CVR values obtained for each item were examined for their significance employing the standard table provided by Lawshe (1975). If the estimated CVR value was equal to or above the standard value, then the item was accepted; otherwise it was eliminated. The significance level (standard value) depended upon the number of experts rating the item. The minimum number of experts required to rate each item should be five. The value of CVR ranged from 0 to 1(Lawshe, 1975; Lewis *et al*, 1995).

The aforementioned steps were followed to evaluate the content of broadband diffusion survey instruments. A sample of items for each construct was identified employing an exhaustive review of literature on generic technology adoption topics, broadband adoption and diffusion. The literature review led to the identification of 75 adoption entries and 35 entries for the usage related constructs. A content validity questionnaire **(Appendix 4.3)** was then generated that comprised the definition of the constructs and associated items on a 1-3 scale.

The experts identified earlier who engaged in broadband diffusion related research were then approached. A total of 12 academic experts were identified on the basis of publications in peer-reviewed journal and leading conferences (ten experts) or their engagement to the research area related to broadband diffusion (two experts). The questionnaire was then sent to the experts via email attachments so as to expedite the process. The purpose of the study and instructions to complete the questionnaire were detailed in the covering email. The experts were asked to rate each item in relation to the different constructs of broadband diffusion on a three-point scale: "1= not necessary"; "2= useful but not essential"; "3=essential". They were also requested to provide comments if the items were not understandable, required rewording or if new entries needed to be added. Responses from all the experts were then collated by counting the numbers of ratings that indicated "essential" for each item.

Following that, the CVR was estimated and evaluated for a statistical significance level of 0.05 by employing Lawshe's (1975) method that was mentioned in the above paragraph. This process was undertaken for each item. For entries where the 0.05 significance level was not achieved, elimination occurred. The list of constructs, along with

their associated CVR values, are presented in **Appendix 4.4 and 4.5,** and are discussed below.

4.5.2 Findings from Content Validation

The final content validity questionnaire with the complete list of items is provided in **Appendix 4.3**. The estimated values for the content validity ratio of all the items are presented in **Appendix 4.4** for the adoption constructs and **Appendix 4.5** for the usage constructs. A summary of the CVR that is derived from **Appendix 4.4 and 4.5** is provided in Tables 4.2 and 4.3. The CVR questionnaire comprised a total of 110 items. Of the 110 items, 75 belonged to adoption and 35 to usage related constructs. The findings presented in Table 4.2 illustrate that, of the 75 items from the adoption domain, the majority of respondents considered 41 items important for inclusion, as the CVR value was significant at the 0.05 level. All 35 usage related items were considered essential. Additionally, the respondents suggested six new online activities to include. Therefore, a total of 41 online activities were included in the next step (Table 4.7).

Table 4.3 illustrates the overall items, average CVR and average mean for each construct. The average CVR value for the 12 constructs was between the maximum value of 0.98 and minimum value of 0.57 at the 0.05 level of statistical significance. This illustrates that the constructs possess a high level of content validity, which means that the items are representative of a construct universe (Table 4.3).

The experts also provided a number of suggestions regarding the rewording and decomposition of some of the items and the addition of a few new items. It was suggested that the BI3 (**Appendix 4.3**) items should be reworded when measuring the behavioural intention that is used to determine the extent of the use of broadband. Furthermore, the experts also commented that it would be useful to include a new item that measured the behavioural intention for determining whether a consumer continues with the current ISPs or switches to a new one. With regards to the utilitarian outcomes construct, it was suggested that item UO5 (**Appendix 4.3**) should be divided into two. This was required because information searches and online shopping are two different activities and measuring both of them with the same item could create ambiguities in the findings. Similarly, the experts suggested that item HO1 should be decomposed into two items by separating music and movies into two different items. Item HO4 was also eliminated (**Appendix 4.3**). This was because e-greetings are utilised more as a communication rather than an entertainment tool. For the service quality items SQ11 and SQ13 (**Appendix 4.3**), the same issue was being determined, but in opposite directions; therefore, the experts advised that it would be better to drop item SQ13. The content validity experts suggested that although the two items FC1

and FC3 of the facilitating condition construct (**Appendix 4.3**) are useful to include in the questionnaire, they are not suitable for measuring perception. The preceding two items represented an actual situation and not a perception. Further, the items could be measured utilising a dichotomous variable i.e. Yes/No. Considering the suggestions of the experts, these two items were removed from the "facilitating condition" construct. The aforementioned suggestions were incorporated along with the suggestions obtained from the pre-test of the instruments in the resulting instrument.

The experts also commented upon the direction of items that were being measured by particular constructs. More discussion on this issue and the improvements made after the suggestions are provided within the sub-section 'Pre-Test'.

The experts also agreed that for the final questionnaire, the 1-7 scale would be more suitable in comparison to the 1-5 scale. This is because the 1-7 scale values are widely spread in comparison to the 1-5 scale and the respondents had more choices to select. This prevents a respondent's bias as respondents can then select a neutral value. Therefore, 1-7 is considered to be the most suitable Likert scale for the final study.

TABLE 4.2
Summary of Content Validity Ratio

CVR	AI	UI
0.90-0.99	5	31
0.80-0.89	10	4
0.70-0.79	0	0
0.60-0.69	11	0
0.50-0.59	15	0
0.40-0.49*	0	0
0.30-0.39*	6	0
0.20-0.29*	0	0
0.10-0.19*	6	0
0-0.09*	13	0
Total	66	35
RLH	9	0
Grand Total	75	35

Legend: *= Not Significant, **RLH** = Items that rated essential by less then half participants, **AI**= Adoption Items, **UI**= Usage Items, **II**= Impact Items

The experts who evaluated the content of the instrument belonged to several countries, namely the UK, Denmark, USA, Australia and Canada. Therefore, the content of the questionnaire is not only specific to the UK, but to the aforementioned countries as well. It was considered essential to have a mix of the countries, as a comparative study of the pre-test and validation of the questionnaire in a number of contexts, such as the USA, Australia, Canada and EU member states would then be possible.

TABLE 4.3
Summary of Constructs, TI, SI, ACVR and AM

Constructs	TI	SI	ACVR	AM
Behavioural Intention	3	2	0.83	2.83
Relative Advantage	9	4	0.63	2.79
Utilitarian Outcomes	14	9	0.74	2.84
Hedonic Outcomes	4	3	0.71	2.86
Service Quality	13	5	0.73	2.80
Primary Influences	4	3	0.56	2.78
Secondary Influences	4	2	0.75	2.88
Requisite Knowledge	6	3	0.61	2.69
Self-efficacy	7	3	0.56	2.61
Facilitating conditions	9	5	0.70	2.79
Usage	35	35	0.98	2.99

Legend: **TI**= Total number of items, **SI**= Number of significant Items, **ACVR** = Average content validity ratio, **AM**= Average mean

The findings also suggest that the content validity experts rated those items that were adopted from the exploratory survey conducted in stage 1 and from the previous study on broadband adoption in South Korea as essential (Oh *et al*, 2003). Contrastingly, the items adopted from the general technology adoption studies (Davis, 1989; Taylor and Todd, 1995) were rated, but considered as non-essential. Therefore, the content validity practice confirms that the items investigated in the exploratory studies are important to understand the consumers' broadband adoption behaviour.

4.5.3 Limitations Encountered During Content Validation

The following three limitations were encountered whilst conducting the content validity for the broadband adoption survey instruments. These were: first, locating the experts relating to the specific research area; second, conducting content validity with the experts located in different places; and third, the length of the content validity instruments.

Since research in broadband adoption and diffusion from the demand perspective is novel, researchers involved in examining this issue are few in numbers. This is particularly true in the instance of locating experts in a country such as the UK. However, the problem was overcome by considering researchers located in other countries, such as the USA, Australia, Canada and Denmark.

The second limitation was distance and the lack of face-to-face interaction with experts. This problem became obvious when the majority of the researchers initially perceived that the questionnaire sent to them was the final instrument. This created confusion when evaluating the questionnaire content. To overcome this problem, several emails were sent to each expert's queries to clarify the context of content validity.

The length of the instrument extended as the content validity questionnaire comprised a definition of each construct and related items. For example, the content validity instruments in this study were ten pages long. Initially, the length of the questionnaire discouraged many experts from participating in the content evaluation exercise. However, after repeated contacts and requests, the researchers agreed to assist with this exercise.

To complete the instrument development process that will be utilised to investigate broadband diffusion, the next step was to conduct a pre-test and pilot test of the questionnaire using respondents from a target population.

4.6 STAGE 3: INSTRUMENT TESTING

4.6.1 Pre-Test

A pre-test of the resulting instrument **(Appendix 4.6 and 4.7)** was conducted with 20 respondents ranging from the broadband industry (3), an IT manager of a county council (1), academics and researchers (10) and household consumers (6). In addition to providing responses, the respondents were asked to determine whether the questions were grammatically correct and understandable and to suggest further improvements. The pre-test participants suggested that all the items for one construct should be measured in the same direction. The content validity experts also repeated this suggestion. Therefore, this particular issue was considered carefully and such changes were made wherever required. The following is an example of such a change:

The items for the facilitating condition construct **'before pre-test'** were:

1. I cannot subscribe to broadband at home because it is too costly to purchase a new computer or to upgrade my old computer.
2. My annual household income level is enough to afford subscribing to broadband.
3. It is too costly for me to subscribe to broadband at its current subscription fee.
4. I would be able to subscribe to broadband if I wanted to.

The items for the facilitating condition construct **'after pre-test'** were:

1. It is not too costly to purchase a new computer or to upgrade my old computer.
2. My annual household income level is enough to afford subscribing to broadband.
3. It is not too costly for me to subscribe to broadband at its current subscription fee.
4. I would be able to subscribe to broadband if I wanted to.

The suggestions that were provided by the content validity experts regarding the rewording and modifying of items were all implemented at this stage and that is reflected in the pilot questionnaire **(Appendix 4.8)**. Another issue that the respondents commented upon at the pre-test stage was the length of the questionnaire. Prior to the questionnaire being sent to the pre-test participants, the questionnaire was 11 pages long. The respondents expressed concern about the length of the questionnaire. They suggested that in the current form, the

questionnaire length was extensive and could lead to a low response rate. Their suggestion was that the length of the questionnaire should be reduced but without losing the measurement content. Bearing in mind the comments of the participants, the total length of the questionnaire was reduced to six pages. This was achieved by making two changes that consisted of the structure and format of the questions. **For example:**

(1) In the pre-test questionnaire the options for the Likert scale questions were arranged in two rows. However, after the comments for each item, the Likert scale options were managed within one row. This assisted in reducing the length of the questionnaire, e.g.

The arrangement of the Likert Scale items in the pre-test questionnaire:

Broadband has an advantage over dial-up/narrowband because it offers faster access to Internet

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree ☐ 1=Extremely disagree

Arrangement of the Likert Scale items in the final questionnaire:

Broadband has an advantage over dial-up/narrowband because it offers faster access to the Internet

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

(2) The second change was made to the usage part of the questionnaire. Both the content validity experts and pre-test participants suggested this change. In the pre-test questionnaire, usage of each online activity was a separate question that required a lot of space, which meant a longer questionnaire. However, following the suggestions, the final questionnaire consisted of these online activities being arranged in a tabular form. An example is provided below:

The arrangement of the online activities in the pre-test questionnaire:

How often do you access the following online services from home?

(1) Email

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(2) Instant messaging

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

The arrangement of the online activities in the final questionnaire:

Online services	**From Home**	**From Work Place, Internet Café, Library**	**Would you like to use it in the future?**
Email	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Instant messaging	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No

Besides the aforementioned changes and a few spelling and typographical errors, the respondents from the pre-test studies supported the content of the questionnaire. After

incorporating all the suggested changes by the content validity experts and pre-test participants, the length of the resultant questionnaire was reduced to six pages (**Appendix 4.8**). More details regarding the contents of the final questionnaire are provided in the following sub-section titled 'pilot-test'.

4.6.2 Pilot-Test

4.6.2.1 Research Method

The final stage of the instrument development process was a pilot test of the questionnaire using respondents whose backgrounds were similar to the final study's target population. The respondents were selected utilising the 'UK-Info Disk V11' database. The database comprised the nationwide addresses of households in the UK. The primary aim of the test was to ensure that the various scales demonstrated the appropriate levels of reliability. The pilot also indicated to the researchers an estimate of the actual response rates. Furthermore, the pilot identified difficulties that respondents could face when completing the questionnaire. For example, some of the difficulties included determining whether the diction of questionnaire and the accompanying instructions were comprehensive enough for completion of the questionnaire (Moore and Benbasat, 1991).

From the pre-test, a survey instrument resulted that was six pages long and consisted of an overall total of 17 questions (**Appendix 4.8**). The questions were divided into four categories: (1) multiple type questions examining the demographics of the respondents (questions 1-6), Internet connection types, frequency and duration of Internet access on a daily basis (question 8-12); (2) Yes/No questions that determined the location of the Internet at home or elsewhere (question 7), accessibility to various (total of 41) online activities (question 16); (3) Likert scale questions to assess the perception of the adopters and non-adopters of broadband (Question 13); and (4) to assess the impact of broadband upon individuals time allocation patterns, respondents were questioned about their use of the Internet. That is, whether usage of broadband had increased, decreased or had no impact, upon the amount of time spent on the 20 various daily life activities (Question 17). **Appendix 4.8** illustrates the questionnaire that was utilised for the pilot study.

Four other questions were also asked in order to determine a respondent's understanding of the questionnaire **(Appendix 4.8)**. The four questions were: (1) Is the length of the questionnaire appropriate? (2) Are the questions understandable? (3) Is the layout of the questionnaire acceptable? (4) How long did it take the respondent to complete the questionnaire? The responses of the respondents on these four questions are summarised in Table 4.5.

The pilot questionnaires were sent to an overall total of 200 respondents via the postal service in the month of December 2004. A covering letter that included the definitions of broadband, narrowband, metered and un-metered, and a self-addressed prepaid return envelope were also included with the questionnaire. A total of 42 replies were received within the specified time limit. Of the replies, there were 40 usable responses and the remaining two replies were incomplete; therefore they offered no relevance and were excluded from the analysis. Hence, a response rate of 20 per cent was obtained.

4.6.2.2 Findings from Pilot Test

Of the overall 40 responses, 21 (52.5%) respondents had narrowband (dialup) connections. Further, seven (17.5%) of them had metered narrowband, whilst 14 (35%) had un-metered narrowband. There were 13 (32.5%) respondents who had broadband. The broadband replies also had categories and the resulting replies are as follows. Eight (20%) respondents had DSL, four (10%) had a cable modem and one (2.5%) had a wireless connection. The remaining six (15%) respondents did not access the Internet from home using either narrowband or broadband. Considering the diversity of the connection types, this sample of 40 respondents was considered to be a good sample for the purposes of pilot testing the instrument, since it consisted of various types of adopters and non-adopters of narrowband and broadband.

The mean, standard deviation (SD) and reliability (alpha) obtained from the pilot-test are presented in Table 4.4. The descriptive statistics (Mean and Standard Deviation) illustrated in Table 4.4 suggest that amongst the attitudinal constructs, the relative advantage construct is highly rated, with the lowest standard deviations at a 7 point Likert scale and the hedonic outcome being poorly rated. Amongst the normative constructs, primary influence was considered to be more important than secondary influence. The descriptive statistics for the control constructs suggest that the skill construct is highly rated. This means that the majority of respondents including the adopters and non-adopters possess skills required for broadband adoption and use. Although a brief summary of the descriptive statistics is provided here, an in-depth analysis of the significance of factors is not provided, as this does not fit within the scope of this chapter. The following sub-sections discuss the test of instrument reliability.

The statistics obtained from the reliability analysis confirm the internal consistency of the measure. Cronbach's α for this test varies between 0.95 for three constructs, namely behavioural intention, secondary influence and self-efficacy and 0.72 for facilitating conditions resources. All the constructs included in the survey possess Cronbach's alpha above 0.70. The IS literature offers advice that in order to satisfy the internal consistency

criteria, Cronbach's α should be above 0.60 for an exploratory survey, and 0.70 for a confirmatory study (Straub *et al*, 2004, pp 411). Therefore, following the aforementioned 'rule of thumb', the obtained values are acceptable. This confirms that the measurement is internally consistent and possesses an appropriate reliability level. Hinton *et al* (2004) have suggested four cut-off points for reliability, which includes excellent reliability (0.90 and above), high reliability (0.70-0.90), moderate reliability (0.50-0.70) and low reliability (0.50 and below) (Hinton *et al*, 2004, pp 364). According to those of the ten constructs, four possess excellent reliability and the remaining six constructs demonstrate high reliability. None of the constructs demonstrated a moderate or low reliability (Table 4.4). Comparing the alpha values obtained from the exploratory survey (**Appendix 4.2**) and pilot-test (Table 4.4), it is clearly suggested that after conducting the content validation and pre-test, the scale reliability has improved for all the constructs. This improvement provides evidence that content validation is not only required to test the representativeness of the items for a construct domain, but is also helpful in improving the internal consistency of measures.

TABLE 4.4
Summary of Statistics Obtained from Pilot-test (N=40)

Constructs	**Number of Items**	**Scale Mean**	**Scale SD**	**RELIABILITY Cronbach's Alpha (α)**	**Type (Hinton *et al*, 2004, pp 364)**
Behavioural Intention	2	5.5	1.7	0.95	**Excellent Reliability**
*BISP	1	3.54	2.15	---	---
Relative Advantage	4	6.3	0.7	0.75	High Reliability
Utilitarian Outcomes	10	5.7	1.0	0.91	**Excellent Reliability**
Hedonic Outcomes	4	3.7	1.7	0.88	High Reliability
Service Quality	4	4.2	1.3	0.78	High Reliability
Primary Influence	3	4.5	1.6	0.88	High Reliability
Secondary Influence	2	3.6	1.9	0.95	**Excellent Reliability**
Facilitating Conditions	4	5.0	1.2	0.72	High Reliability
Resources					
Knowledge	3	5.7	1.3	0.85	High Reliability
Self-efficacy	3	6.2	1.2	0.94	**Excellent Reliability**
**Usage (Online Activities)	41	---	---	---	---
**Impact	20	---	---	---	---

LEGEND: BISP=Behavioural Intention to change subscriber, **SD**= Standard Deviations
*Reliability is not estimated since construct is composed of only one item
** Reliability is not estimated since variables are nominal (categorical) in nature

There were no comments obtained from the pilot respondents upon improving the questionnaire. Only a few respondents suggested that it may be useful to provide definitions of terms, such as broadband, narrowband, metered and un-metered. Table 4.5 illustrate that of the 40 pilot respondents, 35 (87.5%) agreed that the length of the questionnaire was appropriate. Of the 40, 39 (97.5%) respondents found the questions to be understandable and

37 (92.5%) respondents indicated that the layout of the questionnaire was appropriate. To determine the time taken to complete the questionnaire, the participants were offered four options consisting of 10, 15, 20 and 25 minutes. The findings presented in Table 4.5 illustrate that 67.5 % of the respondents took between 10 (37.5% respondents) to 15 minutes (30.0% respondents) to complete the questionnaire. As the outcome of the pilot findings in mind were positive, it was decided that the administered questionnaire for the pilot study did not require any further changes and was considered appropriate for the final survey.

TABLE 4.5
Respondent Perception of Survey Instrument (N=40)

Questions	Frequency		Percent	
	Yes	No	Yes	No
1. Is the length of the questionnaire appropriate?	35	5	87.5	12.5
2. Are the questions understandable?	39	1	97.5	2.5
3. Is the layout of the questionnaire OK?	37	3	92.5	7.5
	Time require to complete questionnaire			
4. How long did it take to complete the questionnaire?	10 Min.	15 Min.	20 Min.	25 Min
Frequency	15	12	12	1
Percent	37.5	30.0	30.0	2.5

4.6.3 Final Survey Instrument

The list of items for the adoption constructs that will be utilised for the final data collection is presented in Table 4.6. However, the complete survey instrument (i.e. the questionnaire) that resulted from the pilot test is provided in **Appendix 4.9**. A total of 40 items formed the survey content of the final instrument and belonged to 11 different constructs that included both the independent and dependent variables. Of the remaining 11, the two constructs behavioural intention (BI) and secondary social influence (SI) were composed of two items each. Only the construct behavioural intention to change the service provider (BISP) was represented by only one item. The three constructs that are primary influence (PI), knowledge (K) and self-efficacy (SE) consisted of three items each. Four constructs, namely relative advantage (RA), hedonic outcomes (HO), service quality (SQ) and facilitating conditions resources (FCR) were composed of four items each. The utilitarian outcomes construct was (UO) represented by 10 items (Table 4.6).

The usage part of the questionnaire was composed of 41 online activities, which are listed in Table 4.7. The categorical variables that included duration and frequency of Internet access are not presented in Table 4.7 but were included in the questionnaire **(Appendix 4.9).** To examine if Internet use by the broadband and narrowband consumers had an impact upon a consumers daily life, 20 different activities were included within the final questionnaire **(Appendix 4.9).** These activities are listed in Table 4.8. Apart from the adoption, usage and impact related variables listed above, five demographic variables (age, gender, education,

income and occupation) were also included in the questionnaire **(Appendix 4.9)**. The theoretical justification and relevance for including these variables are provided in Chapter 3.

TABLE 4.6
List of Constructs and Items to Examine Broadband Adoption

1. BEHAVIOURAL INTENTION (BI) TO ADOPT BROADBAND
BI1: I intend to subscribe to (or continue my current subscription) broadband in the future
BI3: I intend to use (or intend to continue use) broadband Internet service in the future
2. BEHAVIOURAL INTENTION TO CHANGE SERVICE PROVIDER (BISP)
BI2: I intend to continue my current subscription but will change the current service provider
3. RELATIVE ADVANTAGE (RA)
RA1: Broadband has an advantage over dial-up because it offers faster access to Internet
RA2: Broadband has an advantage over dial-up because it provides faster download of files from Internet
RA3: Broadband has an advantage over dial-up because it offers an always-on access to Internet
RA4: Broadband has an advantage over dial-up because it frees up the phone line whilst connected to the Internet
4. UTILITARIAN OUTCOMES (UO)
UO1: Broadband can be useful to find educational materials and accessing library resources at home
UO2: Broadband can be useful for distance learning
UO3: Broadband can be helpful to perform work/job-related tasks at home
UO4: Broadband will help me communicate better via email, chat, Web cam
UO5: Broadband can help in performing personal and household activities i.e. *online shopping*
UO6: Broadband can help in performing personal and household activities i.e. *information search*
UO7: Broadband can be helpful to establish and operate a home business
UO8: Broadband can help children to do their homework
UO9: Subscribing to broadband is compatible with most aspects of my everyday life
UO10: Overall broadband will be useful to me and other members in the family
5. HEDONIC OUTCOMES (HO)
HO1: I will enjoy using broadband to listen to and download music
HO2: I will enjoy using broadband to watch to and download movies
HO3: I will enjoy using broadband to play online games
HO4: I will enjoy using broadband to play online gambling/casino
6. SERVICE QUALITY
SQ1: I am satisfied with the speed of Internet access obtained from my current service providers
SQ2: I am satisfied with the security measures provided with Internet access obtained from my current service providers
SQ3: I obtained satisfactory customer/technical support from my current service providers
SQ4: The overall service quality of my current Internet connection is satisfactory
7. PRIMARY INFLUENCE
PI1: My friends think that I should subscribe to (or continue the current subscription) broadband at home
PI2: My colleagues think that I should subscribe to (or continue the current subscription) broadband
PI3: My family members think that I should subscribe to (or continue the current subscription) to broadband
8. SECONDARY INFLUENCE
SI1: TV and radio advertising encourages me to try broadband
SI2: Newspaper advertising encourages me to try broadband
9. FACILITATING CONDITIONS RESOURCES
FCR1: My annual household income level is enough to afford subscribing to broadband
FCR2: It is not too costly to purchase a new computer or to upgrade my old computer
FCR3: It is not too costly for me to subscribe to broadband at its current subscription fee
FCR4: I would be able to subscribe to broadband if I wanted to
10. KNOWLEDGE
K1: I do not have difficulty in explaining why adopting broadband may be beneficial
K2: I know how broadband is different from dial-up/narrowband Internet
K3: I know the benefits that broadband offer and cannot be obtained by dial-up/narrowband
11. SELF-EFFICACY
SE1: I would feel comfortable using the Internet on my own
SE2: Learning to operate the Internet is easy for me
SE3: I clearly understand how to use the Internet

TABLE 4.7
List of Online Activities for Examining Broadband Usage

SN	Online services	SN	Online services
1	Email	22	Listen to the radio station
2	Instant messaging	23	Watch movies (downloading/streaming)
3	Online Chat	24	Undertake online banking
4	Online News	25	Online bill paying
5	Job related research	26	Purchase a product
6	Look for product info	27	Purchase a travel service
7	Research for school or training	28	Online auctions e.g. e-bay
8	Look for travel information	29	Purchase groceries (household goods)
9	Look for medical information	30	Buy/sell stocks (online share trading)
10	Share computer files	31	Play lottery
11	Create content (e.g. Web pages)	32	Obtain information on hobby
12	Store/display/develop photos	33	Use it for fun e.g. Web surfing
13	Store files on the Internet	34	Play online game
14	Download games	35	View or visit Adult content Websites
15	Download video	36	Video conferencing
16	Download pictures	37	Voice over Internet (VoIP)
17	Download music	38	Online dating and matrimonial services
18	Download movie	39	Online lectures
19	Download free software	40	Collaboration with schoolmates
20	Video streaming/downloading	41	Accessing e-government services
21	Listen to music (streaming/MP3)		

TABLE 4.8
List of Daily Life Activities for Examining Broadband Impact

SN	Activities	SN	
1	Watching television/cable/satellite	11	Time spent on hobbies
2	Shopping in stores	12	Time spent on sleeping
3	Working at home	13	Time spent alone (doing nothing)
4	Reading newspapers/books/magazines	14	Studying
5	Working in the office	15	Household work
6	Commuting in traffic	16	Receiving/ making phone calls
7	Spending time with family	17	Doing charity and social works
8	Spending time with friends	18	Outdoor recreation (DIY, pet care)
9	Attending social events	19	Outdoor entertainment (concerts, cinema)
10	Time spent on sport	20	Visiting or meeting friends or relatives

4.7 SUMMARY AND CONCLUSIONS

This chapter described the development process for a survey instrument that was utilised to examine broadband adoption in the household context. The development process was achieved in three stages: the exploratory survey, content validity and instrument testing. The processes of each stage are summarised below.

The exploratory stage included surveying the known existing instruments, choosing appropriate items, creating required new items and then determining if the selected items were appropriate enough to measure the perceptions of the adopters and non-adopters. This stage also examined the reliability (internal consistency) of the initial scale. At this stage it was found that the majority of items were either selected from the existing instrument or were newly created ones that were important enough to explain the behaviour of the adopters

and non-adopters. However, the reliability of the scale was low in most cases. The exploratory stage also led the researcher to identify the new construct that was referred to as 'service quality' and some new items as well. The output of this stage of research was utilised as an input for the content validity stage.

The content validity stage included the creation of new items for each construct and then the validation of their representativeness utilising a quantitative approach. These new items were created utilising the items obtained from the exploratory stage and also by resurveying the literature and selecting the relevant items. In order to achieve the representativeness of items, several experts working on broadband related issues evaluated the newly created items. This led the researchers to calculate a content validity ratio that was the basis of the exclusion or inclusion of the items. The outcome of this stage was the inclusion of the representative items and the exclusion of non-related items. The reliability of all the ten scales improved after conducting the content validity process. This demonstrated the importance of performing content validation for the increased reliability of the scale and also the representativeness of the items.

The instrument testing stage was sub-divided into two stages, which included the pre-test and pilot test. The purpose of the pre-test was to obtain feedback on the instrument from the respondents, and to improve the wording of items. The purpose of the pilot test was to confirm the reliability of items. The findings obtained from the pilot test demonstrated an acceptable level of reliability for all the constructs. The final output of the three-stage instrument development process that culminated from the pilot test is a parsimonious 40-item instrument, consisting of 11 scales, all with a high level of reliability. The final instrument will be utilised to investigate the behavioural intentions of the household consumers when adopting broadband and also its usage and impact.

The next chapter (Chapter 5) will analyse and present the findings obtained from the final data collection that was conducted on a nationwide basis. Chapter 5 first estimates the response rate and then conducts the response-bias test. This is then followed by a re-examination of the reliability of the instrument and then construct validity is performed by conducting Principal Component Analysis. A test was conducted to assess the biases that may have been introduced due to the ordering of questions. Hereafter, the findings of this study are presented.

Chapter 5: Research Findings

5.1 INTRODUCTION

The previous chapter (Chapter 4) described the development and validation of a survey instrument for the purpose of data collection in order to examine broadband adoption, usage and impact. Chapter 3 provided a discussion and justification of the data collection and analysis methods. This chapter presents the findings obtained from a nationwide survey that was conducted to examine the adoption, usage and impact of broadband in the UK households.

The chapter is structured as follows. Section 5.2 presents a response rate of the survey and descriptions of how the non-response bias test was conducted. Section 5.3 then describes the demographic profile of the survey respondents. This is followed by a description of the findings relating to the adoption of broadband in section 5.4. The findings relating to the usage of broadband are then presented in Section 5.5. The effects of broadband usage on a consumer's time allocation patterns in various daily life activities are illustrated in Section 5.6. Finally, the summary and conclusions of the chapter are provided in Section 5.7.

5.2 RESPONSE RATE AND NON-RESPONSE BIAS

A detailed discussion of the response rate estimation process is provided in Chapter 3 (Section 3.5.2.5). Therefore, in this chapter the estimation process is not described. The total response rate obtained in this research is 26.6 %, which is considered as a good response rate within the field of IS research.

To test whether the characteristics of the respondents from the original responses are similar to the non-respondents, a *t*-test was conducted for the demographics (i.e. age and gender), Internet access at home, type of Internet connection at home, and all constructs from attitudinal, normative and control categories. The findings are illustrated in Table 5.1. The *t*-test on demographics and all key constructs except the primary influence of the study showed no significant differences between the respondents and non-respondents (Table 5.1). There is a significant difference between the original responses and responses from the non-respondents for the primary influence construct. The possible explanation could be that the non-respondents were those who more influenced by primary influence.

As discussed above, the majority of variables produced non-significant results in terms of non-response bias; this suggests that those non-respondents who returned the completed questionnaire after reminders were similar to the respondents from the original responses. Hence, this provides evidence that within the sample used for this research, it is unlikely that the findings were affected due to non-response bias.

TABLE 5.1
***t*-Test to Examine Non-response bias**

Variables	*t*	df	*p*
Age	.766	355	.444
Gender	.557	353	.578
Internet access at home	.646	356	.519
Type of connection	-1.609	306	.109
BI	-.547	356	.585
RA	.377	356	.707
UO	-.996	356	.320
HO	.845	356	.398
SQ	.161	306	.872
PI	-2.271	356	.024
SI	-.834	356	.405
K	.520	356	.604
SE	.072	356	.942
FCR	-1.079	356	.281

5.3 RESPONDENTS' PROFILE

A profile of the survey respondents is presented in Table 5.2. Of the 358 received responses, 26.1% of the respondents belonged to the 25-34 years age group, which formed the largest response category. The 35-44 years age group follows this with 21.6%. The least responsive category was the 65 years and above with 3.9%. In terms of gender, only 2% more responses were obtained from the males (51%) in comparison to the female (49%) respondents (Table 5.2).

The majority of the respondents possessed educational qualifications, with 34.6% having gained an undergraduate degree and 29.3% educated to postgraduate level. The least responsive educational category was the GNVQ/Diploma with an 8.8% response rate. 11.7% of the respondents possessed GCSE level education and 15.5% possessed 'A' level education (Table 5.2).

The occupational category with the highest amount of respondents was 'E', which consisted of students, casual workers, and pensioners (37.1%). This was followed by category 'B', which consisted of managers, teachers and computer programmers (28.4%). C1 represented the third largest occupational category with 19.7% responses, followed by category 'A' with 11.0% response. The least responsive occupational categories were 'D' and 'C2' with response rates of 1.7% and 2.0% respectively (Table 5.2). The aforementioned occupation categories were derived from the marketing literature where mainstream professionals such as doctors, lawyers and judges with the responsibility of more then 25 staff are classified as occupational category 'A' (Gilligan and Wilson, 2003; Rice 1997). The aforementioned occupations with a responsibility of less then 25 staff and academics are grouped as social grade 'B'. Skilled non-manual workers fall within the occupational

category 'C1' and 'C2'. Unskilled manual workers belong to occupational category 'D'. Finally, housewives, retired individuals, students and unemployed citizens were placed in category 'E' (Gilligan and Wilson, 2003; Rice 1997). As broadband provides a function to students and unemployed people who are engaged in job hunting, these groups are more likely to adopt broadband, although they belong to the lower occupation category 'E'.

TABLE 5.2
Profile of Survey Participants

	Categories	Frequency	Percent
Age	<=24	75	21.0
	25-34	93	26.1
	35-44	77	21.6
	45-54	68	19.0
	55-64	30	8.4
	=>65	14	3.9
	Total	**357**	**100.0**
Gender	Male	181	51.0
	Female	174	49.0
	Total	**355**	**100.0**
Education	GCSC	40	11.7
	GNQV/Diploma	30	8.8
	A level	53	15.5
	UG	118	34.6
	PG	100	29.3
	Total	**341**	**100.0**
Occupation	A	38	11.0
	B	98	28.4
	C1	68	19.7
	C2	7	2.0
	D	6	1.7
	E	128	37.1
	Total	**345**	**100.0**
Income	<10 K	33	9.5
	10-19 K	60	17.3
	20-29 K	62	17.9
	30-39 K	60	17.3
	40-49 K	38	11.0
	50-59 K	25	7.2
	60-69 K	33	9.5
	=> 70 K	36	10.4
	Total	**347**	**100.0**
Internet access at home	Yes	308	86.0
	No	50	14.0
	Total	**358**	**100.0**
Type of internet access at home	Narrowband	101	32.8
	Broadband	207	67.2
	Total	**308**	**100.0**

Responses for the household income categories varied between a response rate of 17.9% for the £20-29 K and 7.2% for £50-59K category. The least annual household income group (<=£10K) was represented by a 9.5% response, whilst the largest income group (=>£70K) was represented with a 10.4% response rate (Table 5.2).

Of the 358 respondents, 308 (86%) had Internet access at home and 50 (14%) did not. Of the 308 (86%) respondents who possessed Internet access at home, 101 (32.8%) had a narrowband connection and the remaining 207 (67.2%) respondents had a broadband connection (Table 5.2).

5.4 ADOPTION OF BROADBAND

Before presenting the findings, the research instrument was tested for its reliability, construct validity and method bias (i.e. effect of question ordering). The following section illustrates reliability, Section 5.4.2 shows the construct validity and Section 5.4.3 presents the computed values that demonstrate the absence of a method bias.

5.4.1 Reliability Test

Table 5.3 illustrates the Cronbach's coefficient alpha values that were estimated to examine the internal consistency of the measure. Cronbach's α varied between 0.91 for the utilitarian construct and 0.79 for both hedonic outcomes and service quality constructs. Both secondary influence and self-efficacy possessed a reliability value of 0.90. Cronbach's α for the remaining five constructs varied between 0.80 and 0.90. Two constructs, namely facilitating conditions resources and knowledge, had Cronbach's α at 0.81 and for relative advantage and primary influence there were values of alpha at 0.84. The dependent construct behavioural intention possessed an alpha of 0.87.

Hinton *et al* (2004) have suggested four cut-off points for reliability, which includes excellent reliability (0.90 and above), high reliability (0.70-0.90), moderate reliability (0.50-0.70) and low reliability (0.50 and below) (Hinton *et al*, 2004, pp 364). The aforementioned values suggest that of the ten constructs, three possess excellent reliability and the remaining seven illustrate high reliability. None of the constructs demonstrated a moderate or low reliability (Table 5.3).

The high Cronbach's α values for all constructs imply that they are internally consistent. That means all items of each constructs are measuring the same content universe (i.e. construct). For example, both the items of BI are measuring the same content universe of behavioural intention. Similarly, all ten items of UO are measuring the content universe of

utilitarian outcomes construct. In brief, the higher the Cronbach's α value of a construct, the higher the reliability is of measuring the same construct.

TABLE 5.3
Reliability of Measurements

Constructs	*N*	Number of Items	Cronbach's Alpha (α)	Type
Behavioural Intention	358	2	.8790	High Reliability
BISP	**308**	1	---	---
Relative Advantage	358	4	.8481	High Reliability
Utilitarian Outcomes	358	10	.9131	**Excellent Reliability**
Hedonic Outcomes	358	4	.7968	High Reliability
Service Quality	**308**	4	.7912	High Reliability
Primary Influence	358	3	.8420	High Reliability
Secondary Influence	358	2	.9034	**Excellent Reliability**
Facilitating Conditions Resources	358	4	.8114	High Reliability
Knowledge	358	3	.8193	High Reliability
Self-efficacy	358	3	.9026	**Excellent Reliability**

LEGEND: BISP=Behavioural Intention to change subscriber *N*= Sample Size

5.4.2 Factor Analysis

In order to verify the construct validity (convergent and discriminant validity), a factor analysis was conducted utilising Principal Component Analysis (PCA) with Varimax rotation method. The results of the PCA are presented in Tables 5.4, 5.5 and 5.6.

Before conducting a factor analysis, it is essential to perform a test for sampling adequacy and sphericity. These two tests confirm whether it is worth proceeding with factor analysis (Hinton *et al*, 2004).

5.4.2.1 Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) Test and Bartlett's Test of Sphericity

The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was first computed to determine the suitability of employing factor analysis, and the results are presented in Table 5.4. The KMO is estimated using correlations and partial correlations in order to test whether the variables in a given sample are adequate to correlate. A general 'rule of thumb' is that as a measure of factorability, a KMO value of 0.5 is poor, 0.6 is acceptable and a value closer to 1 is better (Brace *et al*, 2003; Hinton *et al*, 2004).

The results illustrated in Table 5.4 suggest that the KMO is well above the recommended acceptable level of 0.6 as the obtained value is 0.85. The aforementioned results confirm that the KMO test supports the sampling adequacy and it is worth conducting a factor analysis. This means that higher KMO values indicate the possibility of factor existence in data as it was assumed in the conceptual model.

TABLE 5.4
KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.858
Bartlett's Test of Sphericity	Approx. Chi-Square	6033.447
	Df	666
	Sig.	.000

Bartlett's test of sphericity is conducted for the purpose of confirming the relationship between the variables. If there is no relationship then it is irrelevant to undertake factor analysis. As a general rule, a p value <0.05 indicates that it is appropriate to continue with the factor analysis (Brace *et al*, 2003; Hinton *et al*, 2004).

The results illustrated in Table 5.4 suggest that the calculated p value is < 0.001, which means that there are relationships between the constructs in question. Therefore, it was considered appropriate to continue with the factor analysis.

5.4.2.2 Eigenvalues

As mentioned above, factor analysis was conducted utilising Principal Component Analysis as an extraction method and Varimax with Kaiser normalisation as a rotation method. Table 5.5 summarises the eigenvalues and explained total variance for the extracted components.

According to a general rule of thumb, only those factors with eigenvalues greater than 1 should be considered important for analysis purposes (Hinton *et al*, 2004; Straub *et al*, 2004). The results presented in Table 5.5 suggest that all nine constructs included in the factor analysis possess eigenvalues greater than 1. Results from the analysis also suggest that no extracted new factor consisted of an eigenvalues greater than 1.

TABLE 5.5
Eigenvalues and Total Variance Explained

C	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of V	Cumulative %	Total	% of V	Cumulative %	Total	% of V	Cumulative %
1	9.766	26.395	26.395	9.766	26.395	26.395	5.358	14.482	14.482
2	3.324	8.984	35.379	3.324	8.984	35.379	2.677	7.236	21.718
3	2.551	6.894	42.273	2.551	6.894	42.273	2.675	7.229	28.947
4	2.189	5.916	48.189	2.189	5.916	48.189	2.616	7.071	36.018
5	1.632	4.411	52.600	1.632	4.411	52.600	2.568	6.940	42.958
6	1.536	4.151	56.751	1.536	4.151	56.751	2.540	6.865	49.823
7	1.458	3.941	60.692	1.458	3.941	60.692	2.354	6.361	56.184
8	1.290	3.487	64.179	1.290	3.487	64.179	2.188	5.915	62.098
9	1.115	3.014	67.193	1.115	3.014	67.193	1.885	5.095	67.193

Extraction Method: Principal Component Analysis; **Legend:** C = Components; % of V= Percentage of Variance

5.4.2.3 Factor Loadings

The rotated component matrix presented in Table 5.6 shows the factor loadings for all nine constructs. The statistics presented in Table 5.6 clearly suggest that the nine components loaded. All the items loaded above 0.40, which is the minimum recommended value in IS research (Straub *et al*, 2004). Also, cross loading of the items was not found above 0.40.

All ten items of the utilitarian outcomes construct loaded on component 1. Therefore, the first component represents the underlying constructs of utilitarian outcomes. For this construct, coefficients varied between 0.51 and 0.78. All four items of the facilitating conditions resources construct loaded on component 2. Therefore, the second component represents the underlying constructs of facilitating conditions resources. The coefficient for this extracted component varies between 0.64 and 0.78. All four items of the service quality construct loaded on component 3. Therefore, the third component represents the underlying constructs of service quality. Coefficients for this component varied between 0.65 and 0.85. All four of the relative advantage related items loaded on the fourth component and loadings for this component varied between 0.58 and 0.72. Hence, this confirms that the fourth component represents the underlying constructs of relative advantage (Table 5.6).

All three items of the control construct self-efficacy loaded on component 5 with loadings that vary between 0.77 and 0.84. Hence, the fifth component represents the underlying constructs of self-efficacy. All four items related to the hedonic outcomes were loaded on component 6. The coefficients values for this component range between 0.60 and 0.85, and so the sixth component represents the underlying constructs of hedonic outcomes. All three items related to the primary influence construct loaded on the seventh component. The coefficients value was obtained from 0.65 and 0.89. This means that the seventh component represents the primary influence construct (Table 5.6).

The three items related to the control construct knowledge were loaded on the eighth component and the loadings range between 0.61 and 0.75. This means that the eighth component represents the underlying constructs of hedonic outcomes (Table 5.6). Finally, all items related with the secondary influence construct loaded on the ninth component. This construct comprised only two items and the coefficients of these two items were 0.91 and 0.90. Therefore, the ninth component represents the secondary influence construct. There were no cross loading above 0.40 for any of the nine aforementioned components (Table 5.6).

TABLE 5.6
Rotated Component Matrix

Items	Component								
	1(UO)	2 (FCR)	3 (SQ)	4 (RA)	5 (SE)	6 (HO)	7 (PI)	8 (K)	9 (SI)
UO1	**.788**	.094	.102	.041	.070	.025	.087	-.021	-.069
UO6	**.783**	.116	.060	.095	.086	.057	-.016	.136	-.051
UO8	**.758**	.106	.054	.053	.035	.062	.121	-.038	.093
UO5	**.740**	.079	.025	.041	.070	.146	-.034	.077	.118
UO4	**.682**	.121	.094	.194	.027	.084	.041	.153	.014
UO2	**.679**	.041	.028	.107	.019	-.071	.079	.174	.168
UO3	**.663**	.124	.035	.188	.261	.096	.132	.028	-.063
UO10	**.564**	.240	.179	.347	.143	.100	.227	.184	-.006
UO7	**.520**	-.002	-.078	.368	.169	-.038	.134	.109	.021
UO9	**.519**	.309	.139	.246	.058	.021	.227	.227	.096
FCR3	.171	**.780**	.190	.079	.130	.103	.024	.022	.020
FCR1	.133	**.768**	.133	.073	.228	-.037	.084	.201	.020
FCR4	.107	**.687**	.029	.056	.238	-.026	.067	.212	.102
FCR2	.234	**.649**	.016	.206	-.089	.058	.042	-.016	-.070
SQ4	.087	.068	**.858**	.053	.134	.017	.041	.014	-.048
SQ1	.057	.132	**.794**	.063	-.083	.024	.011	.024	.007
SQ3	.041	.017	**.769**	.013	.225	.068	.183	.094	.032
SQ2	.111	.081	**.650**	-.047	-.027	.089	.097	.038	.102
RA4	.137	.153	.038	**.728**	.125	.022	.001	-.073	.105
RA2	.197	.124	.053	**.706**	.129	.118	.017	.308	.022
RA1	.222	.026	-.039	**.683**	.165	-.054	.048	.256	.017
RA3	.373	.175	.054	**.589**	.112	.022	-.013	.196	-.080
S2	.120	.115	.095	.117	**.844**	.055	-.035	.178	.003
S3	.230	.188	.088	.179	**.795**	.013	.016	.262	.032
S1	.172	.183	.045	.241	**.771**	-.005	.095	.139	-.023
HO2	.048	.010	.024	.135	.099	**.853**	.111	-.063	-.011
HO3	.081	.030	.109	-.151	-.049	**.793**	.133	.099	.135
HO1	.226	.090	.038	.116	.148	**.767**	.187	-.057	.047
HO4	-.028	-.013	.060	-.015	-.138	**.600**	-.055	.208	.268
PI1	.092	-.010	.093	.036	.005	.132	**.897**	.063	.108
PI2	.123	.067	.065	-.017	.058	.163	**.864**	.015	.117
PI3	.298	.216	.271	.077	-.008	.064	**.654**	.033	.036
K3	.215	.123	.115	.255	.192	.054	.011	**.758**	-.021
K2	.182	.064	.067	.163	.311	.020	-.025	**.754**	-.010
K1	.173	.314	.015	.147	.130	.108	.177	**.615**	.033
SI1	.065	.034	.034	.112	.011	.143	.160	-.049	**.910**
SI2	.108	.026	.061	-.021	.005	.193	.091	.039	**.903**

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalisation.

The factor analysis results satisfied the criteria of construct validity including both the discriminant validity (loading of at least 0.40, no cross-loading of items above 0.40) and convergent validity (eigenvalues of 1, loading of at least 0.40, items that load on posited constructs) (Straub *et al*, 2004, pp 410). This confirms the existence of the construct validity (both discriminant validity and convergent validity) in the instrument measures of this

research that were utilised for data collection (Table 5.6). This means that the collected data and findings that were obtained from this instrument are reliable.

Stevens (1996) provided the following three recommendations regarding the reliable factors. First, the components with four or more loadings above 0.60 in absolute value are reliable, regardless of the sample size. Second, components with about ten or more with 0.40 loadings are reliable as long as the sample size is greater than about 150. Third, components with only a few loadings should not be interpreted unless the sample size is at least 300 (Stevens, 1996). The results that are illustrated in Table 5.6 and presented above satisfied all the three criteria recommended by Stevens (1996). Therefore, it confirms that the extracted components are reliable and that the construct validity exists (Table 5.6).

5.4.2.4 Total Variance Explained

Table 5.5 summarises the explained total variance for the extracted components that shown in Table 5.6. As mentioned in Section 5.4.2.2, all constructs had eigenvalues greater than 1 and in combination accounted for a total of 67.13% variance in data. Variance contributed by each construct varies before and after rotation.

Values presented hereafter represent before-rotation variance and after-rotation values and are illustrated in Table 5.5. Within this category, the maximum variance of 26.39% was explained by the utilitarian outcomes construct. Amongst the attitudinal constructs, service quality had the second largest variance in data (6.89%). The relative advantage construct followed this with a variance of 5.91%. The hedonic outcomes contribute to a variance of 4.15% (Table 5.5).

The minimum variation of 3.01% was accounted for by the normative construct 'secondary influence' . The other normative construct (primary influence) accounted for only a 3.94% variance in data (Table 5.5).

The first control construct, self-efficacy, accounted for a total variance of 4.44%. The second control construct, knowledge, accounted for a total of 3.48% variance. The third control construct, facilitating conditions resources, accounted for 8.98% variance in the data (Table 5.5).

Findings from both the reliability test and factor analysis, which respectively confirms internal consistency of measures and construct validities (i.e. convergent and discriminant validity), suggest that it is appropriate to create aggregated measures by averaging the means of all items of each construct. Section 3.6.3.1 in Chapter 3 has already provided a discussion on this issue.

5.4.3 Test for Ordering of Questionnaire Items

Straub *et al* (2004) argued that as a result of the lack of randomisation of items for a particular construct, respondents may sense the inherent constructs via the ordering of questionnaire items and therefore their response may introduce a bias, which is termed as a methods bias. This type of bias is considered to be threat to construct validity (Straub, 2004). To examine if any method bias exists within this study, a *t*-test was conducted for two samples, one with randomisation of questionnaire items and one without it. Table 5.7 illustrates the results that showed no significant difference between the obtained responses from the randomised and non-randomised questionnaire. Therefore, it is unlikely that a method bias exists in the collected data, or more specifically, that the questionnaire items ordering in this particular instance contributed to the pattern of responses; instead the findings presented the 'true scores'. In brief, there is no threat to the construct validity due to a method bias in the data.

TABLE 5.7
***t* -Test to Compare Means of Aggregated Measures Obtained from Randomised (N= 40) and Non-randomised (N=318) Questionnaire**

	t Value	df	*p*
BI	.209	356	.835
RA	.122	356	.903
UO	.089	356	.930
HO	.745	356	.457
SQ	-1.399	306	.163
PI	-.334	356	.739
SI	-.533	356	.594
K	-1.361	356	.174
SE	.910	356	.364
FCR	.269	356	.788

5.4.4 Descriptive Statistics

Table 5.8 presents the means and standard deviations of the items related to all 11 constructs included in the study to measure the perceptions regarding broadband adoption. The means and standard deviations of aggregated measures for all the 11 constructs are also illustrated in Table 5.9.

The respondents showed strong agreement for both of the items of the behavioural intentions (BI1 and BI3), as the mean score varies between 5.78 (SD=1.62) and 6.05 (SD=1.48) (Table 5.8) with an average score of 5.92 (SD=1.55) (Table 5.9). Only the item (BI2) of the behavioural intention to change service provider (BISP) construct was less agreed by survey respondents (M = 3.42, SD = 1.88) (Table 5.8).

The respondents agreed strongly for all of the items of the relative advantage constructs, where item RA1 scored the maximum (M = 6.39, SD = 1.11) and minimum (M = 6.10, SD = 1.28) for item RA3 (Table 5.8) with the high average score of aggregate measure (M = 6.31, SD = 1.17) (Table 5.9). A strong agreement was also made for the utilitarian outcomes (M = 5.60, SD = 1.45) and service quality (M = 4.67, SD = 1.70) constructs by survey respondents (Table 5.9). The importance of hedonic outcomes was less agreed with an average mean score of 3.51 and standard deviations of 1.92 (Table 5.9).

Amongst the normative constructs, primary influence rated above average (*M* = 4.75, *SD* = 1.68) and was agreed more strongly than the secondary influence which was rated slightly above than average (*M* = 3.65, *SD* = 1.80) on a 7 point likert scale (Table 5.9). Self-efficacy was rated stronger (*M* = 6.24, *SD* = 1.29) than the other control constructs, namely knowledge (*M* = 5.59, *SD* = 1.49) and facilitating conditions resources (*M* = 4.67, *SD* = 1.70) (Table 5.9).

TABLE 5.8
Descriptive Statistics

SN	Items	*N*	*Mean*	*SD*	SN	Items	*N*	*Mean*	*SD*
1	**BI1**	358	5.78	1.624	21	**HO4**	358	1.92	1.587
2	**BI2**	308	3.42	1.882	22	**SQ1**	308	4.74	1.859
3	**BI3**	358	6.05	1.481	23	**SQ2**	308	4.39	1.817
4	**RA1**	358	6.39	1.119	24	**SQ3**	308	4.47	1.593
5	**RA2**	358	6.38	1.131	25	**SQ4**	308	5.07	1.533
6	**RA3**	358	6.10	1.287	26	**PI1**	358	4.68	1.642
7	**RA4**	358	6.39	1.148	27	**PI2**	358	4.62	1.632
8	**UO1**	358	5.89	1.328	28	**PI3**	358	4.94	1.768
9	**UO2**	358	5.63	1.396	29	**SI1**	358	3.80	1.844
10	**UO3**	358	5.76	1.440	30	**SI2**	358	3.49	1.783
11	**UO4**	358	5.73	1.480	31	**K1**	358	5.44	1.540
12	**UO5**	358	5.32	1.550	32	**K2**	358	5.61	1.511
13	**UO6**	358	5.64	1.407	33	**K3**	358	5.73	1.417
14	**UO7**	358	5.57	1.341	34	**S1**	358	6.32	1.314
15	**UO8**	358	5.41	1.520	35	**S2**	358	6.17	1.308
16	**UO9**	358	5.26	1.601	36	**S3**	358	6.23	1.239
17	**UO10**	358	5.82	1.414	37	**FCR1**	358	5.57	1.720
18	**HO1**	358	4.71	2.040	38	**FCR2**	358	4.57	1.793
19	**HO2**	358	4.04	1.995	39	**FCR3**	358	4.79	1.809
20	**HO3**	358	3.35	2.050	40	**FCR4**	358	5.60	1.582

N: Total number of responses. ***SD***: Standard Deviation

The aforementioned descriptive statistics are the cumulative scores obtained from both broadband and narrowband consumers, and it is expected that the mean score may differ for the two groups. Hence, the findings that illustrate the cross sectional view are presented in the next subsection, which demonstrates broadband consumers' perception of having broadband significantly higher than its narrowband counterpart.

TABLE 5.9
Summary of Descriptive Statistics

SN	Construct	NI	*N*	Descriptive			
				Mean	Min	Max	*SD*
1	Behavioural Intention	2	358	5.92	5.78	6.05	1.55
2	BISP	1	308	3.42	---	---	1.88
3	Relative Advantage	4	358	6.31	6.09	6.39	1.17
4	Utilitarian Outcomes	10	358	5.60	5.25	5.89	1.45
5	Hedonic Outcomes	4	358	3.51	1.92	4.71	1.92
6	Service Quality	4	308	4.67	4.39	5.06	1.70
7	Primary Influence	3	358	4.75	4.62	4.94	1.68
8	Secondary Influence	2	358	3.65	3.49	3.79	1.81
9	Facilitating Conditions Resources	4	358	5.13	4.57	5.60	1.73
10	Knowledge	3	358	5.59	5.44	5.73	1.49
11	Self-efficacy	3	358	6.24	6.17	6.32	1.29

NI: Total number of variables or items. *N*: Total number of responses. *SD*: Standard Deviation

5.4.5 The Difference Between Broadband Adopters and Non-adopters

5.4.5.1 *t*-Test

Table 5.10 presents the means and standard deviations of the all the ten aggregate measures included in the study for both narrowband and broadband consumers.

TABLE 5.10
***t*-Tests to Examine Equality of Group Means**

Construct	Type of connection	*N*	*M*	*M* Difference	*SD*	*t*	df	*p* (2-tailed)
BI	Narrowband	101	5.18	1.36	1.74	9.70	306	.000
	Broadband	207	6.54		.71			
	Broadband	207	3.46		1.90			
RA	Narrowband	101	6.14	.38	.95	4.10	306	.000
	Broadband	207	6.53		.67			
UO	Narrowband	101	5.17	.74	1.12	6.56	306	.000
	Broadband	207	5.92		.83			
HO	Narrowband	101	3.21	.40	1.53	2.24	306	.025
	Broadband	207	3.62		1.46			
SQ	Narrowband	101	4.02	.94	1.34	6.18	306	.000
	Broadband	207	4.97		1.22			
PI	Narrowband	101	4.43	.59	1.52	3.44	306	.001
	Broadband	207	5.02		1.36			
SI	Narrowband	101	3.74	-.17	1.74	-.819	306	.414
	Broadband	207	3.57		1.73			
K	Narrowband	101	5.36	.49	1.29	3.50	306	.001
	Broadband	207	5.85		1.08			
SE	Narrowband	101	6.04	.39	1.28	3.05	306	.003
	Broadband	207	6.44		.93			
FCR	Narrowband	101	4.68	.94	1.49	6.41	306	.000
	Broadband	207	5.62		1.04			

Table 5.10 also provides the results of the *t*-test, which tested the differences between the narrowband and broadband consumers on these constructs. The findings indicate that with the exception of secondary influence, the narrowband and broadband consumers differ significantly on the mean score for the remaining nine constructs. Even though overall both groups (i.e. narrowband and broadband consumers) view the adoption of broadband positively, the mean scores indicate that broadband consumers have significantly more positive perceptions on the various constructs than narrowband consumers.

5.4.5.2 Discriminant Analysis

To confirm the effectiveness of various factors for discriminating adopters from non-adopters, a discriminant analysis was performed using broadband adoption as the dependent variable and behavioural intention, relative advantage, utilitarian outcomes, hedonic outcomes, service quality, primary influence, secondary influence, facilitating conditions resources, knowledge and self-efficacy as the predictor variables. A total of 308 cases were analysed. The findings are presented in Tables 5.11–5.15. The univariate ANOVAs revealed that the narrowband and broadband consumers differed significantly on all the predictor variables except for secondary influence (Table 5.11). A single determinant function was calculated (Table 5.14). The value of this function was significantly different for the narrowband and broadband consumers (χ^2 (10, N = 308) = 128.867, p < .001) (Table 5.13). The correlations between the predictor variables and the discriminant function suggested that behavioural intention was the best predictor of the future adoption of broadband whilst secondary influence was found to be least useful (Table 5.14). Overall, the discriminant function successfully predicted the outcome for 80.2% of the cases, with accurate predictions being made for 72.3% of the narrowband consumers and 84.1% of the broadband consumers (Table 5.15).

TABLE 5.11
Tests of Equality of Group Means

	F	df1	df2	*p*
BI	94.154	1	306	.000
RA	16.833	1	306	.000
UO	43.083	1	306	.000
HO	5.056	1	306	.025
SQ	38.263	1	306	.000
PI	11.849	1	306	.001
SI	.670	1	306	.414
K	12.310	1	306	.001
SE	9.211	1	306	.003
FCR	41.192	1	306	.000

TABLE 5.12
Eigenvalues

Function	Eigenvalue	% of Variance	Canonical Correlation
1	.534	100.0	.590

TABLE 5.13
Wilks' Lambda

Test of Function(s)	Wilks' Lambda	χ^2	df	*p*
1	.652	128.867	10	.000

TABLE 5.14
Structure Matrix

	Function
BI	.759
UO	.513
FCR	.502
SQ	.484
RA	.321
K	.274
PI	.269
SE	.237
HO	.176
SI	-.064

TABLE 5.15
Classification Results [a]

	Type of connection	Predicted Group Membership		Total
		Narrowband	Broadband	
Count	Narrowband	73	28	101
	Broadband	33	174	207
%	Narrowband	72.3	27.7	100.0
	Broadband	15.9	84.1	100.0

[a.] 80.2% of original grouped cases correctly classified.

5.4.6 Demographic Differences

5.4.6.1 Age and Adoption of Broadband

Table 5.16a illustrates that the adoption of broadband amongst consumers increases with age; however, the subscription rate fell after the 54 years range and only 1% of subscribers were reported at the above 65 years category. The majority of broadband subscribers were between 25 and 54 years. The findings in Table 5.16a suggest that broadband consumers belong to the youthful and middle-aged aged groups; however, the

older age groups consisted of a majority of non-adopters. Pearson's chi-square test (Table 5.16a) confirmed that there was a difference between the ages of the adopters and non-adopters of broadband ($\chi^2(5, N = 357) = 15.016, p = .010$).

TABLE 5.16a
Age as a Determinant of Broadband Adopters and Non-adopters

Age Categories	Non-adopters		Broadband adopters	
	Frequency	Percent	Frequency	Percent
Less than 24	25	16.7	50	24.2
25-34	43	28.7	50	24.2
35-44	28	18.7	49	23.7
45-54	29	18.7	39	18.8
55-64	13	8.7	17	8.2
More than 65	12	8	2	1
Total	150	100	207	100

χ^2Test (N=357)
Age X broadband adoption

	Value	df	*p* (2-sided)
Pearson χ^2	15.016	5	.010

A binary correlation test was also conducted to examine if there was any association between the age of respondents and broadband adoption. Table 5.16b presents the results obtained from this test. The findings suggest that there was a significant negative correlation between the age of respondents and broadband adoption (Table 5.16b).

TABLE 5.16b
Spearman's rho Correlations to Show Association between Age and Broadband Adoption

		Broadband Adoption
Age of Respondents	Correlation Coefficient	-.153(**)
**Correlation is significant at the 0.05 level (1-tailed).	Sig. (1-tailed)	.004
	N	357

5.4.6.2 Gender and Adoption of Broadband

In terms of gender differences, Table 5.17 illustrates that amongst the broadband adopters there are more males (53.6%) compared to the females (46.4%). Contrastingly, within the non-adopters, the females (52.7%) exceeded the males (47.3%). Although the aforementioned numbers suggest gender differences between the adopters and non-adopters, it is not large enough to suggest the occurrence of any significance (Table 5.17).

Table 5.17 illustrates that there were no significant differences between the genders of broadband adopters and non-adopters ($\chi^2(1, N = 355) = 1.382, p = .240$).

TABLE 5.17
Gender as a Determinant of Broadband Adopters and Non-adopters

Gender	Non-adopters		Broadband adopters	
	Frequency	Percent	Frequency	Percent
Male	70	47.3	111	53.6
Female	78	52.7	96	46.4
Total	148	100	207	100

χ^2Test (N=355)
Gender X broadband adoption

	Value	df	*p* (2-sided)
Pearson χ^2	1.382	1	.240

5.4.6.3 Education and Adoption of Broadband

Table 5.18a illustrates the educational attainment of the broadband adopters and non-adopters. The findings suggest that the majority of adopters are educated to an undergraduate degree level (39%) followed by respondents who had postgraduate level (33%) education. 15.5% adopters of broadband had A-level qualifications. A small number of the adopters (5%) had an education level of GCSE followed by GNVQ (7.5%). In comparison to the adopters, the majority of non-adopters were reported to have lower levels of education. The educational qualification of GCSE had the highest percentage of non-adopters; of the 40 respondents who had GCSE level education, 30 were non-adopters (Table 5.18a). The Pearson's chi-square test validated that there was a significant difference between the education levels of the adopters and non-adopters of broadband (χ^2 (4, N = 341) = 24.532, p < .001) (Table 5.18a).

TABLE 5.18a
Education as a Determinant of Broadband Adopters and Non-adopters

Education level	Non-adopters		Broadband adopters	
	Frequency	Percent	Frequency	Percent
GCSE	30	21.3	10	5
GNVQ/DIPLOMA	15	10.6	15	7.5
A LEVEL	22	15.6	31	15.5
UG	40	28.4	78	39
PG	34	24.1	66	33
Total	141	100	200	100

χ^2Test (N=341)
Education X broadband adoption

	Value	df	*p* (2-sided)
Pearson χ^2	24.532	4	< .001

Also a binary correlation test was conducted to examine if there was any association between the education level of respondents and broadband adoption. Table 5.18b presents the results obtained from this test. The findings suggest that there was a significant positive

correlation between the education level of respondents and broadband adoption (Table 5.18b).

TABLE 5.18b
Spearman's rho Correlations to Show Association between Education and Broadband Adoption

		Broadband Adoption
Education of Respondents	Correlation Coefficient	.208(**)
** Correlation is significant at the 0.01 level (1-tailed).	Sig. (1-tailed)	.000
	N	341

5.4.6.4 Occupation and Adoption of Broadband

Table 5.19 illustrates the occupational category for both the adopters and non-adopters. This suggests that a total of 38 respondents from occupational category 'A' provided responses. Of those 38, 26 respondents in this category were adopters and 12 were non-adopters. Similar trends were observed for occupational category 'B', which consisted of 68 adopters compared to 30 non-adopters. Occupational category 'E' also consisted of more adopters (74) than non-adopters (54). Contrastingly, occupational categories C1, C2 and D had more non-adopters than adopters (Table 5.19). The findings from Pearson's chi-square test also validated that there was a significant difference between the occupational categories of adopters and non-adopters of broadband (χ^2 (5, N = 345) = 17.181, p = .004) (Table 5.19).

TABLE 5.19
Occupation as a Determinant of Broadband Adopters and Non-adopters

Occupation Categories	Non-adopters		Broadband adopters	
	Frequency	Percent	Frequency	Percent
A	12	8.4	26	12.9
B	30	21	68	33.7
C1	38	26.6	30	14.9
C2	4	2.8	3	1.5
D	5	3.5	1	.5
E	54	37.8	74	36.6
Total	143	100	202	100

χ^2 Test (N=345)
Occupation X broadband adoption

	Value	df	*p* (2-sided)
Pearson χ^2	17.181	5	.004

5.4.6.5 Household Annual Income and Adoption of Broadband

The findings illustrated in Table 5.20 suggest that the minimum numbers (9.4%) of adopters belonged to the category with less then a £10 K annual household income. The

second lowest income group, that is £10-19 K, have more non-adopters (26.9%) than adopters (10.4%). However, all the income categories above £10-19 K had more adopters than non-adopters (Table 5.20a). Generally, the adopters exceeded the non-adopters in all the higher income levels. The Pearson's chi-square test confirmed that there was a significant difference between the household annual income category of the adopters and non-adopters of broadband ($\chi^2(7, N = 347) = 28.401, p < 0.001$) (Table 5.20a).

TABLE 5.20a

Household annual income as a Determinant of Broadband Adopters and Non-adopters

Income Categories	Non-adopters		Broadband adopters	
	Frequency	Percent	Frequency	Percent
Less than 10 K	14	9.7	19	9.4
10-19 K	39	26.9	21	10.4
20-29 K	28	19.3	34	16.8
30-39 K	29	20	31	15.3
40-49 K	10	6.9	28	13.9
50-59 K	5	3.4	20	9.9
60-69 K	11	7.6	22	10.9
More than 70 K	9	6.2	27	13.4
Total	145	100	202	100

χ^2 Test (N=347)
Income X broadband adoption

	Value	df	*p* (2-sided)
Pearson χ^2	28.401	7	<.001

A binary correlation test was also conducted to examine if there was an association between household annual income and broadband adoption. The results obtained from this test suggest that there was a significant positive correlation between household annual income of respondents and broadband adoption (Table 5.20b).

TABLE 5.20b

Spearman's rho Correlations to Show Association between Income and Broadband Adoption

		Broadband Adoption
Households Annual Income	Correlation Coefficient	.222(*)
	Sig. (1-tailed)	.000
* Correlation is significant at the 0.01 level (1-tailed).	N	347

5.4.7 Regression Analysis I

A regression analysis was performed with behavioural intention as the dependent variable and relative advantage, utilitarian outcomes, hedonic outcomes, primary influence, facilitating conditions resources, knowledge and self-efficacy as the predictor variables. A total of 358 cases were analysed. From the analysis, a significant model emerged (*F* (7, 358)

= 40.576, $p < 0.001$) (Table 5.22) with the adjusted R square being 0.437 (Table 5.21). The significant variables are shown in Table 5.23 and include FCR (β = .169, $p < .001$), HO (β = .094, $p = .027$), PI (β = .196, $p < .001$), SE (β = .139, $p = .005$) and RA (β = .230, $p < .001$). Knowledge (β = .086, $p = .121$) and utilitarian outcomes (β = .098, $p = .072$) were not considered to be significant predictors in this model.

TABLE 5.21
Regression Analysis I: Model Summary

Model	R	R^2	Adjusted R^2	Std. Error of the Estimate
1	.669[a]	.448	.437	1.10130

[a] Predictors: (Constant), FCR, HO, PI, SE, RA, UO, K

TABLE 5.22
Regression Analysis I: ANOVA [b]

Model		Sum of Squares	df	Mean Square	*F*	*p*
1	Regression	344.487	7	49.212	40.576	.000(a)
	Residual	424.499	350	1.213		

[a] Predictors: (Constant), FCR, HO, PI, SE, RA, UO, K
[b] Dependent Variable: BI

TABLE 5.23
Regression Analysis I: Coefficients [a]

	Unstandardized Coefficients		Standardized Coefficients				Collinearity Statistics	
	B	Std. Error	β	*t*	*p*	Partial Correlations	Tolerance	VIF
(Constant)	-.830	.434		-1.913	.057			
RA	.348	.081	.230	4.299	.000	.224	.549	1.820
UO	.132	.073	.098	1.807	.072	.096	.537	1.861
HO	.091	.041	.094	2.216	.027	.118	.880	1.136
PI	.197	.045	.196	4.395	.000	.229	.789	1.267
K	.099	.064	.086	1.553	.121	.083	.511	1.957
SE	.174	.061	.139	2.837	.005	.150	.655	1.527
FCR	.179	.049	.169	3.635	.000	.191	.731	1.368

[a] Dependent Variable: BI

5.4.7.1 Regression Analysis II: After Removing Knowledge Constructs from Predictors

Knowledge and utilitarian outcomes were not significant predictors in the model obtained from the regression analysis whose results are presented above (Table 5.23). The *p* value of the utilitarian outcomes construct was close to the significance level; however, for the knowledge construct it was not. Therefore, it was decided to undertake another regression analysis cycle keeping the other settings as above but removing knowledge from the predictors list.

TABLE 5.24
Regression Analysis II: Model Summary

Model	R	R^2	Adjusted R^2	Std. Error of the Estimate
1	.666[(a)]	.444	.435	1.10351

[a.] Predictors: (Constant), FCR, HO, PI, SE, RA, UO

The regression analysis was performed with behavioural intention as the dependent variable and relative advantage, utilitarian outcomes, hedonic outcomes, primary influence, facilitating conditions resources and self-efficacy as the predictor variables. This time the total number of predictor variables included in the analysis was six, which was one less than before as knowledge was eliminated from the list. A total of 358 cases were analysed.

TABLE 5.25
Regression Analysis II: ANOVA [(b)]

Model		Sum of Squares	df	Mean Square	*F*	*p*
1	Regression	341.563	6	56.927	46.749	.000(a)
	Residual	427.423	351	1.218		

[a.] Predictors: (Constant), FCR, HO, PI, SE, RA, UO
[b.] Dependent Variable: BI

From the analysis, a significant model emerged (F (6, 358) = 46.749, $p < .001$) (Table 5.25). The adjusted R square was 0.435 (Table 5.24). This time all six including the utilitarian outcomes predictor variables included in the second round of analysis were found to be significant (shown in Table 5.26). These include FCR (β = .169, $p < .001$), HO (β = .100, $p = .018$), PI (β = .195, $p < .001$), SE (β = .165, $p < .001$), RA (β = .255, $p < .001$) and utilitarian outcomes (β = .113, $p = .035$).

TABLE 5.26
Regression Analysis II: Coefficients [(a)]

	Unstandardized Coefficients		Standardized Coefficients			Partial Correlations	Collinearity Statistics	
	B	Std. Error	β	*t*	*p*		Tolerance	VIF
(Constant)	-.904	.432		-2.093	.037			
RA	.384	.077	.255	4.962	.000	.256	.601	1.664
PI	.196	.045	.195	4.362	.000	.227	.789	1.267
FCR	.191	.049	.180	3.916	.000	.205	.749	1.335
SE	.206	.058	.165	3.582	.000	.188	.742	1.347
UO	.153	.072	.113	2.116	.035	.112	.555	1.801
HO	.097	.041	.100	2.382	.018	.126	.890	1.124

[a.] Dependent Variable: BI

As illustrated in Table 5.26, the constructs are arranged according to their size of β values in decreasing order. The size of β suggests that relative advantage has the largest impact in the explanation of variations of BI. This is followed by the primary influence construct and then facilitating conditions resources. This suggests that the first three

constructs that have the largest impact in explaining variance of BI belong to all three categories (i.e. attitudinal, normative and control constructs). The self-efficacy construct from the control category contributed the fourth largest variance of BI. The remaining two constructs (e.g. UO and HO) were from attitudinal category.

When performing a regression analysis, an important cause of concern is the existence of multicollinearity amongst the independent variables such as RA, PI, FCR, SE, UO and HO. It is likely to exist when the independent variables included in the analysis are not truly independent and measure redundant information (Myers, 1990).

The existence of multicollinearity negatively affects the predictive ability of the regression model (Myers, 1990) and causes problems when attempting to draw inferences about the relative contribution of each predictor variable to the success of a model (Brace *et al,* 2003). Therefore, it is important to examine whether the problem of multicollinearity exists in this research.

SPSS provides two options to estimate the tolerance and variance inflation factor (VIF) to trace if data suffers with the problem of multicollinearity (Brace *et al*, 2003; Myers, 1990). According to Myers (1990), if the VIF value for any constructs surpasses 10, then there is a possibility of multicollinearity amongst constructs. If detected, in order to overcome this problem, a variable with a VIF value more than 10 needs to be deleted (Myers, 1990).

An alternative to this approach is an estimation of the tolerance value. The tolerance values are a measure of the correlation between the predictor variables varies between 0 and 1. The closer to zero the tolerance value is for a variable, the stronger the relationship between this and the other predictor variables. It is a matter of concern if a predictor variable in a model has a tolerance of less than 0.0001 (Brace *et al*, 2003).

In order to detect multicollinearity in this research, both the VIF and tolerance that were estimated are shown in Table 5.26. Values obtained for both VIF and tolerance indicate that there is no problem of multicollinearity in this research. Table 5.26 illustrates that the VIF for this model varied between 1.80 for primary influence constructs and 1.12 for hedonic outcomes constructs, which are much below the recommended level (Brace *et al*, 2003; Myers, 1990; Stevens, 1996).

Table 5.26 also illustrates that all the predictors have a high tolerance of more than 0.55. Therefore, both the VIF and tolerance values suggest that the independent variables (i.e. RA, PI, FCR, SE, UO and HO) included in this study do not suffer from the problem of multicollinearity.

5.4.7.2 Regression Analysis III: Examining the Relationship Between Overall Attitudinal, Normative, Control Constructs and Behavioural intentions

A new scale (i.e. aggregated measure) was created for each attitudinal, normative and control category. The computing average of all the items for each category achieved this. The purpose was to conduct a regression analysis with behavioural intention as the dependent variable and attitudinal, normative and control as the predictor variables. A total of 358 cases were analysed. From the analysis, once again a significant model emerged (F (3, 358) = 86.932, $p < 0.001$) (Table 5.28). The adjusted R square was 0.419 (Table 5.27). All three variables were found to be significant (shown in Table 5.29). These include the attitudinal (O_A_CONS) ($\beta = .282$, $p < .001$), normative (O_N_CONS) ($\beta = .151$, $p = .001$), and control (O_C_CONS) ($\beta = .367$, $p < .001$).

TABLE 5.27
Regression Analysis III: Model Summary

Model	R	R^2	Adjusted R^2	Std. Error of the Estimate
1	.651[a]	.424	.419	1.11839

[a] Predictors: (Constant), O_C_CONS, O_N_CONS, O_A_CONS

TABLE 5.28
Regression Analysis III: ANOVA [b]

Model		Sum of Squares	Df	Mean Square	*F*	*p*
1	Regression	326.204	3	108.735	86.932	.000(a)
	Residual	442.782	354	1.251		

[a] Predictors: (Constant), O_C_CONS, O_N_CONS, O_A_CONS
[b] Dependent Variable: BI

TABLE 5.29
Regression Analysis III: Coefficients [a]

Model	Predictors	Un standardized Coefficients		Standardized Coefficients	*t*	*p*
		B	Std. Error	β		
1	(Constant)	-.230	.388		-.593	.553
	O_A_CONS	.463	.089	.282	5.225	.000
	O_N_CONS	.175	.053	.151	3.318	.001
	O_C_CONS	.525	.071	.367	7.433	.000

[a] Dependent Variable: BI

5.4.7.3 Logistic Regression: Examining the Relationship Between Behavioural Intention, Facilitating Conditions Resources and Broadband Adoption Behaviour

The dependent variable, which measures the broadband adoption behaviour, is categorical in nature and represented by Yes and No. Yes is equal to 1 if the respondent possesses broadband and 0 if they do not have broadband. It was also possible to employ the

Ordinary Least Squares Regression to fit a linear probability model. However, the limitation of the linear probability model is that it may predict probability values beyond the 0.1 range; therefore, the logistic regression model was found most appropriate to estimate the factors which influence broadband adoption behaviour (Greene, 1997; Stynes and Peterson, 1984).

A logistic regression analysis was performed with broadband adoption as the dependent variable and behavioural intention and facilitating conditions resources as the predictor variables. A total of 358 cases were analysed and the full model was considered to be significantly reliable (χ^2 (2, N = 358) = 128.559, p < .001) (Table 5.30). This model accounted for between 30.2% and 40.6% of the variance in broadband adoption (Table 5.31), and 88.4% of the broadband adopters were successfully predicted (Table 5.32). However, only 58.9% of the predictions for the non-adopters were accurate. Overall, 76.0% of the predictions were accurate (Table 5.32).

TABLE 5.30
Logistic Regression: Omnibus Tests of Model Coefficients

		χ^2	df	p
Step 1	**Step**	128.559	2	.000
	Block	128.559	2	.000
	Model	128.559	2	.000

Table 5.33 offers the coefficients, Wald statistics, associated degrees of freedom and probability values for each of the predictor variables. This shows that both the behavioural intention (BI) and facilitating conditions resources (FCR) reliably predicted broadband adoption. The values of the coefficients reveal that each unit increases in BI and the FCR score is associated with an increase in the odds of broadband adoption by a factor of 2.50 and 1.58 respectively (Table 5.33). This means that BI has a larger part in explaining actual adoption than FCR.

TABLE 5.31
Logistic Regression: Model Summary

Step	Cox & Snell R^2	Nagelkerke R^2
1	.302	.406

TABLE 5.32
Logistic Regression: Classification Table

Observed		Predicted		
		Broadband Adopters and Non Adopters		Percentage Correct
		No	Yes	
Broadband Adopters and Non Adopters	No	89	62	58.9
	Yes	24	183	88.4
Overall Percentage				76.0

TABLE 5.33
Logistic Regression: Variables in the Equation

		B	S.E.	Wald	df	*p*	Exp (B)
Step 1[(a)]	BI	.916	.141	42.021	1	.000	2.500
	FCR	.455	.109	17.471	1	.000	1.576
	Constant	-7.529	.954	62.222	1	.000	.001

[a.] Variable(s) entered on step 1: BI, FCR.

5.4.7.4 Regression Analysis IV: Explaining The Relationship Between Service Quality, Secondary Influence and Behavioural Intention to Change Service Provider

A regression analysis was conducted with behavioural intention to change service provider (BISP) as the dependent variable and secondary influence and service quality as predictor variables. A total of 308 cases were analysed. From the analysis, a significant model emerged (F (2, 308) = 13.239, $p < .001$) (Table 5.35). The adjusted R square was 0.074 (Table 5.34). Both the variables were found to be significant (Table 5.36). These include secondary influence (SI) ($\beta = .153$, $p = .006$) and service quality (SQ) ($\beta = -.255$, $p < .001$). Service quality is negatively correlated with the behavioural intention to change service provider, which means that the lower the quality of the service provided, the higher the chance that consumers will change service providers. However, it is important to indicate that since the adjusted R square is very low (Table 5.34), service quality and secondary influence is almost unable to explain the variation of BISP.

TABLE 5.34
Regression Analysis IV: Model Summary

Model	R	R^2	Adjusted R^2	Std. Error of the Estimate
1	.283[(a)]	.080	.074	1.811

[a.] Predictors: (Constant), SI, SQ

TABLE 5.35
Regression Analysis IV: ANOVA [(b)]

Model		Sum of Squares	df	Mean Square	*F*	*p*
1	Regression	86.841	2	43.420	13.239	.000(a)
	Residual	1000.289	305	3.280		

[a.] Predictors: (Constant), SI, SQ
[b.] Dependent Variable: BISP

TABLE 5.36
Regression Analysis IV: Coefficients [(a)]

Model	Predictors	Un standardized Coefficients		Standardized Coefficients	*t*	*p*
		B	Std. Error	β		
1	(Constant)	4.495	.415		10.843	.000
	SQ	-.359	.078	-.255	-4.619	.000
	SI	.166	.060	.153	2.774	.006

[a.] Dependent Variable: BISP

5.5 USAGE OF BROADBAND

5.5.1 Consumers Online Habits: Rate of Internet Use

5.5.1.1 Frequency of Internet Access

Table 5.37a illustrates the difference between broadband and narrowband consumers in terms of the frequency of usage or accessibility to the internet. The results indicate clear differences and suggest that the majority of broadband consumers (74.4%) access or use the internet several times a day in comparison to 52.5% of the narrowband consumers. However, the numbers of broadband consumers decrease as the frequency of Internet access decreases. Only 15% of broadband's consumers in comparison to 20.8% narrowband consumers access the Internet about once a day. Similarly, 10.9% of narrowband consumers access the Internet 3-5 days a week, in comparison to 5.8% of broadband users. Generally, broadband consumers' online habits in terms of their frequency of Internet access differ from narrowband consumers. Broadband consumers belong to the more frequent categories whilst narrowband consumers belong to the less frequent categories (Table 5.37a).

The chi-square test confirmed a significant difference (χ^2 (5, N = 308) = 20.027, p = .001) between narrowband and broadband consumers in terms of the frequency of Internet access (Table 5.37a).

TABLE 5.37a
Frequency of Home Internet Access

Frequency of Internet access	Narrowband		Broadband	
	Frequency	Percent	Frequency	Percent
Several times a day	53	52.5	154	74.4
About once a day	21	20.8	31	15
3-5 days a week	11	10.9	12	5.8
1-2 days a week	10	9.9	8	3.9
Once every few weeks	4	4	2	2
Less often	2	2	0	0
Total	101		207	

χ^2 Test (N=308)
Type of connection X Frequency of Internet Access

	Value	df	p (2-sided)
Pearson χ^2	20.027	5	.001

A binary correlation test was also conducted to examine if there was an association between frequency of Internet access and broadband adoption. The results obtained from this test suggest that there was a significant negative correlation between frequency of Internet access and broadband adoption (Table 5.37b).

TABLE 5.37b
Spearman's rho Correlations to Show Association between Duration of Internet Access and Broadband Adoption

		Broadband Adoption
Frequency of internet access	Correlation Coefficient	.297(**)
**Correlation is significant at the 0.01 level (1-tailed).	Sig. (1-tailed)	.000
	N	354

5.5.1.2 Duration of Internet Use

Table 5.38a illustrates the difference between broadband and narrowband consumers in terms of total time spent on the Internet on a daily basis. Similar to the frequency of internet access, the results indicate that clear differences occur between narrowband and broadband consumers. Generally broadband consumers increase as the number of hours increase. Contrastingly, the number of narrowband consumers increase as the hours decrease. 24% of narrowband consumers spend less than half an hour in contrast to only 9.2% broadband consumers. However, in the 3-4 hours category, broadband consumers (23.2%) exceeded the narrowband consumers (17%). 16.9% of broadband consumers spent more than four hours on the Internet on a daily basis, in comparison to 12% of narrowband users (Table 5.38a).

The chi-square test confirmed a significant difference (χ^2 (5, N = 307) = 16.488, p = .006) between the narrowband and broadband consumers in terms of the total time spent on the Internet on a daily basis (Table 5.38a).

TABLE 5.38a
Duration of Internet Access on a Daily Basis

Duration of Internet access	Narrowband		Broadband	
	Frequency	Percent	Frequency	Percent
<1/2 hour	24	24	19	9.2
1/2-1 hour	12	12	15	8.8
>1-2 hour	29	29	68	32.9
>2-3 hour	6	6	22	10.6
>3-4 hour	17	17	48	23.2
=>4 hour	12	12	35	16.9
Total	100		207	

χ^2Test (N=307)
Type of connection X Duration of Internet Access

	Value	df	p (2-sided)
Pearson χ^2	16.488	5	.006

A binary correlation test was also conducted to examine if there was any association between duration of Internet access and broadband adoption. The results obtained from this test suggest that there was a significant negative correlation between duration of Internet access and broadband adoption (Table 5.38b).

TABLE 5.38b
Spearman's rho Correlations to Show Association between Duration of Internet Access and Broadband Adoption

		Broadband Adoption
Duration of internet access	Correlation Coefficient	.225(**)
**Correlation is significant at the 0.01 level (1-tailed).	Sig. (1-tailed)	.000
	N	353

5.5.2 Variety of Internet Use

The variety of Internet use was computed by counting how many online services the narrowband and broadband consumers use on average. Table 5.39a illustrates that broadband consumers access or use more online services than narrowband consumers. The results indicate that, on average, non-adopters of broadband (i.e. narrowband users) use 17.97 online services, which is significantly lower (t = 4.107, df = 273, p < .001) than the 22.41 online services used on average by broadband adopters (Table 5.40a).

TABLE 5.39a
Variety of Internet Activities Accessed by Broadband and Narrowband Consumers

Type of connection	*N*	*Mean*	*SD*	Std. Error Mean	*t*	df	*p*
Narrowband	89	17.97	8.340	.884	4.107	273	.000
Broadband	186	22.41	8.418	.617			

A binary correlation test was also conducted to examine if there was any association between variety of Internet use and the type of Internet connection. The results obtained from this test suggest that there was a significant positive correlation between variety of Internet use and the type of Internet connection (Table 5.39b).

TABLE 5.39b
Spearman's rho Correlations to Show Association between Variety of Internet Use and Type of Internet Connection

		Type of Internet Connection
Variety of Internet Use	Correlation Coefficient	.256(**)
** Correlation is significant at the 0.01 level (1-tailed).	Sig. (1-tailed)	.000
	N	275

5.5.2.1 Usage of Online Services by Narrowband and Broadband Consumers

A total of 41 online services that belonged to nine different categories (Horrigan, and Rainie, 2002) were included to examine the difference in the usage of the Internet by consumers of narrowband and broadband (Table 5.40). These nine categories (Horrigan, and Rainie, 2002) comprised communications (five online services), information seeking (seven online services), information producing (four online services), downloading (six services),

media streaming (five services), e-commerce (eight services), entertainment activities (four services), social and personal (two services) and e-government (Table 5.40).

For all 41 online services, except for email, broadband consumers outnumbered the narrowband consumers. However, the differences between the narrowband and broadband consumers were significant for only 19 online services. The results indicate that use of none of the five online services that were placed within the communications category significantly differed between both broadband and narrowband consumers (Table 5.40).

Within the information seeking category, of the seven online services, the use of five was found to be significantly different between broadband and narrowband consumers. These included online news (χ^2 (1, N = 276) = 6.77, p = .009), job related research (χ^2 (1, N = 276) = 13.18, p < .001), research for school or training (χ^2 (1, N = 276) = 7.36, p = .007), searches for travel information (χ^2 (1, N = 276) = 5.26, p = .002) and the accessing of online lectures (χ^2 (1, N = 276) = 3.98, p = .046).

Within the information producing category, of the four online services, the use of three was found to be significantly different between broadband and narrowband consumers. These included sharing computer files (χ^2 (1, N = 276) = 7.67, p = .006), store/display/develop photos (χ^2 (1, N = 276) = 7.96, p = .005) and storing files on the Internet (χ^2 (1, N = 276) = 12.53, p < .001) (Table 5.40).

Within the downloading category, of the six online services, the use of three was found to be significantly different between the broadband and narrowband consumers. These included downloading videos (χ^2 (1, N = 276) = 8.77, p = .003), downloading music (χ^2 (1, N = 276) = 7.65, p = .006) and downloading free software (χ^2 (1, N = 276) = 7.51, p = .006) (Table 5.40).

Within the media streaming category, of the four online services, the use of three was found to be significantly different between broadband and narrowband consumers. This included video streaming (χ^2 (1, N = 276) = 8.16, p = .004), listening to music (χ^2 (1, N = 276) = 7.72, p = .005) and watching movies streaming (χ^2 (1, N = 276) = 7.76, p = .005) (Table 5.40).

Within the e-commerce category, of the eight online services, the use of three was found to be significantly different between broadband and narrowband consumers. These included undertaking online banking (χ^2 (1, N = 276) = 7.67, p = .006), online bill playing (χ^2 (1, N = 276) = 4.65, p = .031) and online auctions (χ^2 (1, N = 276) = 5.88, p = .015) (Table 5.40).

TABLE 5.40
Access of online services by broadband and narrowband users (N=276)

	Narrowband		Broadband			χ^2Test		
Category/Online services	Freq.	%	Freq.	%	Total%	χ^2Value	df	Sig.
Communications								
Email	89	100	186	99.5	99.6	.478	1	.489
Instant messaging	46	51.7	116	62	58.7	2.66	1	.103
Online Chat	34	38.2	81	43.3	41.7	.649	1	.421
Video conferencing	16	18	49	26.2	23.6	2.26	1	.132
Voice over Internet (VoIP)	18	20.2	57	30.5	27.2	3.20	1	.073
Information Seeking								
Online News	58	65.2	149	79.7	75	6.77	1	.009
Job related research	60	67.4	161	86.1	80.1	13.18	1	.000
Look for product info	78	87.6	171	91.4	90.2	.988	1	.320
Research for school or training	54	60.7	143	76.5	71.4	7.36	1	.007
Look for travel information	75	84.3	174	93	90.2	5.26	1	.002
Look for medical information	61	68.5	140	74.9	72.8	1.22	1	.269
Online lectures	17	19.1	57	30.5	26.8	3.98	1	.046
Information Producing								
Share computer files	37	41.6	111	59.4	53.6	7.67	1	.006
Create content (e.g. Web pages)	30	33.7	70	37.4	36.2	.362	1	.547
Store/display/develop photos	49	55.1	135	72.2	66.7	7.96	1	.005
Store files on the Internet	26	29.2	97	51.9	44.6	12.53	1	.000
Downloading								
Download games	23	25.8	59	31.6	29.7	.941	1	.332
Download video	20	22.5	76	40.6	34.8	8.77	1	.003
Download pictures	46	51.7	120	64.2	60.1	3.92	1	.048
Download music	38	42.7	113	60.4	54.7	7.65	1	.006
Download movie	23	25.8	69	36.9	33.3	3.31	1	.069
Download free software	50	56.2	136	72.7	67.4	7.51	1	.006
Media Streaming								
Video streaming	24	27	84	44.9	39.1	8.16	1	.004
Listen to music (streaming/MP3)	35	39.3	107	57.2	51.4	7.72	1	.005
Listen to the radio station	45	50.6	112	59.9	56.9	2.14	1	.143
Watch movies streaming)	18	20.2	69	36.9	31.5	7.76	1	.005
E-commerce								
Undertake online banking	43	48.3	123	65.8	60.1	7.67	1	.006
Online bill paying	42	47.2	114	61	56.5	4.65	1	.031
Purchase a product	74	83.1	162	86.1	85.5	.591	1	.442
Purchase a travel service	65	73	148	79.1	77.2	1.27	1	.258
Purchase groceries (household goods)	31	34.8	78	41.7	39.5	1.19	1	.278
Online auctions e.g. eBay	38	42.7	109	58.3	53.3	5.88	1	.015
Buy/sell stocks (online share trading)	14	15.7	41	21.9	19.9	1.450	1	.228
Play lottery	6	6.7	25	13.4	11.2	2.65	1	.103
Entertainment activities								
Obtain information on hobby	54	60.7	144	77.0	71.7	7.93	1	.005
Use it for fun e.g. web surfing	57	64	147	78.6	73.9	6.63	1	.010
Play online game	17	19.1	50	26.7	24.3	1.91	1	.167
View or visit adult content websites	14	15.7	30	16	15.9	.004	1	.947
Social and Personal								
Online dating and matrimonial services	8	9	17	9.1	9.1	.001	1	.987
Collaboration with schoolmates	27	30.3	72	38.5	35.9	1.74	1	.186
E-government								
Accessing e-government services	40	44.9	97	51.9	49.6	1.15	1	.282

Within the entertainment category, of the four online services, the use of two was found to be significantly different between broadband and narrowband consumers. These included obtaining information on hobbies ($\chi^2(1, N=276) = 7.93, p = .005$), and using it for fun ($\chi^2(1, N=276) = 6.63, p = .010$) (Table 5.40).

Similar to the communication category, none of the placed services within the remaining two categories (the first being social and personal and the second being e-government) significantly differed between both broadband and narrowband consumers (Table 5.40).

5.6 IMPACT OF BROADBAND

A cross-sectional analysis was applied to both the narrowband and broadband consumers' usage of time upon various activities (Table 5.41). The results found a clear distinction between the narrowband and broadband consumers in terms of time spent on a total of twenty daily life activities examined within this research. The broadband consumers' behaviour in terms of time spent on various activities is dissimilar to dial-up consumers. For example, the television-watching behaviour of 41% of the broadband consumers decreased in comparison to 36% of the dial-up consumers. Similarly, reading newspapers/books/magazines was more affected by broadband use. Compared to 18% of the dial-up users, 28% of the broadband consumers read fewer newspapers/books/magazines in comparison.

Other activities where consumers spent less time than before include in-store shopping, working in the office and commuting in traffic (Table 5.41). Working in the office had decreased for 25% of the broadband consumers in comparison to 4% of the dial-up consumers. 18% of the broadband consumers spent less time when commuting in traffic then 4% of the narrowband consumers.

There is a minor distinction between the narrowband and broadband consumers in terms of time allocation pattern for activities such as spending time with family and friends, time spent alone, receiving or making phone calls and outdoor entertainment (Table 5.41).

The only activity where the time spent had increased was 'working at home'. The working at home behaviour of 53% of the broadband consumers increased in comparison to 28% of the narrowband ones (Table 5.41).

As illustrated above, differences existed between the broadband and narrowband consumers in terms of their time allocation pattern for all the 20 activities examined in this research. However, the chi-square test confirmed that the narrowband consumers' time allocation patterns differed significantly to the broadband ones only for five activities (Table

5.41). These included shopping in-store (χ^2 (2, N = 278) = 6.7, p = .034), working at home (χ^2 (2, N = 278) = 18.1, p < .001), reading newspapers/books/magazines (χ^2 (2, N = 278) = 7.6, p = .022), working in the office (χ^2 (2, N = 278) = 18.4, p < .001) and commuting in traffic (χ^2 (2, N = 278) = 10.8, p = .005). It was also found that the time allocation patterns for the remaining 15 activities did not differ significantly between the narrowband and broadband users. However, the Internet on its own has begun to influence the daily routine of consumers. This is evident from the findings in Table 5.41, where it was learnt that both the broadband and narrowband consumers influence the time allocation patterns for undertaking daily life activities.

TABLE 5. 41
The Impact of Broadband Internet on Various Daily Life Activities (N=278)

	Type of Internet Connection						χ^2 Tests		
	Narrowband n=92			Broadband n=186					
Daily Life Activities	Nc. (%)	Dec. (%)	Inc. (%)	Nc. (%)	Dec. (%)	Inc. (%)	χ^2	df	Sig.
Watching television/cable/satellite	62	36	2	56	41	3	.92	2	.629
Shopping in stores	77	16	7	63	31	6	6.7	2	**.034**
Working at home	68	5	28	42	5	53	18.1	2	**.000**
Reading e.g. newspapers/books	76	18	5	60	28	12	7.6	2	**.022**
Working in the office	86	4	10	65	25	10	18.4	2	**.000**
Commuting in traffic	95	4	1	80	18	2	10.8	2	**.005**
Spending time with family	77	17	5	81	12	6	1.33	2	.513
Spending time with friends	80	13	7	82	12	6	.137	2	.934
Attending social events	85	8	8	84	10	6	.567	2	.753
Time spent on sport	82	12	7	83	12	4	.636	2	.728
Time spent on hobbies	77	14	9	73	16	11	.731	2	.694
Time spent on sleeping	72	24	4	77	20	3	1.08	2	.581
Time spent alone (doing nothing)	61	25	14	66	25	9	1.69	2	.430
Studying	60	14	26	63	10	26	.954	2	.621
Household work	82	14	4	82	17	1	3.31	2	.191
Receiving/ making phone calls	63	34	3	60	32	9	2.75	2	.258
Doing charity and social works	86	8	7	89	7	4	.692	2	.707
Outdoor recreation (DIY, pet care)	85	8	8	89	8	3	2.66	2	.263
Outdoor entertainment	85	11	4	76	12	12	4.28	2	.117
Visiting or meeting friends or relatives	85	11	4	85	11	4	.063	2	.969

Legend: NI= Not Included, **Inc.**=Increased, **Dec.**= Decreased, **Nc.**=No Change

5.7 SUMMARY AND CONCLUSIONS

This chapter presented the findings obtained from the data analysis of the survey that was conducted to examine consumer adoption and usage and the impact of broadband in UK households. The findings were presented in several sections. The first step was to calculate the response rate of the survey and conduct a response bias test. The estimated response rate was 26.6% and the response bias test suggested that there was no significant difference for the demographic characteristics such as the age and gender of the respondents and non-

respondents. Also a response bias test showed no significant differences between the responses of respondents and non-respondents with regards to key constructs such as relative advantage, utilitarian outcome, hedonic outcome, service quality, secondary influence, knowledge, self-efficacy and facilitating conditions resources.

Following the nonresponse bias test, there was a discussion of the validation and findings obtained on the adoption of broadband. The section initially presented findings that illustrated the reliability test, construct validity and effect of the question ordering. The reliability test confirmed that the measures are internally consistent, as all the constructs possessed a Cronbach's alpha above 0.70.

The construct validity was established utilising the PCA. The results of the PCA provided evidence of higher KMO values (0.858), a significant probability of Bartlett's test of sphericity (< .001), extraction of components consistent with the number of independent factors in the conceptual model (all the nine factors possessed eigenvalues above 1), factors which all loaded above 0.40 and no cross loading above 0.40. This confirmed that both types of the construct validity (i.e. convergent and discriminant) existed in the survey instrument.

A *t*-test was conducted to confirm if any difference occurred due to the ordering of questionnaire items. The results indicated no significant differences between the responses with or without the ordering of questionnaire items. This further strengthened the existence of the construct validity in the survey instrument.

Findings from the descriptive statistics suggested that all the constructs except the BISP rated strongly (mean above 3.5 at the 1-7 Likert scale). This suggested that the respondents showed strong agreement in factors included in the study for examining the adoption of broadband. There was then an examination of the differences between the adopters and non-adopters of broadband, employing the *t*-test and discriminant analysis techniques. The results from the *t*-test and discriminant analysis suggested that significant differences occur between the responses obtained from the narrowband and broadband consumers with regards to attitudinal, normative and control constructs.

Examination of the demographic differences employing the chi-square test suggest that broadband consumers differ significantly to narrowband consumers in terms of age, education, occupation and income. Finally, the linear and logistic regression analysis provided evidence that the attitudinal, normative and control constructs (independent variable) significantly explain behavioural intentions which, along with the facilitating conditions resources, significantly explain the broadband adoption behaviour.

The findings related to the usage of the Internet suggested that broadband consumers significantly differ to narrowband users in terms of the online habits and variety of Internet

use. When accessing or using 19 online services from an overall total of 41 services, the numbers of broadband consumers were significantly higher than the narrowband ones.

The last section of this chapter examined the effects of broadband usage on a consumer's time allocation pattern on twenty daily life activities. The findings suggest that for all twenty activities, broadband consumers' time allocation pattern differs to that of narrowband consumers; however, the differences were found to be significant only for five activities.

The next chapter (Chapter 6) will discuss the findings in light of the previous work. This chapter will provide a discussion on the validation of the instrument, model refinement, and the usage and impact of broadband.

Chapter 6: Discussion

6.1 INTRODUCTION

The previous chapter presented the findings obtained from a survey conducted to examine adoption, usage and impact of broadband in UK households. The purpose of this chapter is to discuss and reflect upon the findings from a theoretical perspective using those provided in Chapter 2. It also discusses the empirical issues that have been reported from the survey findings in the previous chapter.

This chapter is structured as follows. The next section (6.2) discusses the appropriateness of the response rate of this survey in light of the existing work. Section 6.2 also discusses the non-response bias. Then Section 6.3 discusses the instrument validation process by reflecting upon issues such as content validity, reliability and construct validity. After this, a summary of the hypotheses test is provided and discussed in Section 6.4. Section 6.5 discusses and reflects upon the conceptual model of broadband adoption. The usage of broadband and its effects on a consumer's time allocation pattern on various daily life activities are illustrated in Section 6.6. Finally, the summary and conclusions of the chapter are provided in Section 6.7.

6.2 RESPONSE RATE AND NON-RESPONSE BIAS

A 26.6% response rate was obtained in this research. Cornford and Smithson (1996) suggested that, within IS research, a response rate of 20% is considered to be acceptable and if the response rate is approximately 10% then that means the questionnaire design was poor (Cornford and Smithson, 1996). According to Fowler (2002), the majority of surveys produce response rates between two extreme values that are 5% at the lower end and 95% at the higher end, with response rates above 20% being considered as satisfactory (Fowler, 2002). Considering the above two recommended levels (Cornford and Smithson, 1996; Fowler, 2002), the survey response of this research is considered to be satisfactory and acceptable.

However, despite the response rate, a non-response bias could arise in the findings. Therefore it is essential to conduct a non-response bias test in order to demonstrate whether the non-respondents are similar to the respondents (Fowler, 2002; Karahanna *et al*, 1999). Therefore, in this research a *t*-test was undertaken to determine whether the characteristics of the respondents from the original responses are similar to the non-respondents. The *t*-test was conducted for demographics (i.e. age and gender), Internet access at home, the type of internet connection at home, and all constructs from the attitudinal, normative and control categories. The findings are illustrated in Table 5.1, which suggests that the demographics and all key constructs except the primary influence of the study showed no significant

differences between the respondents and non-respondents. There is a significant difference between the original responses and responses from the non-respondents for the primary influence construct. Since primary influence is the only construct of the 14 variables that was tested for the response bias and was found to be significant, it is possible that the non-respondents were those who more influenced by primary influence. This suggests that those non-respondents who returned the completed questionnaire after reminders were similar to the respondents from the original responses. Hence this provides evidence that within the sample used for this research there are minimal chances that it is likely that data has a non-response bias.

Recent studies have demonstrated that a low response rate in survey research does not necessarily produce a non-response bias (Keeter *et al*, 2000; Karahanna *et al*, 1999). Keeter *et al*'s (2000) study compared two telephone surveys, in which the first one obtained a 36% response and the second had a 60% response rate. This study reported that both the surveys with a different response rate provided similar results with minor statistically significant differences (Fowler, 2002; Keeter *et al*, 2000). In a study that employed the postal questionnaire as a data collection tool, it was found that there were no significant differences between the responses of respondents and non-respondents for both the demographic variables and key constructs (Karahanna *et al*, 1999). Since this research reported similar findings as the previous two studies, it can be said that it is less likely that these findings are affected by a non-response bias.

6.3 INSTRUMENT VALIDATION

To establish and demonstrate rigour in the findings of positivist research, validity should be undertaken both prior to and after final data collection (Straub *et al*, 2004). The validation process suggested for application to the cases is one where research either utilises previously validated instruments or creates new instruments (Straub *et al*, 2004, pp 412). Although application of validation is recommended in both the aforementioned situations, it is essential in the latter case where a study employs newly created instruments for data collection (Straub et al, 2004, pp 414). Since this study created a new research instrument for examining broadband adoption, usage and impact, the utmost care was taken to validate a newly created instrument. The process of development and validation of the instrument is already described in chapters 3, 4 and 5. This section provides an overall picture of the validation process and also briefly discusses if the undertaken validity measures and their outcomes are on a par with the recommendations made in IS research.

The recommended validities include content validity, construct validity, reliability, manipulation validity and the common method bias (Straub *et al*, 2004). Amongst the

aforementioned validities, this research examined all the suggestions except for manipulation validity. Manipulation validity that forms an essential component of experimental research was not employed in this research, as it was suggested to be inappropriate in the context of survey research (Straub *et al*, 2004). Figure 6.1 depicts the overall process of creating and validating a new research instrument. The justification for undertaking each stage is provided in the previous chapters (chapters 4 and 5) and the purpose is briefly illustrated in Figure 6.1.

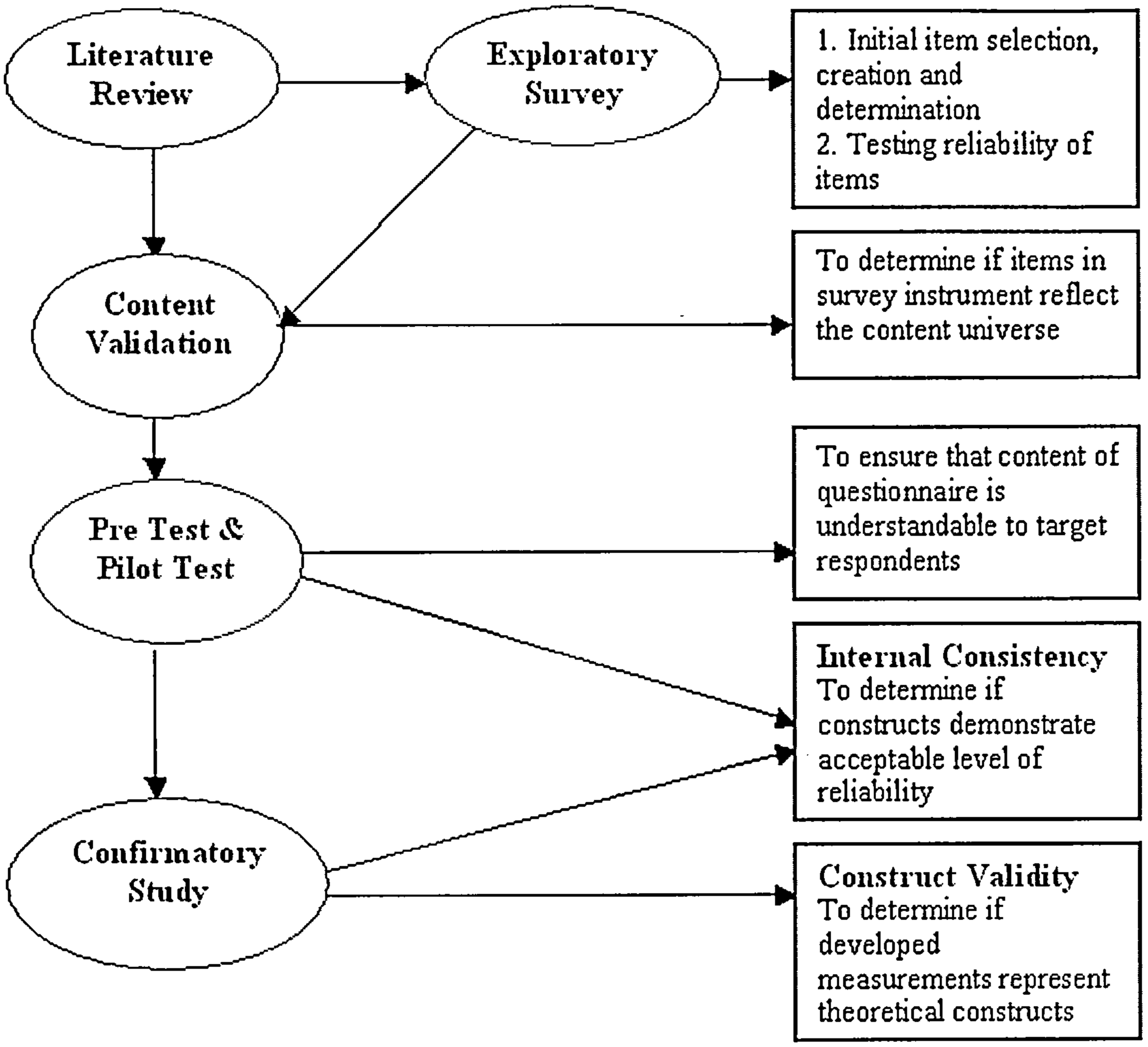

Figure 6.1: Development and Validation Process of Research Instrument

The stages involved in the validation process comprised an exploratory survey, content validation, pre and pilot tests and finally the confirmatory study. Validities that are exercised in this research included content validity, reliability and construct validity (Figure 6.1 and Table 6.1). The previous study on broadband adoption in the South Korean perspectives, although it employed post data collection validity measures such as reliability and construct validity, lacked the application of validity prior to data collection such as content validity. In order to create a reliable survey instrument and confidence in the research findings, this study employed both pre (i.e. content validity) and post data collection

validities (i.e. reliability and construct validity) that are recommended in IS research (Straub *et al*, 2004).

TABLE 6.1
Summary of Instrument Validation Process (Source: Adapted from Straub *et al*, 2004)

Validity Component	Type	Technique Suggested	Heuristics	Technique Applied / Remarks
Content	Highly Recommended	Literature review; expert panels or judges; content validity ratios [Lawshe, 1975]; Q-sorting	Items only included if Content Validity Ratios (CVR)=> 0.5	**Content Validity Ratio (CVR)** 12 Experts rated items; Items that possess CVR <0.50 were dropped [Lawshe, 1975] This suggest that content validity exist in final instrument
Construct				
1. Discriminant Validity	Mandatory	MTMM; PCA; CFA; PLS AVE; Q-sorting	Latent Root Criterion (eigenvalue) of or above 1, Loadings of at least .40 (although some references suggest a higher cutoff); no crossloading of items above .40. Items that do not load properly may be dropped from the instrument [Churchill, 1979].	**Principal Component Analysis (PCA)** 1. Latent Root Criterion (eigenvalue) of 1 2. All items loaded above .40; 3. No crossloading of items above .40. This confirms existence of discriminant validity in final instrument.
2. Convergent Validity	Mandatory	MTMM; PCA; CFA; Q-sorting	Eigenvalues of 1; loadings of at least .40; items load on posited constructs; items that do not load properly are dropped.	**Principal Component Analysis (PCA)** 1. Eigenvalues of 1 2. All loadings >.40 3. All items loaded on posited constructs; 4. No items needed to be dropped due to crossloading This confirms existence of convergent validity in final instrument.
3. Methods bias	Highly Recommended	MTMM, CFA through LISREL	Collect data at more than one period; collect data using more than one method; separate data collection of IVs from DVs	*t* -Test *p* value for all constructs found to be non significant that suggested there was no bias due to items ordering in questionnaire
Reliability Internal consistency	Mandatory	Cronbach's α; correlations; SEM reliability coefficients	Cronbach's α should be above .60 for exploratory, .70 for confirmatory; in PLS, should be above .70; in LISREL, EQS, and AMOS, should also be above .70.	**Cronbach's α** Cronbach's α for all constructs found above .79 which suggest that internal consistency exist in instrument

Table 6.1 compares the validities that are undertaken in this research with the recommended standard in IS research. The first validity that was applied in this research was content validity, which utilised a quantitative approach (Lawshe, 1975) that is recommended by Straub *et al* (2004). Since content validity was not applied in any of the previous studies on broadband adoption and diffusion, it was not possible to compare this research's process and findings. Lawshe (1975) suggested that constructs that should be included in a study are those that account for a content validity ratio (CVR) of more than 0.5 on a 0 to 1 scale. The

findings presented in Table 4.3 illustrate that all the 11 constructs had a CVR value above 0.5; it can therefore be said that the instrument possessed an appropriate level of content validity. This means that the items in this instrument reflect the content universe to which the instrument of this research will be generalised (Straub *et al*, 2004).

Table 6.1 further illustrates that this research also undertaken construct validity and reliability test. Construct validity was performed utilising PCA. Oh *et al's* (2003) study also employed the PCA to confirm construct validity in a previous broadband adoption study. The standard recommendation (Straub *et al*, 2004) suggested that items should not be cross loaded over 0.40, but Oh *et al's* (2003) study suppressed the value below 0.50. Therefore, in this study it was not possible to consider whether any items cross loaded on any other constructs, and so it created a sense of doubt as to whether the construct validity existed in Oh *et al's* (2003) study. This study did not suppress values and Table 6.1 clearly demonstrates that this study meets the standard criteria (Straub *et al*, 2004) of all types of validities, namely convergent validity, discriminant validity and method bias (Table 6.1). This implies that the validated instrument provides an effective measure of the theoretical constructs included in the conceptual model.

Finally, the internal consistency of measures was assessed utilising a reliability test (i.e. Cronbach's α). Straub *et al* (2004) suggested that, for a confirmatory study, reliability should be equal to or above 0.70 (Table 6.1). The reliability values reported in Oh *et al's* (2003) study varies between 0.70 and 0.89 for various constructs. Reliability or the Cronbach's α value of various constructs in this research varies between 0.79 and 0.91, which means that all the constructs possessed reliability values above the minimum recommended level (Table 5.3). This suggests that measures of this study demonstrate an appropriate level of internal consistency.

6.4 RESEARCH HYPOTHESES

Although the explanation and discussion on each hypothesis included in this study are provided in the following sections, this section simply summarises the numbers of hypotheses proposed in Chapter 2 and states whether they are supported by the data or not. Table 6.2 illustrates that a total of 14 research hypotheses were tested to examine if the independent variables significantly explained the dependent variables. Of the 14 research hypotheses, only one (*H11*) was not supported by the data. The fact that the remaining 13 research hypotheses were supported by the data means that all but one independent variable significantly explained the intention to adopt broadband. Further discussions on the aforementioned 14 research hypotheses are provided in Section 6.5 (from subsections 6.5.1 to 6.5.3). In order to examine the demographic differences between the broadband and

narrowband consumers, a total of five research hypotheses were tested. The aforementioned five research hypotheses related to the differences between the broadband and narrowband consumers were supported by the data (Table 6.2) and further discussions are provided in Section 6.5.

TABLE 6.2
Summary of Research Hypotheses

HN	Research Hypotheses	Results
H1	Overall attitudinal factors will have a positive influence on the behavioural intention to adopt broadband	Supported
H2	Relative advantage will have a positive influence on behavioural intention	Supported
H3	Utilitarian outcomes will have a positive influence on behavioural intention.	Supported
H4	Hedonic outcomes will have a positive influence on behavioural intention.	Supported
H5	Service quality will have a negative influence on the behavioural intention when changing from a current service provider.	Supported
H6	Overall the normative factors will have a positive influence on the behavioural intention when adopting broadband.	Supported
H7	Primary influences will have a positive influence on the perceived behavioural intention to adopt broadband.	Supported
H8	Secondary influences will have positive influence on perceived behavioural intention to change current service providers.	Supported
H9	The overall control factors will have a positive influence on the behavioural intention to adopt broadband.	Supported
H10a	Facilitating conditions resources will have a positive influence on the behavioural intention to adopt broadband.	Supported
H10b	Facilitating conditions resources will have a positive influence on the adoption of broadband.	Supported
H11	Knowledge will have a positive influence on the behavioural intention to adopt broadband.	**Not Supported**
H12	Self-efficacy will have a positive influence on the behavioural intention to adopt broadband.	Supported
H13	Behavioural intention and facilitating conditions resources will have an influence on the adoption of broadband.	Supported
H14	There will be a difference between the adopters and non-adopters of the various age groups.	Supported
H15	The adopters of broadband will be more from male than female gender.	**Not Supported**
H16	There will be a difference between the adopters and non-adopters of broadband in different levels of education.	Supported
H17	There will be a difference between the adopters and non-adopters of different levels of household annual income.	Supported
H18	There will be a difference between the adopters and non-adopters of different types of occupation.	Supported
H19a	The adopters of broadband will spend more time online than non-adopters.	Supported
H19b	The adopters of broadband will access the Internet more frequently than non-adopters	Supported
H19c	The adopters of broadband will access a higher number of online activities than the non-adopters.	Supported

To examine the usage related differences between broadband adopters and non-adopters, three research hypotheses (*H19a, H19b, H19c*) were tested and all the data supported all the three hypotheses (Table 6.2). Further discussions on the aforementioned three usage related research hypotheses are provided in Section 6.6.

6.5 BROADBAND ADOPTION

6.5.1 Attitudinal Constructs

As discussed in Chapter 2, if the attitude of individuals towards the technology adoption behaviour is positive then they are likely to form an intention to perform the behaviour (Ajzen, 1985; 1991; Fishbein and Ajzen, 1975; Tan and Teo, 2000; Taylor and Todd, 1995). Following this idea, it was assumed that if the perception of the respondents regarding the attitudinal factor is positive, then it is more likely that it will have a positive influence on the behavioural intention. This theoretical assumption is confirmed by the findings obtained in this research which suggest that the overall attitudinal factors have a significant positive influence on the behavioural intention to adopt broadband (Figure 6.2b).

Following the theoretical basis presented in Chapter 2, Section 2.4 (Taylor and Todd, 1995; Venkatesh and Brown, 2001), this research decomposed attitude into four dimensions: hedonic outcomes, utilitarian outcomes (Venkatesh and Brown, 2001), relative advantage (Rogers, 1995) and service quality. Three constructs, namely relative advantage, utilitarian outcomes, and hedonic outcomes, were expected to provide measures of attitude towards the behaviour of broadband adoption in the UK household. The fourth construct, service quality, was expected to predict if the adopters are contracted or obligated to the same broadband provider. Alternatively, if the adopters were not satisfied with the obtained service, they will switch to another provider. The outcomes obtained from this study about the attitudinal factors are discussed below in detail.

6.5.1.1 Relative Advantage

As discussed in Chapter 2, several previous empirical studies have found that perceived relative advantage is an important factor for determining the adoption of an innovation (Tan and Teo, 2000; Taylor and Todd, 1995; Tornatzky and Klein, 1982). In comparison to narrowband, broadband offers faster, un-metered, always-on access to the Internet, and provides a number of advantages, convenience and satisfaction to its users. It was expected that individuals who perceive broadband as advantageous would also be likely to adopt the technology. The findings obtained in this study confirmed that relative advantage has a significant positive influence on the behavioural intention to adopt broadband (Figure 6.2a, Tables 5.23 and 6.2). This study also confirmed that the non-adopters' (i.e. narrowband consumers) score for perceived relative advantage of having broadband is significantly lower than the adopters of broadband (Table 5.10). This is in line with the diffusion theory and previous work on technology adoption and diffusion (Moore and Benbasat, 1991).

6.5.1.2 Utilitarian Outcomes

As defined in Chapter 2, utilitarian outcomes referred to the extent to which using a technology enhances the effectiveness of household activities such as budgeting, homework and office work (Venkatesh and Brown, 2001). This construct was proposed and validated to examine the adoption of technology (i.e. PC) in a household setting (Venkatesh and Brown, 2001). Theoretically, it has been argued that broadband can offer a more flexible lifestyle (BSG, 2004). For instance, many people subscribe to broadband in order to work at home instead of travelling to the office; broadband can assist the children with their homework, and many more household activities can be performed conveniently using the faster access of the Internet offered via broadband. Therefore, it is expected that the greater the perception of the usefulness of broadband for work or household related activities, the more likely it is that broadband technology will be adopted in the home. The findings obtained from this study are consistent with the above assumption. The findings of this study confirmed that the perceived utilitarian outcomes construct has a significant positive influence on the behavioural intention to adopt broadband (Figure 6.2a, Tables 5.23 and 6.2). It was also found that non-adopters scored significantly lower than adopters on perceived utilitarian outcomes (Table 5.10).

6.5.1.3 Hedonic Outcomes

Venkatesh and Brown (2001) defined hedonic outcomes as pleasure derived from PC use; for example, for games, fun, and entertainment. Hedonic information systems are described as a self-fulfilling activity and strongly connected to the home and leisure activities, focused on the fun aspect of using information systems, encouraging prolonged rather than productive use (Heijden, 2004). Empirical findings from the Venkatesh and Brown (2001) study established that, when adopting a technology, the role of entertainment (PC games and video games) was important as a factor for consideration on the consumer decision-making process (Venkatesh and Brown, 2001). The entertainment potential of a PC was much more enhanced by the advent of the Internet (Venkatesh and Brown, 2001). The Internet offered the opportunity to play online games, download music and video, chat and send online messages (Venkatesh and Brown, 2001). However, this potential was severely hampered by the slow speed of dial-up Internet (Rose *et al*, 1999). This barrier is being overcome by broadband technology, which offers faster download speeds and streaming capabilities to Internet users, and hence more convenience and compelling environments (Anderson *et al,* 2002; BSG, 2004). Considering the entertainment potential that broadband offers in comparison to narrowband, it was expected that individuals who perceive broadband as a good entertainment medium will also be likely to adopt the technology. The

findings confirm the underlying research hypotheses that states hedonic outcomes will have a significant positive influence on the behavioural intention (Figure 6.2a, Tables 5.23 and 6.2). This is in line with the findings of recent studies (Lee *et al*, 2003, Lee and Choudrie, 2002) that suggested that an important factor that was responsible for broadband adoption in South Korea was the PC bang phenomenon. It also supported Anderson *et al's* (2002) study that argued that broadband users are more likely to use the Internet for fun and entertainment in comparison to narrowband users.

The findings also suggested that the non-adopters scored significantly lower than the adopters on perceived hedonic outcomes (Table 5.10). However an important issue that was observed from the findings was that the agreement of respondents on perceived hedonic outcomes of both broadband and narrowband consumers were much lower than the aforementioned two attitudinal constructs (i.e. relative advantage and utilitarian outcomes) (Table 5.10). A possible reason for that is the recent legal restriction against freeloading of music from the Internet (Anderson, 2000; Bhattacharjee *et al,* 2003; Cowen, 2004; Premkumar, 2003). The restriction is likely to reduce impact on the consumer attitude towards using broadband for entertainment purposes. Freeloading and peer-to-peer online sharing of music is considered similar to software piracy (Bhattacharjee *et al,* 2003) and considered as life threatening to the music industry (Premkumar, 2003).

Since the early stages of high-speed Internet diffusion, digital freeloading of music has become a cause for concern for regulators and lawmakers in the United Kingdom and the rest of Europe (Anderson, 2000). The sensitivity of the piracy issue became evident when the music industry across the Europe, including the UK, sued hundreds of consumers who were engaged in sharing music files on the Internet (Cowen, 2004). A study that examined the relationship between regulations, information technologies and human behaviour found that regulation does affect the human behaviour of file sharing in peer-to-peer applications (Mlcakova and Whiteley, 2004). Therefore, such legal regulation might inhibit consumers to realise the entertainment potential of broadband. This was considered to be a plausible reason for why respondents of this study considered hedonic outcomes as less important.

6.5.1.4 Service Quality

It was discussed in Chapter 2 that only a limited number of studies have included the service quality construct to measure the successful adoption of technology. DeLone and McLean (2003) extended the IS success model (DeLone and McLean, 1992) by integrating a service quality construct. The service quality construct was included to evaluate the fact that an IS department also has a role in facilitating end-user computing via the services that are offered to business personnel wishing to develop their own systems (Rosemann and Vessey,

2005). However, this construct was not employed in the case of PC adoption study in household context (Venkatesh and Brown, 2001). This is because, when purchasing PC, the consumers have only one opportunity to make a choice to purchase or not to purchase. And once a product is sold, the seller is not expected to provide any further after-sales customer support. However, the case of a broadband subscription is different to a PC purchase. That is, the consumers sign an annual contract and during this period, if the provided service is not satisfactory, they can discontinue the broadband subscription.

Alternatively, if consumers have a choice of providers then they might transfer to the competitors. Therefore, it is important to understand whether consumers are satisfied with their current providers and provided services. The findings of this study suggest that service quality has a significant negative influence on the behavioural intention to change the current service provider (Figure 6.2a, Tables 5.23 and 6.2). This means that if the consumer perception is lower for the quality of service obtained from the current service providers, s/he is more likely to switch to new providers. It was also expected that the non-adopters would score significantly lower than the adopters of broadband on service quality, which is confirmed by the findings obtained from *t*-test (Table 5.10).

6.5.2 Normative Constructs

As per the discussion provided in Chapter 2 the subjective norm in its original form in the TPB is employed as a single dimensional construct and is considered directly related to the behavioural intention. This is because a person's behaviour is based on their perception of what others think of what they should do (Tan and Teo, 2000). Following the theoretical arguments in the existing studies, it was expected that the stronger the perceived social influence to adopt broadband, the more likely it is that consumers will develop a stronger intent to subscribe to broadband (Ajzen, 1985; 1991; Fishbein and Ajzen, 1975, Tan and Teo, 2000; Taylor and Todd, 1995; Venkatesh and Brown, 2001). Findings of this study confirmed the research hypothesis, which confirmed that, overall, the normative factors have a positive influence on the behavioural intention to adopt broadband (Figure 6.2b).

In terms of consumer-oriented service, the sources of influence could be the adopter's friends, family and colleagues/peers (Tan and Teo, 2000). Rice *et al* (1990) defined such influence as social pressures where members of a social network affect one another's behaviour. Venkatesh and Brown's (2001) study suggests that social influences are significant determinants of the purchasing behaviour of PCs. Similarly, it was also expected that households with broadband connections are likely to influence their relatives and friends by telling and demonstrating to them the benefits and convenience offered by broadband. Measures that influence adopters can appear in two forms that are termed as primary and

secondary influences (Taylor and Todd, 1995; Venkatesh and Brown, 2001). These two dimensions are separated and defined below. The findings obtained from this study on the contributions of the primary and secondary influence factors in explaining behavioural intention to adopt broadband are discussed in detail below.

6.5.2.1 Primary Influences

A social influence from friends, colleagues, peers and family members that take the form of conversations and messages, and assist in forming perceptions of broadband adoption, is defined as a primary influence (Venkatesh and Brown, 2001). Considering the findings from the previous studies (Taylor and Todd, 1995; Venkatesh and Brown, 2001), it was expected that if broadband adopters are influenced by their social networks with positive messages, they are more likely to have a strong behavioural intention to adopt broadband. The findings of this study confirmed that primary influences have a statistically significant positive influence on the perceived behavioural intention to adopt broadband (Figure 6.2a, Tables 5.26 and 6.2). It was also examined to determine whether the perception of primary influence differs between narrowband and broadband consumers when regarding the influence to adopt broadband. The findings confirmed that non-adopters differed significantly from adopters in terms of primary influences (Table 5.10).

6.5.2.2 Secondary Influences

As discussed in Chapter 2, messages that are disseminated using mass media, such as TV and newspaper advertisements (secondary sources of information) are considered to be secondary influences, which are likely to influence consumer's intentions to adopt or reject the technology in question (Rogers, 1995; Venkatesh and Brown, 2001). In terms of this research, a secondary influence affects those who have already adopted broadband but are not satisfied with the service quality; hence, if the advertisements on TV or in newspapers, which advertise broadband packages that are economical and offer a better quality service, they are more likely to cause the adopters to contract with a new provider. The aforementioned theoretical argument was supported by the findings obtained in this research. The results illustrate that secondary influences have a positive influence on the perceived behavioural intention to change current service providers (Figure 6.2a, Tables 5.26 and 6.2). However, it was found that non-adopters did not score significantly lower than the adopters in terms of secondary influence (Table 5.10).

6.5.3 Control Constructs

Findings from this study provide evidence that the overall control factors have a significant positive influence on the behavioural intention to adopt broadband (Figure 6.2b). The finding is consistent with TPB, which suggests that the presences of constraints can inhibit both the behavioural intention to perform behaviour and the actual behaviour itself (Ajzen, 1985; 1991). The findings of this research and the above theoretical argument are in line with the obtained findings from these studies that illustrated that the higher the perception of an individual's control over their internal and external constraint, the more likely that he/she will adopt the technology in question (Ajzen, 1991; Tan and Teo, 2000). However, if the individual's control over the external and internal constraints is low, then despite having a strong behavioural intention, he/she is less likely to adopt the technology (Ajzen, 1991; 1985).

In order to develop a better understanding, consistent with the DTPB and MATH the current study considered the following three constructs as barriers to the adoption of broadband: high costs (i.e. facilitating conditions resources); the ease/difficulty of PCs, Internet use (i.e. self-efficacy); and the lack of knowledge on broadband's benefits (Mathieson, 1991; Taylor and Todd, 1995; Venkatesh and Brown, 2001). The empirical evidence from this research for the role of the aforementioned three control constructs for explaining the behavioural intention and actual adoption of broadband is provided below.

6.5.3.1 Facilitating Conditions Resources

The South Korean government's vision recognised an affordable monthly cost of broadband for a middle-income household as an important factor that led to the high rates of adoption (Lee and Choudrie, 2002). An exploratory study on broadband adoption in the UK also suggests that a high monthly cost is a major barrier that is inhibiting the adoption of broadband in the household (Dwivedi *et al,* 2003). Therefore, it is expected that if the monthly cost to subscribe broadband is perceived as high, then adoption will be slow. Furthermore, broadband technology is not compatible to the specifications of old PCs and necessitates either an upgrade or the purchase of a new PC. However, PCs are not easily replaceable devices for the medium and lower income households.

Therefore an economic barrier in the form of costs that are incurred when upgrading or purchasing new personal computers inhibits the adoption of broadband in the household. In line with the theoretical basis, these findings suggest that the facilitating conditions resources have a significant positive influence on both the behavioural intentions to adopt and the actual adoption of broadband (Figure 6.2a, Tables 5.26 and 6.2). The findings also

suggest that the non-adopters scored significantly lower than the adopters on the perceived resources to subscribe to broadband (Table 5.10).

6.5.3.2 Self-efficacy

The findings of this study provided evidence that self-efficacy has a positive influence on the behavioural intention to adopt broadband (Figure 6.2a, Tables 5.26 and 6.2). This is because the use of broadband also requires using a PC and the Internet. The ease or difficulty of use and requisite knowledge of a PC and Internet use were expected to have an impact upon broadband adoption. An approach to remove such a barrier can be seen in a country such as South Korea where broadband was successfully deployed. The South Korean government installed a variety of promotion policies such as "The Ten Million Program" which was designed to boost Internet use amongst housewives, the elderly, military personnel, farmers, and excluded social sectors such as low-income families, the disabled and even prisoners (Choudrie and Lee, 2004; Lee *et al,* 2003; Lee and Choudrie, 2002).

This promotion of providing PC and Internet skills in the year 2000 contributed towards the adoption of the Internet. A total of 4.1 million people, including one million housewives, obtained such skills (Choudrie and Lee, 2004; Lee *et al,* 2003; Lee and Choudrie, 2002). This initiative led to the removal of barriers of self-efficacy amongst the household consumers, which then manifested in large-scale broadband adoption in households within a very short period of time.

Although basic skills required for accessing the Internet are similar for both narrowband and broadband consumers, the latter is expected to possess a higher self-efficacy than the earlier one (Oh *et al,* 2003):

> *"There is little difference between the skills needed for using a modem connection over plain old telephone service networks and broadband connection to the internet. However, when an individual uses the broadband internet, he or she can have access to additional information and services such as video on demand, high-quality MP3 digital music, broadcasting services and other multi-media services. An individual may also need different skills and experience in order to use or to take advantage of the broadband internet connection. Time is also required for a user to learn how to set up the system and what he or she can access via the broadband"* Oh *et al* (2003).

The above statement clearly suggests that broadband consumers would have a stronger perception of skills in comparison to the narrowband ones. This study provides empirical evidence that the non-adopters (i.e. narrowband consumers) scored significantly lower than the broadband adopters on the perceived skills (Table 5.10).

6.5.3.3 Knowledge

Rogers (1995) suggested that the level of knowledge about an innovation, its risks and benefits affect the adoption rate. The greater the awareness of the benefits of the innovation amongst the consumers and users, the more likely an innovation gets adopted. Previous research suggests that, in South Korea, the consumers were aware of the potentials of broadband (Choudrie and Lee, 2004; Lee *et al,* 2003; Lee and Choudrie, 2002). The consumers were also aware of the benefits of faster Internet access, which was essential to satisfy their needs. This was considered to be one of the factors that accelerated broadband adoption in South Korea. Therefore, in Chapter 2 it was explained that the adoption of broadband requires a clear message of its usages and benefits amongst the total segments of society (Choudrie and Lee, 2004; Lee *et al,* 2003; Lee and Choudrie, 2002; Rogers, 1995).

Also, if consumers are not aware of the benefits of adopting a particular innovation, then it is expected that they are more likely to reject the decision to make a purchase due to the lack of the perceived needs. However, in contrast to the theoretical reasoning, the empirical findings suggest that the knowledge construct is unlikely to have a large impact on variance of behavioural intention to adopt broadband (Figure 6.2a, Table 5.26). This is in line with the argument that the majority of consumers are already aware of what to do with the Internet as it permeates people's lives and work environments (Oh *et al*, 2003). This may be a possible reason why this construct has not contributed largely towards explaining the variance in behavioural intention of adopting broadband.

6.5.4 Research Model of Broadband Adoption (MBA)

A summary of the research hypotheses test, and also a reflection on the hypotheses in relation to proposed conceptual model, were provided above. This subsection summarises the above discussion and reflects on the performance of the broadband adoption model in comparison to its guiding models and framework.

Figure 6.2a illustrates the validated model of broadband adoption (MBA) that was proposed in Chapter 2 (Figure 2.6). Figure 6.2a depicts the paths from relative advantage, utilitarian outcomes and hedonic outcomes towards the behavioural intention to adopt broadband (BI) being significant. Consistent with the hypothesis, the fourth attitudinal construct (service quality) significantly explained the behavioural intention to change service providers. The path from the overall attitudinal dimension to BI is also significant. As it was hypothesised, paths from the primary influence and overall normative factors to BI are significant. The second normative construct (secondary influences) is significantly related to the behavioural intention to change service providers. Of the three control constructs, two,

namely self-efficacy and facilitating conditions resources, are significantly related to BI. However, the path from the third control construct (i.e. knowledge) to BI is not significant. The overall control factors also significantly explained BI. This means that all three dimensions of the determinants of BI, (i.e. overall attitudinal, normative and control construct), are significantly related to BI. Finally, both BI and the facilitating conditions resources are significant determinants of the actual behaviour of adopting broadband.

It is not possible to compare the predictability of broadband adoption model with Oh *et al*'s (2003) study. This is because the aforementioned two studies have examined different independent and dependent constructs. For example, this study has employed BI and actual behaviour as dependent constructs, but in Oh *et al*'s study the ultimate dependent construct was attitude. However, the predictive power of the broadband adoption model can be compared to guiding models such as TAM, TPB and DTPB. This is because constructs such as BI and behaviour and structure of broadband adoption model are similar to TAM, TPB and DTPB.

TABLE 6.3
Comparison of Intention and Behaviour in Terms of Adjusted R^2

Study	Theory	Adjusted R^2	
		Behavioural Intention	**Behaviour**
Davis *et al* (1989)	TAM	---	0.45
Davis *et al* (1989)	TRA	---	0.32
Davis (1989)	TAM	---	0.51
Taylor and Todd (1995)	DTP	0.57	0.34
Taylor and Todd (1995)	TPB	0.57	0.34
Taylor and Todd (1995)	TAM	0.52	0.34
Karahanna *et al* (1999)	TRA + TAM	0.38	---
Agarwal & Karahanna (2000)	TAM & Cognitive Absorption	0.50	---
Gefen & Straub (2000)	TAM	0.20	---
Brown *et al* (2002)	TAM	0.52	---
Koufaris (2002)	TAM + Flow Theory	0.54	---
Current Study	**TPB + DTPB + MATH**	**0.43**	**0.40**
Recommended level (Straub *et al*, 2004)	**---**	**0.40 or above**	**0.40 or above**

Table 6.3 illustrates the comparison of previous studies for the adjusted R^2 obtained for both behavioural intention and actual behaviour. The comparison clearly demonstrates that the broadband adoption model performed as well as the previous studies. With regards to the behavioural intention value of the adjusted R^2 varied between 0.20 (Gefen and Straub, 2000) and 0.57 (Taylor and Todd, 1995) (Table 6.3), the adjusted R^2 for this study is found to be 0.43, which suggests the appropriate level of explained variance (Tables 5.24 and 6.3). This means that independent variables considered in this study are important for understanding a consumer's behavioural intention to adopt broadband. In terms of behaviour, the adjusted R^2 reported in previous studies varied from 0.32 (Davis *et al*, 1989) to 0.51

(Davis, 1989) (Table 6.3). Since the adjusted R^2 value for this study revealed the variance in behaviour to be 0.40 (Tables 5.31 and 6.3), it falls within the aforementioned acceptable range.

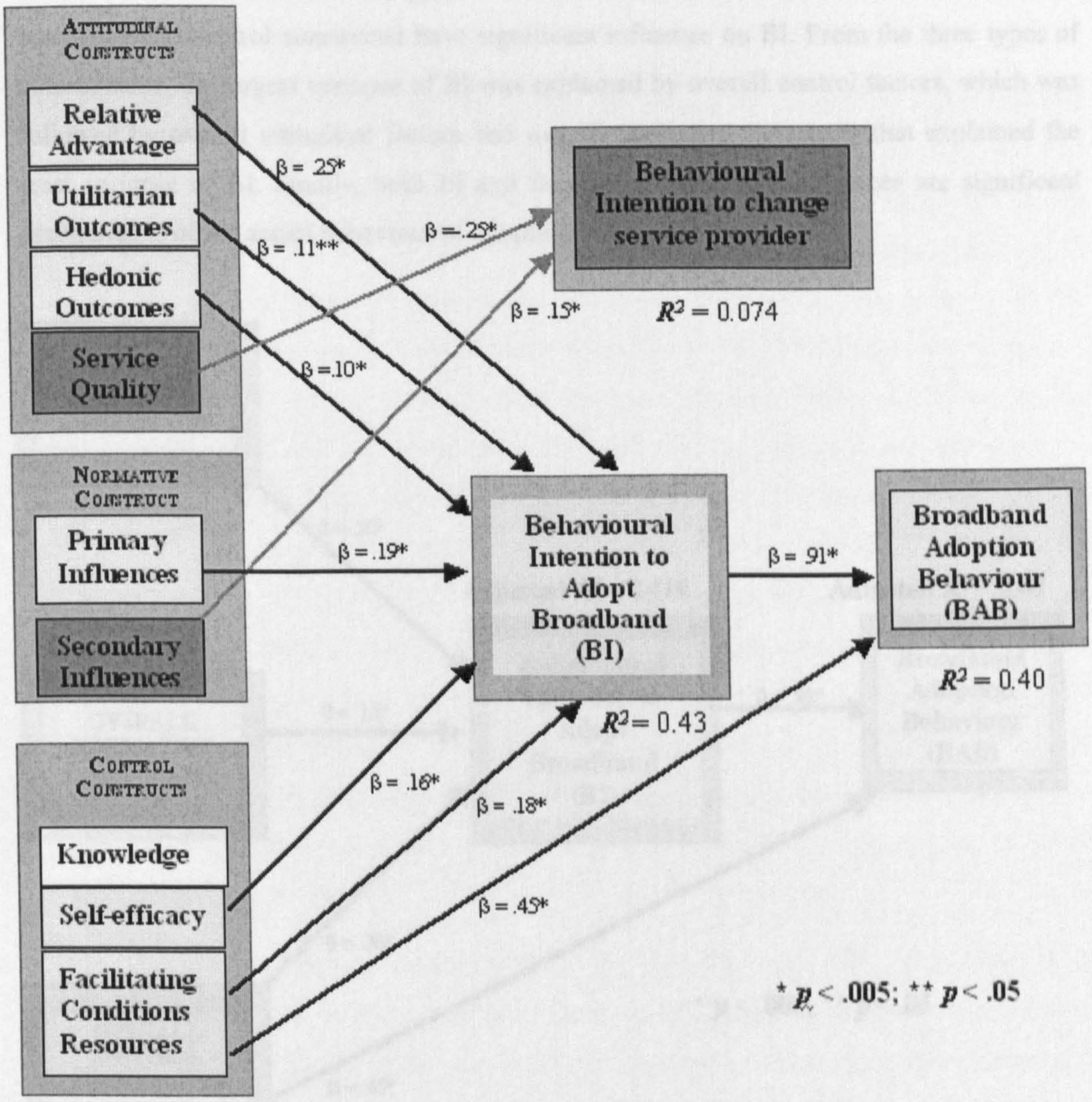

Figure 6.2a: Model of Broadband of Adoption **(MBA)**

Therefore, similar to behavioural intention, behaviour also sufficiently explains the variance in broadband adoption by household consumers. The adjusted R^2 value for both the behavioural intention and behaviour also satisfy the criteria of predictive ability (Straub *et al*, 2004). Straub *et al* (2004) suggested that the predictive ability of a model is satisfactory if the explained variance falls in the 0.40 range or above. Since both the values (BI= 0.43, B= 0.40) are within the range of 0.40, it suggests that the model possesses a satisfactory level of predictive ability. Figure 6.2a illustrates the decomposed validated model of broadband adoption (MBA) that provides detailed depiction of all factors from attitudinal, normative and control categories and their impact on variance of BI.

Figure 6.2b depicts the overall paths from attitudinal, normative and control constructs towards the behavioural intention to adopt broadband. Consistent with the hypotheses, the overall attitudinal, normative and control constructs significantly explained the BI. This means that all three types of the determinants of BI (i.e. the overall attitudinal, normative and control constructs) have significant influence on BI. From the three types of determinants, the largest variance of BI was explained by overall control factors, which was followed by overall attitudinal factors and overall normative constructs that explained the least variance of BI. Finally, both BI and facilitating conditions resources are significant determinants of the actual behaviour of adopting broadband.

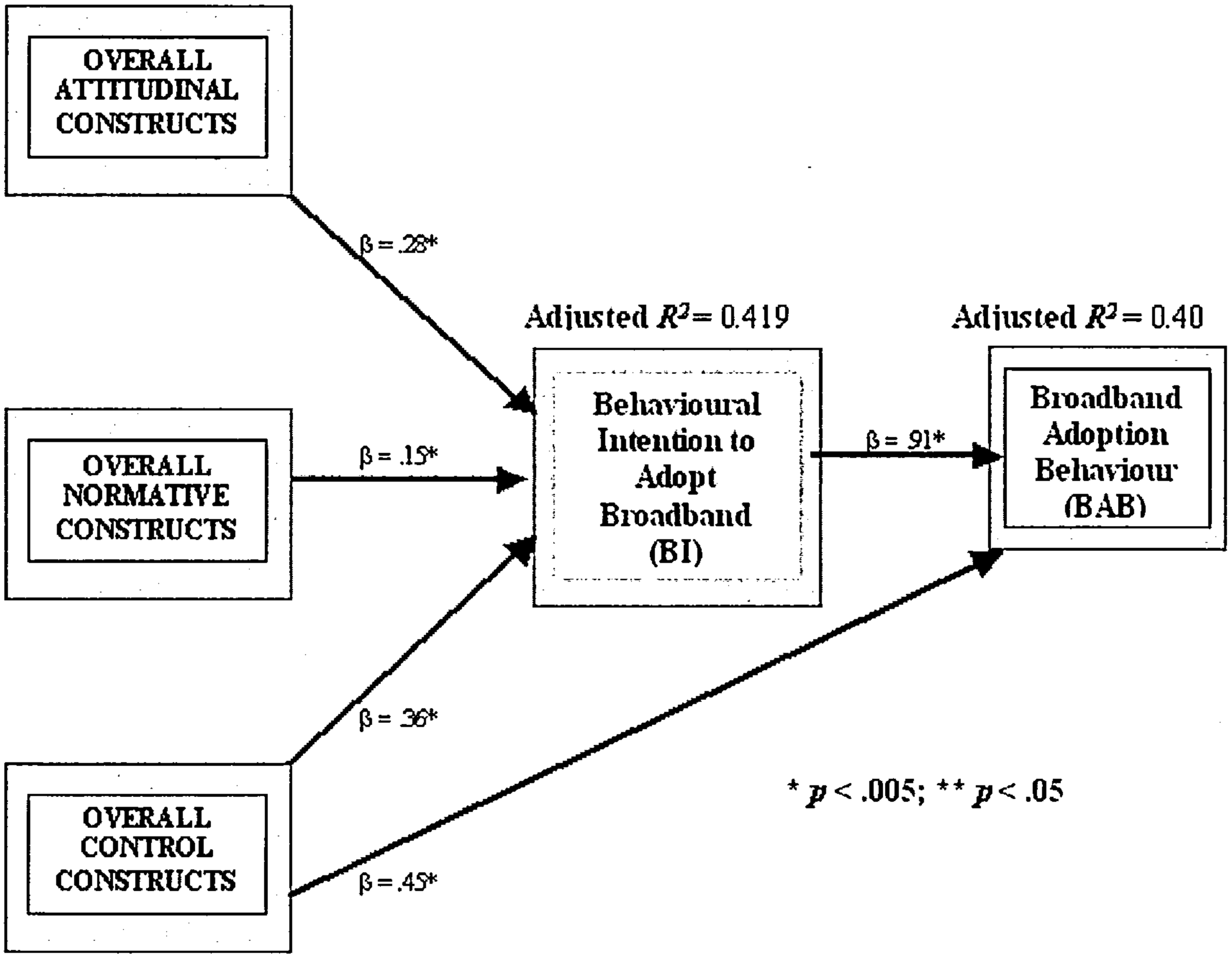

Figure 6.2b: MBA Illustrating Overall Impact of Attitudinal, Normative and Control Factors

6.5.5 Demographics and Adoption of Broadband

All of the five hypotheses except one that were formulated to confirm the role of the socio-economic attributes were supported by the collated data and chi-square test (Table 6.2). Of the five hypotheses, four were significant (at 0.05 level) and 1 was non-significant (Table 6.2). Therefore, the findings from the chi-square test are in line with the assumptions made whilst proposing the research hypotheses. A detailed discussion on the theoretical basis for each hypothesis and expected outcome are provided in Chapter 2 (Section 2.7) and

illustrated in Figure 2.7. Briefly, Figure 6.3 and Table 6.2 illustrate that of the five socio-economic characteristics selected for this study, four, namely age, education, income and occupation, significantly differentiated the broadband adopters from the non-adopters. However, variable gender failed to explain the significant differences between the broadband adopters and non-adopters.

Early predictions of the impact of the age ranges on consumers and broadband adoption correspond to the results of this study. Earlier anecdotal evidence suggested that older aged people are less likely to subscribe to broadband, which was supported by the findings of this research. The above 65 year olds category achieved only two adopters but 12 non-adopters. A possible explanation is that the respondents within this category do not possess the basic skills to operate computers and the majority of them do not have computers at home because they do not consider them necessary for their needs. A majority of the adopters belonged to the age group of 25-54 years. This is because this age group is considered as economically active. The respondents within this age group are mainly entrepreneurs, are in employment and are expected to have a high disposable income (Rice, 1997). Therefore a new innovation is more likely to be adopted and diffused within this segment of the age group (Rogers, 1995). A high number of non-adopters also belong to the age ranges of 25-54 years. A possible explanation of this is the lack of compelling content with a broadband connection. Although the members of this age group are economically active and possess high disposable incomes, they are reluctant to subscribe to broadband as they are of the opinion that broadband does not offer substantial advantages, or an added value in comparison to dial-up.

In the case of gender, proposed hypothesis was not supported by data collected in this study. Although the adopters were more from the male category, whilst the non-adopters were more from female, the differences were not large enough to suggest the occurrence of significance. This may be because within the household, the choice of purchasing or subscribing to a service that requires financial commitment, i.e. paying a monthly subscription fee, requires joint decisions from a majority of the households. Therefore, in household terms, gender may be less clear-cut in explaining the differences between the adopters and non-adopters of broadband. This theoretical claim was also supported by some previous studies that reported decreases in the gender gap in terms of the computer and Internet access (Carveth and Kretchmer, 2002; Mason and Hacker, 1998). A study by Carveth and Kretchmer (2002) also provided similar indications for Internet users in the USA. This study suggested that in the USA there are approximately equal numbers of men and women using the Internet (Carveth and Kretchmer, 2002).

It was expected that a large number of the educated respondents are more likely to adopt broadband. The findings of this are in accordance with the predictions for demographic variables, such as income and education. The findings suggest that the lowest proportion of the adopters possess only a GCSE qualification, which is the lowest listed level of education. Contrastingly, a majority of the adopters possessed an undergraduate and postgraduate level education. This is because broadband is a utility tool for accessing study material and an effective communication medium. Furthermore, highly educated people are most likely to hold higher occupation positions of employment; hence, they may need broadband to undertake office work at home.

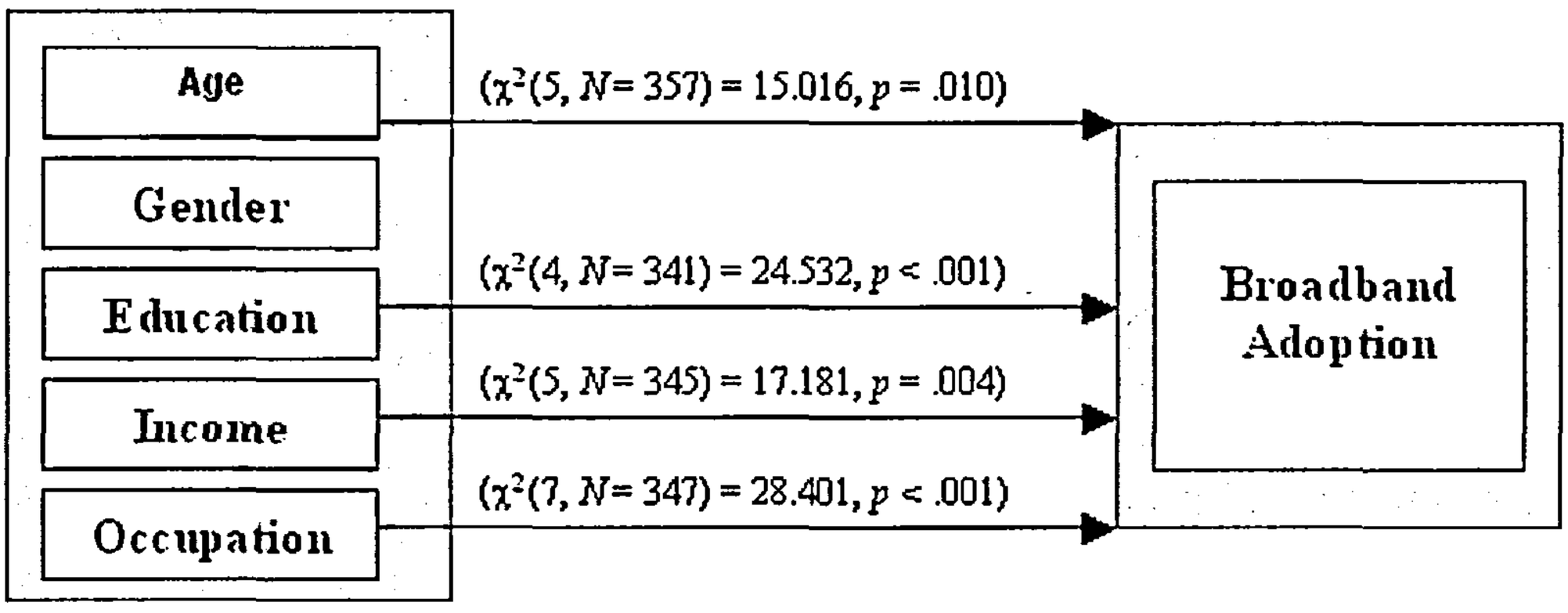

Figure 6.3: Effects of Demographic Variables on Broadband Adoption

The findings suggest that the majority of broadband adopters belong to either of the higher occupational categories, 'A' or 'B'. It was not expected that the respondents from the lowest occupational category i.e. 'E' would have a broadband connection; however, the findings imply that the largest number of broadband adopters belong to this category. This can be attributed to the following reasons: the respondents are in employment that maps to the occupational category 'E'; however other family members may hold higher levels of occupation. Second, as Rice (1997) argued, an anomaly in the occupational category may occur when a respondent who belongs to 'B' obtains redundancy in employment and then immediately drops to the grade 'E 'section. This is despite the fact that the disposable income could have increased due to redundancy payments (Rice, 1997).

Freeman (1995) also discusses the link between unemployment and the diffusion of ICTs. It was found in this research that the unemployed respondents in category 'E' are engaged in re-skilling in order to achieve white-collar jobs (Freeman, 1995). ICTs facilitate the process of re-skilling; therefore, it is more likely that such unemployed respondents become the adopters of broadband than non-adopters. The other reason behind this exception is that occupational segment 'E' consists of a majority of respondents who are studying at various levels; thereby, they require Internet access at home. This is in accordance with Freeman's (1995) view that the most intensive use of technological resources such as

computers comes after school hours (Freeman, 1995). Therefore, students are most likely to adopt new technologies including computers and broadband as a means of facilitating their studies and improving performance.

The findings also revealed that income levels are good predictors of broadband adopters and non-adopters, which is in line with the arguments offered in the theoretical section (Venkatesh *et al*, 2000; Rogers, 1995). Further, it can be learnt that the adopters are fewer from the lower income groups. However, the numbers of adopters increase as the income level rises. Therefore, the numbers of non-adopters are higher in the lower income group but decrease as the income level increases. The numbers of non-adopters is minimal in the highest income category.

6.6 USAGE AND IMPACT OF BROADBAND

6.6.1 Usage of Broadband

As described in Chapter 1, studies related with usage and impact of broadband have been in the form of user surveys, which have examined the broadband users' behaviour in comparison to the narrowband users. Results from initial studies suggested that Internet users behave differently when they have broadband access. Broadband users use the online facilities on a longer basis, utilise more services or applications and apply them more often (Anderson *et al*, 2002; Carriere *et al,* 2000; Dwivedi and Choudrie, 2003a; Horrigan *et al,* 2001). In comparison to the dial-up users, broadband users spend more total time on electronic media applications (Bouvard and Kurtzman, 2001). Although the aforementioned studies examined the usage of broadband, they lack theoretical underpinnings, as they are data led and exploratory in nature. In order to examine and confirm differences with regards to the usage of the Internet between the broadband and narrowband household consumers in the UK, this study employed two theoretical constructs; namely the rate of Internet use and variety of internet use (Shih and Venkatesh, 2004). Figure 6.4 illustrates that both the aforementioned theoretical constructs successfully distinguished broadband consumers from the narrowband ones. In terms of both duration of internet access that is, how long consumers spent online and frequency, that is how many times consumers access the internet on a daily basis the broadband consumers significantly exceeded the narrowband ones (Figure 6.4). This implies that due to the advantages that broadband offers, such as faster access, always-on access, faster download, un-metered access, consumers have been using the Internet in a more intense manner than the narrowband users.

Similar to the rate of use, the advantages of broadband also significantly influenced UK consumers in terms of the variety of Internet use (Figure 6.4). Variety in this context

means the types of online services and/or accessed applications. In this study, a total of 41 online services that belonged to nine different categories were included to examine the variety of Internet use (Table 5.40). As was already described in Chapter 5, these nine categories of online services and applications comprised of communications (five online services), information seeking (seven online services), information producing (four online services), downloading (six services), media streaming (five services), e-commerce (eight services), entertainment activities (four services), social and personal (two services) and e-government (Table 5.40).

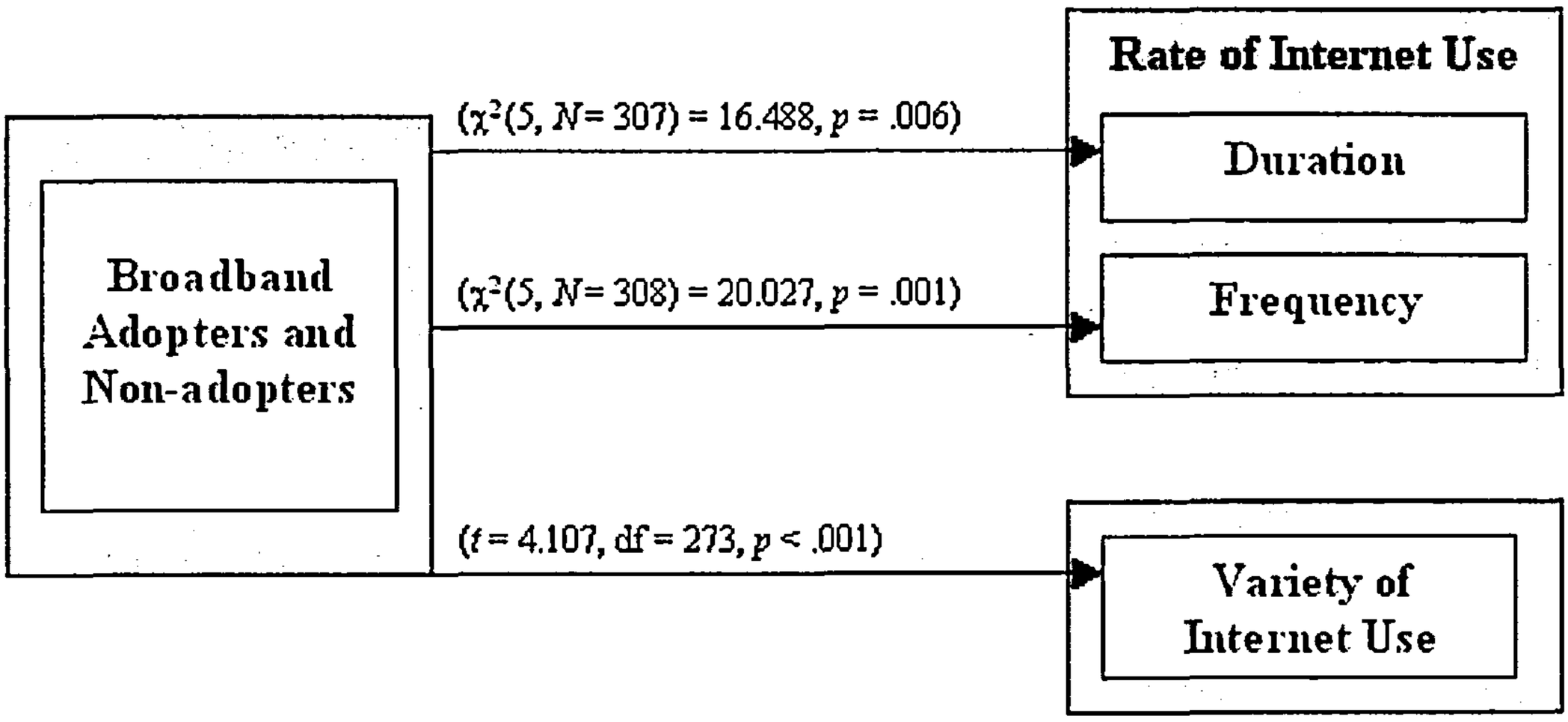

Figure 6.4: Usage of Internet by Broadband Adopters and Non-adopters

This cross-sectional study confirmed that of the 41 activities that belonged to nine different categories, broadband consumers on average used 22.41 activities that significantly exceeded the narrowband users who utilised an average of 17 online activities from home. This is in line with the theoretical argument that the intense usage of technology leads to a higher variety of use (Shih and Venkatesh, 2004). Since broadband consumers used the Internet more intensely; they accessed a significantly larger number (i.e. more variety) of online services and applications than the narrowband ones. The speed of the internet was theoretically considered to be one of the barriers of growth and diffusion of electronic services, including electronic commerce; subsequently, they contributed to the doom of business-to-consumer electronic commerce (Rose *et al*, 1999). This is also supported by the findings of this research, as both the rate and variety of Internet use are less within the narrowband consumers. This means that this type of Internet connection hampers the growth and diffusion of emerging electronic services.

This is supported by the findings presented in Table 5.40 and illustrates that of the 41 activities, 20 online activities were accessed or utilised by significantly more number of the broadband consumers than the narrowband ones. The percentage of the consumers who

accessed the remaining 21 activities were also more from the broadband categories than narrowband ones; however, the differences were not large enough to be significant. The 21 activities can be placed in the following two categories: first, online services such as email, which does not require high speed access; hence, the services are used equally by narrowband and broadband consumers; second, new online services such as video conferencing and VoIP that requires high speed Internet; hence, it is not convenient to access them utilising narrowband, and consequently, few respondents tried such services. Contrastingly, although these services can be accessed utilising broadband, there are many new consumers who may not be aware of them and subsequently they are not being utilised. However, as these emerging services mature, increasing numbers of broadband consumers will access them, but due to bandwidth problems, the narrowband consumers may not be able to do so. This will then lead to significant differences in the percentage of the consumers. Again this indicates that narrowband will slow down the adoption and diffusion of new electronic services.

6.6.2 Impact of Broadband

According to the diffusion literature, new innovations are likely to change the associated behaviours of users, which are termed as perceived consequences or the impact of new innovations (Rogers, 1995; Shih and Venkatesh, 2004; Vitalari *et al*, 1985). Previous studies have demonstrated the impacts of various technologies (e.g. automobiles, telephones, computers and Internet) on a user's daily life (Anderson and Tracey, 2001; Vitalari *et al,* 1985). It was argued in Chapter 2 that since broadband offers an alternative way of work and entertainment and consumes time that traditionally has been spent on other activities, it is likely that broadband will alter the time allocation pattern of a user's daily activities. Therefore, it was also a part of the research aim of this study to investigate the impact of broadband upon changes in the time allocation patterns of a UK household.

The discussion presented in Section 6.6.1 illustrates that the Internet usage behaviour of broadband consumers differs from the narrowband ones; hence, it is likely to have an impact on their daily life. The findings of this study indicate the relationship between technology use and changes in time allocation patterns, which is depicted in Figure 6.5. The significant increase in total time spent online (Figure 6.4) and frequency of Internet access (Figure 6.4) may have triggered an imbalance in the equilibrium in the household systems that existed before the adoption and use of broadband. This imbalance is adjusted due to the changes in time allocation patterns on various daily life activities. The findings provide evidence that all twenty activities are affected by the change in time allocation patterns (Table 5.41). However, the magnitude of the effect was more on the activities

closely related to broadband use. These include an increase in working at home and a decrease in working at an office, thereby decreasing the commuting in traffic. Similarly, watching television and reading were considered to be cognate activities and their usage patterns were closely similar to computer and Internet use (Vitalari *et al.* 1985). Therefore, a substantial number of respondents reported a reduction or increase in time for these activities (Table 5.41). It was also found that there is a significant difference between the narrowband and broadband consumers in terms of changes in time allocation patterns for five activities that comprised a decrease in shopping in store, increases in job related work at home, decreases in working in the office, decreases in commuting in traffic and a reduction in reading newspapers and books (Table 5.41).

Although differences occurred for the remaining 15 activities, they were not large enough to be statistically significant (Table 5.41). This was because the aforementioned five activities have a close relation to high-speed Internet connection use, whereas the other 15 do not. For example, performing job related tasks at home does require high-speed Internet services for efficiency and effectiveness reasons. Similarly, shopping online requires a high-speed Internet service for security and convenience reasons. Therefore, these activities were significantly affected by Internet use, as opposed to the impacts on other activities such as the time spent on sport, which has the least relation to Internet use.

The above discussion supports the theoretical arguments presented in Chapter 2 (Section 2.10). The findings support the model of homeostasis that was utilised to conceptualise the impact of broadband on the time allocation patterns of households. This is similar to the previous study (Vitalari *et al*, 1985) that examined the impact of computer use in the household. Subscribing to the Internet at home may affect a consumer in one of the following three possible ways. First, a lack of change in the existing pattern of behaviour; as is illustrated in Table 5.41, respondents reported no change in the way they acted. This is because the characteristics of household users, such as age, are such that they elicit a low level of interest in the Internet (Vitalari *et al*, 1985).

Second, short term changes in the behaviour for those activities that are reported by a small number of respondents. Such activities are mainly external in nature and include sports, eating and socialising with friends (Vitalari *et al*, 1985). The reason why a technology - in this case, broadband - affects unrelated activities is that, at the initial stage of adoption, users try to experiment and undertake new activities with technology and consequently have less time to spend on other activities. However, such changes slowly disappear as users get acquainted and adjusted to the use of new technology (Vitalari *et al*, 1985). It was also argued that the aforementioned short-term changes might become long-term if the use of the Internet is continued over time (Vitalari *et al*, 1985). For example, online shopping may be

an initial instance of a short-term change in consumer behaviour; however, if there is continuous use of the Internet and a consumer develops trust and routine, then it may become a long-term change in household behaviour. However, it is not possible to demonstrate this within this study as the data is collected at one point of time. This requires a longitudinal approach to examine the impact of new technology, which cannot be achieved within this study due to the time constraints.

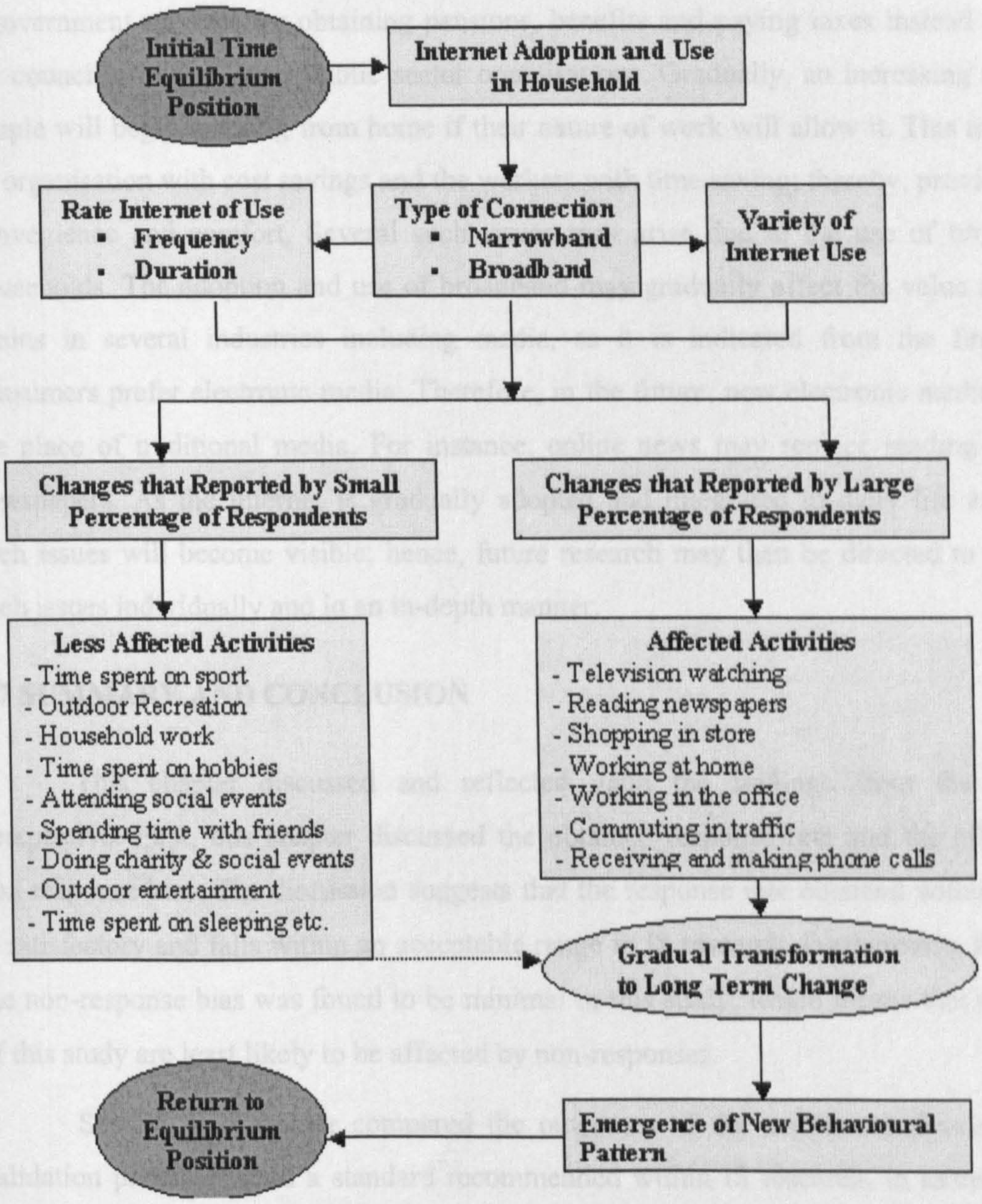

Figure 6.5: Broadband Impact in the Household (An Adaptation of Homeostatic Model of the Effect of Computer Use on Household Time Allocation Patterns, Vitalari *et al*. 1985)

Third, long term changes in the household's behaviour for activities that are reported by a fairly large number of respondents. The affected activities that may bring long-term changes in behaviour are internal in nature and closely associated to the technology in question. Examples include watching television, reading, studying, increases in working at home and decreases in working at an office (Vitalari *et al*, 1985). Activities such as working

at home, working in the office and commuting in traffic are interconnected and are more likely to be affected by being connected using broadband, as it offers the opportunity to undertake office work at home.

The above discussion indicates that household consumers will gradually reflect new behavioural patterns, where consumers will not spend their time visiting stores or shopping malls for the purchase of household commodities. Likewise, consumers may prefer utilising e-government services for obtaining pensions, benefits and paying taxes instead of visiting the council office or other public sector organisations. Gradually, an increasing number of people will begin working from home if their nature of work will allow it. This may benefit an organisation with cost savings and the workers with time saving; thereby, providing better convenience and comfort. Several such issues may arise due to the use of broadband in households. The adoption and use of broadband may gradually affect the value and supply chains in several industries including media, as it is indicated from the findings that consumers prefer electronic media. Therefore, in the future, new electronic media may take the place of traditional media. For instance, online news may replace reading hard copy newspapers. As the Internet is gradually adopted and integrated in daily life and society, such issues will become visible; hence, future research may then be directed to investigate such issues individually and in an in-depth manner.

6.7 SUMMARY AND CONCLUSION

This chapter discussed and reflected upon the findings from the theoretical perspective. First, this chapter discussed the obtained response rate and the effects of the non-response bias. The discussion suggests that the response rate obtained within this study is satisfactory and falls within an acceptable range in IS research. Furthermore, the effect of the non-response bias was found to be minimal in this study, which means that the findings of this study are least likely to be affected by non-responses.

Second, this chapter compared the outcomes of the instrument development and validation processes with a standard recommended within IS research, in terms of content validity, construct validity and reliability. The comparison led to the conclusion that the research instrument possessed an appropriate level of content validity, reliability and construct validity and satisfied the standard criteria within IS research.

Third, this chapter presented the refined and validated conceptual model of broadband adoption. The discussion led to the conclusion that all the constructs, except for knowledge, significantly explained the behavioural intention to adopt broadband; which in turn significantly explained the actual broadband adoption behaviour. A comparison of adjusted R^2 obtained in this study with the previous studies suggest that the performance of

the conceptual model that was used to understand the behavioural intention for the adoption and actual broadband adoption is as good as its guiding models.

Fourth, this chapter also discussed the usage and impact of broadband on household consumers. The discussion revealed that the broadband users differ from narrowband ones with regards to the usage and impact of the Internet. From the discussion, it can be concluded that broadband consumers significantly differ from narrowband ones in terms of duration and the frequency of Internet access on a daily basis. It was also found that the use of broadband significantly affected the time allocation patterns on those activities that closely resemble it or those whose execution is dependent on the faster access of the Internet.

Finally, the next chapter (Chapter 7) will conclude this dissertation. Chapter 7 will initially provide a summary, as well as conclusions drawn from each chapter. Then discussions on research contribution, limitations and further research directions are provided.

Chapter 7: Conclusions

7.1 INTRODUCTION

This chapter provides a conclusion to the results and discussions of the research presented in this thesis. The chapter begins with an overview of this research in Section 7.2. This is followed by the main conclusions drawn from this research in Section 7.3. Then Section 7.4 provides a discussion of the research contributions and implications of this research in terms of the theory, policy and practice. This is followed by the research limitations in Section 7.5. A review of the future research directions in the area of broadband diffusion and adoption is provided in Section 7.6. Finally, the summary of the chapter is provided in Section 7.7.

7.2 RESEARCH OVERVIEW

Chapter 1 defined the research problem and outlined the research motivation for conducting this research. Given large-scale investments in developing and upgrading infrastructures, the slow uptake and decreasing rate of residential broadband adoption in the UK was the motivation for this research. The literature analysis indicated that existing research on broadband had frequently examined this issue from macro level perspectives, such as the geography of the country, density of population, competition amongst Internet Service Providers (ISPs), local loop unbundling, stakeholder analysis and government policies. Although the aforementioned types of studies were helpful to prepare and promote the broadband market, they offered limited implications to the ISPs who are the most important supply side stakeholders and who are directly involved with the household consumers.

However, the analysis of the literature suggested that an examination of broadband adoption, usage and impact from the consumers' perspective has just begun to emerge and is yet to be undertaken. It was also found that initial studies from the broadband consumers' perspective are mainly data driven and exploratory in nature. A recently conducted study (Oh *et al*, 2003) has made initial efforts in investigating the influence of the diffusion of innovation characteristics on attitude building towards the use of broadband in South Korea. However, the contributions of the study were also limited, as it did not examine how various factors including attitude influence the behavioural intentions (BI) and actual adoption of broadband. This study also excluded the issue of broadband usage and impact on consumers and how it differs from narrowband consumers. Since both aforementioned issues, which were excluded from Oh *et al*'s (2003) study, are imperative for understanding broadband adoption, the implications of the study for ISPs and policy makers were limited.

Therefore, this research aimed to identify and determine the consumer level factors that influence broadband adoption and use and, consequently, its impact on UK household consumers. The objectives to achieve the overall aim include: developing a conceptual model; developing and validating a research instrument; then conducting data collection and analysis in order to validate and refine the conceptual model; and finally outlining implications for theory, practice and policy. Chapter 1 also provided brief information on potential research approaches, outlined the research contribution to theory, practice and policy and finally provided an overview of the dissertation.

In order to achieve the first objective of this research, Chapter 2 first reviewed the various technology adoption and diffusion related theories and models including the Diffusion of Innovations, TRA, TPB, DTPB, TAM, MATH and Use Diffusion Models. Since the aforementioned adoption and diffusion theories and models provided this research with a number of underlying constructs or factors, they were considered to be guiding frameworks for current research. Chapter 2 then discussed and justified the reason for selecting factors that were expected to predict the BI to adopt broadband, which ultimately explains the broadband adoption behaviour (BAB). Also the BAB is expected to differentiate between the rate and variety of Internet usage between broadband and narrowband users.

Using selected factors, a conceptual model of broadband adoption was developed. The proposed conceptual model is based on the assumption that the attitudinal, normative and control factors are responsible for influencing BI to adopt broadband, which in turn is expected to predict the BAB. This study also included constructs that investigated whether the broadband users differ from narrowband users with regards to usage and the impact of the Internet. Whilst discussing the aforementioned factors, a number of underlying hypotheses were also proposed that are required to be tested in order to validate and refine the conceptual model. Accomplishment of Chapter 2 led to achieve the first objective of this research, which is "*to develop a conceptual model for examining consumer adoption, usage and impact of broadband*".

Chapter 3 provided an overview of the research approaches utilised within the information systems (IS) field and then selected an appropriate research approach for guiding this research. To validate and understand the conceptual model it was found that a quantitative research approach would be more appropriate than a qualitative one. An overview of the underlying epistemologies was provided in order to decide whether positivism is appropriate as a philosophical foundation for this research. Following this, an overview discussion on various issues related to the available research approaches in the IS field, and a justification for the selection of the survey as a research approach, is provided.

The survey research approach was considered most appropriate when conducting this study. The survey approach facilitates data collection from a wide geographical area (i.e. nationwide) within a limited time and resources (Fowler, 2002). This was required to determine if the selected underlying constructs significantly explained the consumers' decision regarding broadband adoption and subsequent use and impact. Following this, there was a detailed account of the various aspects of the survey approach. It was found that for the purpose of this research it was appropriate to employ UK-Info Disk V11 as a sampling frame, with stratified random sampling as a basis of sample selection and a postal (i.e. mail) questionnaire as a data collection tool. The reasons for the aforementioned selection were also provided in a detailed manner. The issues relating to the data analysis were then discussed in detail and it was concluded that a number of statistical techniques such as factor analysis, *t*-test, ANOVA, χ^2 test, discriminant analysis, binary correlations, linear and logistics regression analysis were appropriate to utilise for data analysis purposes in this research.

Chapter 4 described the development process for a research instrument. The development process was achieved in three stages, which were made up of the exploratory survey, content validity and instrument testing. The exploratory stage included surveying the known existing instruments, choosing appropriate items, creating the required new items and then determining if the selected items were appropriate enough to measure the perceptions of adopters and non-adopters. This stage also examined the reliability of the initial scale. At this stage it was found that although the majority of items either selected from the existing instrument or newly created ones were important enough to describe the behaviour of the adopters and non-adopters, the reliability of the scale was low in most cases. The exploratory stage also helped to identify a new construct that is termed as 'service quality'. The output of this stage of the research was utilised as an input for the content validation stage.

The content validation stage involved the creation of new items for each construct and then validation of their representativeness, utilising a quantitative approach. These new items were created utilising the items obtained from the exploratory stage and also resurveying the literature and selecting the relevant items. In order to achieve the representativeness of the items, several experts working on broadband related issues evaluated the newly created items. This led to the calculation of a content validity ratio that was the basis of the exclusion or inclusion of the items. The outcome of this stage was the inclusion of representative items and the exclusion of non-related items.

The instrument testing stage was sub-divided into two stages, which included the pre and pilot tests. The purpose of the pre-test was to obtain feedback from the respondents on the instrument, in order to improve the wording of items. The purpose of the pilot test was to

confirm the reliability of the items. The findings obtained from the pilot test demonstrated an acceptable level of reliability for all the constructs. The reliability of all the ten scales improved after conducting a content validity and pre-test. This demonstrates the importance of performing a content validation for the increasing reliability of scale and also the representativeness of the items. The final output of the three-stage instrument development process that was undertaken in Chapter 4 is a parsimonious, 40-item instrument, consisting of 11 scales, all with a high level of reliability.

Chapter 5 presented the findings obtained from the data analysis of the conducted survey that examined consumer adoption, usage and impact of broadband in the UK households. The findings were obtained using several steps. The first step was to calculate the survey's response rate and conduct a response bias test. The estimated response rate was 26.6% and the response bias test suggested that there was no significant difference for the demographic characteristics such as the age and gender of the respondents and non-respondents. Also the response bias test showed no significant difference between the responses of the respondents and non-respondents with regards to key constructs such as relative advantage, utilitarian outcomes, hedonic outcomes, service quality, secondary influence, knowledge, self-efficacy and facilitating conditions resources. Responses for one of the construct 'primary influence' were found to be significantly different for the respondents and non-respondents. Since all other constructs and demographics were non-significant, it was concluded that there were minimal chances of a response bias in collected data.

Chapter 5 also presented the findings that illustrate the reliability test, construct validity and effect of ordering of the questionnaire items. The reliability test confirmed that the measures are internally consistent, as all the constructs possessed a Cronbach's alpha above 0.70. Construct validity was established utilising Principal Component Analysis (PCA). Results of the PCA provided evidence of higher KMO values, a significant probability of Bartlett's test of sphericity, extraction of nine components consistent with the number of independent factors in the conceptual model (all nine factors possessed eigenvalues above 1), factors loaded above 0.40 and no cross loading above 0.40. This confirms that both types of the construct validity (i.e. convergent and discriminant) exist in the survey instrument. A *t*-test was conducted to confirm if any difference occurs due to the ordering of the questionnaire's questions. The results indicated that there was no significant difference between the responses with or without the questions being ordered. This further strengthened the existence of the construct validity in the survey instrument.

This was followed by the descriptive statistics for both the items and the scale being provided. The findings suggested that the survey respondents showed strong agreement for

all the constructs except the behavioural intention to change service providers (BISP). Results from the *t*-test and discriminant analysis suggested that there was a significant difference that occurred between the obtained responses from the narrowband and broadband consumers with regards to the attitudinal, normative and control constructs. Examination of the demographic differences that arose by employing the chi-square test suggested that the broadband consumers significantly differed from the narrowband consumers in terms of age, education, occupation and income. Finally, the regression analysis suggested that the attitudinal, normative and control constructs significantly explained the BI that, in turn, significantly explained the BAB, along with the facilitating conditions resources.

The findings related to the usage of the Internet suggested that the broadband consumers significantly differed to the narrowband ones in terms of consumers' online habits and Internet use variations. The numbers of broadband consumers were exceedingly and significantly higher than the narrowband consumers for accessing or using 19 online services from a total of 41 services examined in this research. The last section of Chapter 5 examined the effects of broadband usage on a consumer's time allocation pattern in twenty daily life activities. The findings suggested that, for all twenty activities, the broadband consumers' time allocation pattern differed from the narrowband ones; however, a significant difference was found to be apparent for only five activities.

Chapter 6 discussed and reflected upon the findings from the theoretical perspectives. This chapter first discussed the obtained response rate and effects of the non-response bias. The discussion suggests that the response rate obtained within this study is satisfactory and falls within a range that is acceptable in the IS research. Furthermore, the effects of a non-response bias were found to be minimal in this study, which means that the findings of this study are least likely to be affected due to non-responses. Then the outcomes of the overall instrument development and validation process were also compared to a recommended standard within IS research with regards to content validity, construct validity and reliability. The comparison led to the conclusion that a research instrument possessed an appropriate level of content validity, reliability and construct validity and satisfied the standard criteria within IS research. Accomplishment of chapters 3, 4, 5, along with part of Chapter 6, led to the achievement of the second objective of this research, which was "*to operationalise the constructs included in conceptual model by developing a research instrument and demonstrate their reliability and validity*".

Chapter 6 then presented and discussed the refined and validated conceptual model of broadband adoption. The discussion led to the conclusion that all the constructs except knowledge significantly explained the BI to adopt broadband, which in turn significantly explained BAB. Comparison of the adjusted R^2 obtained in this study compared with

previous studies suggests that the performance of the conceptual model that can be used to understand the BI for the adoption and actual broadband adoption is as good as its guiding models. This chapter then discussed the usage and impacts of broadband on household consumers. The discussion revealed that the findings supported the assumption made in Chapter 2 that broadband users differ from narrowband users with regards to the usage and impact of the Internet. It is possible to conclude from the discussion that broadband consumers differ significantly from the narrowband ones in terms of duration and frequency of Internet access on a daily basis.

It was also found that the use of broadband significantly affected the time allocation patterns on those activities that closely resemble it or those whose execution is dependent on faster access of Internet. Completion of Chapter 5 and Chapter 6 led to achieving the third objective of this research, which was "*to empirically validate and refine the conceptual model that is proposed to examine broadband adoption, usage and impact in UK households*". Accomplishment of these two chapters also led to answering all research questions outlined in Chapter 2 (Section 2.3.1).

7.3 MAIN CONCLUSIONS

The following main conclusions are drawn from this research and are based on underlying research questions proposed in Chapter 2 (Section 3.2.1):

1. All three types of construct, namely overall attitudinal, normative and control constructs significantly explained the BI of consumers when adopting broadband. Amongst the aforementioned three types of construct, overall control construct contributed to the largest variance ($\beta = 0.367$) when explaining BI of broadband consumers. The overall attitudinal constructs contributed to the second largest variance ($\beta = 0.282$), whilst overall normative constructs ($\beta = 0.151$) contributed the least amongst the aforementioned three types of constructs.

2. A total of seven constructs from attitudinal (relative advantage, utilitarian outcomes, hedonic outcomes), normative (primary influence) and control (knowledge, self-efficacy and facilitating conditions resources) categories were expected to be correlated to the BI of consumers when adopting broadband in the UK household. Of the aforementioned seven constructs, six including relative advantage, utilitarian outcomes, hedonic outcomes, primary influence, self-efficacy and facilitating conditions resources significantly correlated to the BI of consumers when adopting broadband in the UK household. The only one that did not was knowledge.

3. In terms of the size of the effect of the six aforementioned constructs that contributed significantly to the behavioural intentions, relative advantage exhibited largest ($\beta = 0.255$) and hedonic outcomes ($\beta = 0.10$) demonstrated the least variance to the BI when adopting broadband in the UK households. Primary influence explained the second largest variance ($\beta = 0.195$), which was followed by facilitating conditions resources ($\beta = 0.180$). The fourth strongest construct was self-efficacy ($\beta = 0.165$) and the fifth one was utilitarian outcomes ($\beta = 0.113$).

4. Both BI and the control construct significantly correlated to the broadband adoption behaviour in the UK households. In terms of relative impact of the two aforementioned constructs that contributed significantly to the BAB, BI had much higher impacts **(Exp (B) = 2.50)** than the control construct **(Exp (B) = 1.57)**.

5. Amongst the five demographic factors that were included in this research except gender, all the other four factors (i.e. age, income, occupation and education) associated with the adoption of broadband in UK households.

6. Although both service quality and secondary influence constructs were significantly correlated to the BI when changing current service provider (BISP), the overall explained variance was low (adjusted R square = 0.074). This meant that both the aforementioned constructs were also not able to explain the variation of BISP.

7. The rate of Internet usage differs for the broadband and narrowband users. Broadband users spend more time and access the Internet more frequently than narrowband ones.

8. Broadband users access significantly more online activities than narrowband users.

9. The use of broadband is associated with the time spent on various daily life activities. However, the magnitude of that association differs according to the nature of the activities. The association was more on activities such as an increase in working at home, a decrease in shopping in a physical store and a decrease in working in the office compared to activities such as spending time with family and friends.

7.4 RESEARCH OFFERINGS AND IMPLICATIONS

This research presents one of the initial efforts towards understanding the adoption and usage behaviour and impact of broadband in UK households. Also this study is one of only a few studies that address the issue of individual adoption and usage of technology in the household that is beyond the boundary of workplace. The following comment illustrates

the importance of conducting a study that examines technology adoption in the household context.

> *"Much work in the area of home computing remains to be done to better understand the adoption of technologies at home given its potential implications for society in general and for the workplace in particular"* (Venkatesh and Brown, 2001).

By employing the quantitative approach, this study is an initial effort that confirms the role of various constructs (such as relative advantage, utilitarian outcomes, hedonic outcomes, primary influence, secondary influence, knowledge, self-efficacy and facilitating conditions resources) for understanding adoption of broadband in household. This study not only initially validated the model of adoption of technology in households (MATH) for examining broadband but also extended it by incorporating constructs such as 'relative advantage', 'service quality' and also the decomposing social influence into two categories, namely, 'primary influence' and 'secondary influence'.

Findings of this study empirically suggest that primary influence plays a key role in the first time adoption decision of broadband in households, whilst secondary influence emphasises a key role of continued subscription with the same service providers. An added strength of this research is that, unlike other related studies on technology adoption, the current work investigated all three components of diffusion comprising adoption, usage and impact. This in turn helped in obtaining an extensive understanding of adoption and usage from the perspective of household consumers. This study brings about several theoretical contributions and implications to practice and policy. These contributions and implications are discussed below.

7.4.1 Offerings to Theory

The first offering of this research towards theory is that it integrates the appropriate information systems (IS) literature in order to enhance the knowledge of technology adoption from the consumer perspectives. That is, initially, this research evaluates the flexibility of various models when studying the technology adoption issues. Second, it assimilates previous research findings to develop a coherent and comprehensive picture of the technology adoption research conducted in the IS field. Third, this research introduces a conceptual model that integrates factors from different technology adoption models so as to study home technology diffusion from a consumer's perspective.

The second offering is to empirically confirm the appropriateness of various constructs and validate the conceptual model in the context of household consumers. Venkatesh and Brown's (2001) study was based on the semi-structured interview method for data collection. The study examined PC adoption within American households. The study

advised researchers to move beyond and employ a survey research approach for validating the conceptual model in order to utilise it for examining technology adoption from a household consumer's perspectives. This is emphasised in the following future research direction:

> *"A study that employs a survey with items/questions measuring the various dimensions/constructs will help achieve methodological triangulation and examine generalisability. Such a quantitative study will also help shed more light on the asymmetry between the belief structure influencing intenders and non intenders"* (Venkatesh and Brown, 2001).

As suggested above, this study employs a survey with items/questions measuring the various constructs such as relative advantage, utilitarian outcomes, hedonic outcomes, primary influence, secondary influence, knowledge, self-efficacy and facilitating conditions resources specifically in the context of broadband adoption; therefore, the approach of this study is similar to that suggested by Venkatesh and Brown (2001). This quantitative study clearly illustrated the asymmetry between the factors influencing the adopters (i.e. broadband consumers) and non-adopters (i.e. narrowband consumers).

The third offering is that this research introduced and validated novel constructs such as 'service quality', 'secondary influence' and 'perceived behavioural intention to change service provider' for investigating the continued adoption of broadband in the household. Since these constructs were not included in any of the guiding frameworks, including TPB, DTPB, MATH and Diffusion of Innovation, there is an offering that contributes towards theory development in the form of a theory extension. These constructs can be utilised to measure the perception of household consumers towards the continued adoption of subscription-based emerging technology and new Internet based services.

The fourth theoretical offering of this research was to confirm the role of socio-economic variables such as age, education, income and occupation when explaining the actual adoption of broadband. This was considered to be one of the important research issues of this study, which is to investigate the socio-economic characteristics in order to determine their effect on the adoption of broadband. This study concludes that the age, education, income and occupation are important variables that distinguish broadband's adopters and non-adopters, but gender does not. Referring to the research question that was posed initially in Chapter 2, it was learnt that there is the occurrence of an unequal or heterogeneous adoption rate or digital divide in various variables, including age, income, occupation and education.

The fifth contribution of this research towards theory is to successfully utilise theoretical constructs such as the rate and variety of Internet use to examine the differences

between the narrowband and broadband consumers. Previous studies that focused upon the usage of broadband in households contained two main limitations. First, the existing studies were data driven and exploratory in nature; therefore, they lacked theoretical underpinning. Second, these studies either examined broadband or narrowband consumers; therefore, they lacked a cross-sectional approach to distinguish the broadband consumers from narrowband ones.

This research adapted the usage constructs from the use diffusion model to distinguish in terms of usage the broadband consumers from narrowband. Therefore, by overcoming the two aforementioned limitations of previous studies, this research provides better understanding of Internet usage and helps to enhance theoretical underpinning.

The sixth theoretical contribution of this research is to develop theoretical understanding of the impact of broadband use in the household. The discussion on the impact of broadband in the previous chapter (Chapter 6) suggested that findings supported the overall assumptions made that were illustrated in Figure 6.5 and the concept of homeostasis in household systems (Robinson 1977, Vitalari *et al.* 1985). Therefore this study provides an incremental contribution towards theory development in the area of the impact of ICTs in households. This study also contributes to academia by confirming the findings of previous studies relating to the impact of broadband related issues and also by analysing the differences in the behaviour of broadband and dial-up users.

The seventh offering towards the theory is the analysis of the approaches that are utilised to study technology adoption and diffusion related issues. Several such studies were conducted to review research approaches employed within IS area and were considered important, as they provides further direction towards the utilisation of available research approaches. However, no such effort has been made to review research approaches specifically employed to examine technology adoption and diffusion related issues. The current study conducted a review of articles related with technology adoption and diffusion published in four respected and peer reviewed journals including *MIS Quarterly, European Journal of Information Systems, Information Systems Research* and *Information Systems Journal*. Details about its process and findings were presented in the 'Research Methodology' chapter (Chapter 4). By doing so, this study contributed by reflecting upon the use of various research approaches for investigating technology adoption and diffusion issues from the perspectives of both users (i.e. in organisations) and consumers (i.e. in households).

The eighth theoretical offering is the development and validation of a survey instrument. In a situation where theory is advanced, but prior instrumentation is not

developed and validated, it is essential to involve the creation and validation of new measures and such efforts are considered a major contribution to scientific practice in the IS field. As Straub *et al* (2004) mentioned that:

> *"Researchers who are able to engage in the extra effort to create and validate instrumentation for established theoretical constructs are testing the robustness of the constructs and theoretical links to method/measurement change. This practice, thus, represents a major contribution to scientific practice in the field"* (Straub *et al*, 2004).

Moore and Benbasat (1991) and Davis (1989) provide examples of such work on instrument development and validation, which the authors considered as a major contribution towards IS field. Although the constructs utilised in this research have taken from established theories and models such as TPB, DTPB, MATH and the Diffusion of Innovation, prior instrumentation to study broadband adoption and diffusion was not developed and validated in existing studies. Therefore it was considered essential to create and validate a new research instrument for constructs included in the conceptual model.

Since this study satisfied the criteria quoted above (Straub *et al*, 2004) it makes a substantial contribution towards the research methodology. This was achieved by modifying, creating and validating measures that correspond to various constructs included in the conceptual model. The research instrument developed and validated in this research can be utilised to examine various emerging technologies within the context of households.

7.4.2 Offerings to Industry and Policy

This study concludes that the amongst seven independent variables, six constructs including relative advantage, utilitarian outcomes, hedonic outcomes, primary influence, self-efficacy and facilitating conditions resources significantly influence the BI of consumers when adopting broadband in the UK household. The only exception is knowledge. It was found that relative advantage was most important and hedonic outcomes least important in terms influencing the BI when adopting broadband in the UK households. Other important constructs that fall within two extremes were primary influence, facilitating conditions resources, self-efficacy and utilitarian outcomes. The aforementioned findings of this research generate a number of issues that may assist both policy makers and ISPs for increasing consumer adoption of broadband.

For example, since relative advantage is found to be strongest construct, it indicates that ISPs have to provide broadband services to consumers in such a package that would illustrate a clear advantage over narrowband consumers. Similarly, facilitating conditions resources is the third most important factor in terms of influencing BI to adopt broadband.

This has implications for both ISPs and policy makers. For instance, ISPs have to think about more consumer centric services and alternative price plans so that all consumers who want to subscribe broadband would be able to do so. Policy makers have to provide alternative places for broadband access where lower income groups or those who cannot afford it can use high speed Internet. It may help to increase behavioural intention to adopt broadband and therefore encourage overall adoption and diffusion of broadband in the UK household.

As mentioned above, self-efficacy is also an important factor that influences behavioural intention to adopt broadband, which brings policy-related issues. This suggests that there is a need to equip citizens with the skills to use computers and the Internet. Since both utilitarian outcomes and hedonic outcomes are important factors for explaining behavioural intentions, it is important to integrate more content and applications for the purpose of household and entertainment utility.

One of the research questions of this study was to investigate the socio-economic characteristics in order to determine their impact on the adoption of broadband. Referring to the research question that was posed initially in Chapter 2, it was learnt that there is the occurrence of an unequal or heterogeneous adoption rate or digital divide in various dimensions including age, income, occupation and education.

It has been learnt that an important implication for supply side stakeholders, such as policy makers and industry, is to identify segments of society that are slow in adopting broadband. By obtaining results such as those afforded by this research, the reasons for slow adoption can be explored and appropriate measures can be developed and implemented so that they can be overcome.

As discussed before, broadband service providers may face two key challenges. First, there are consumers who cannot afford the current price plan. Therefore, the ISPs may consider providing alternative price plans in order to create a mass-market demand, which is an issue currently being emphasised. Second, some of the consumers with a high annual household income may also be reluctant to subscribe to broadband due to a lack of compelling content; hence, the challenges to the ISPs are to integrate content and applications and make them apparent to the ordinary members of the public.

The ISPs may overcome the aforementioned challenges by offering differential price plans and segment specific broadband subscription packages. For example, the ISPs can differentiate within the offered subscription price ranges depending upon factors such as the income levels and needs of the users. Further ideas of fulfilling this challenge are as follows. First, with an increasing demand in the lower income segments and those with fewer needs

of broadband, ISPs may offer price plans that can compete with the current price plan of un-metered narrowband.

Currently, there is a price gap between the two packages; therefore, a low price plan of un-metered narrowband is an inhibiting factor for broadband adoption in the segments with lower incomes and fewer needs. Second, since cost is not a factor of consideration when segmenting between the higher income and occupation levels, it should be offered in broadband packages with even faster speeds and appealing content. Such packages may assist in illustrating the clear benefits of broadband over narrowband to consumers of higher incomes and occupation levels, and provide them with added reasons for subscribing to broadband.

A recently published report that was submitted to the Department of Trade and Industry (DTI) suggests that the penetration of broadband is likely to promote usage of advanced Internet content and applications; however, due to the lack of data at present, it is difficult to support this theoretical claim (Analysys, 2005). The Analysys report states that:

> *"Much has been made of the requirement for countries to invest in broadband communications infrastructure, and to promote its usage. Increased take-up of broadband access services is expected to stimulate usage of advanced Internet content and applications by consumers and by businesses, thus changing individuals' behaviour, creating new industries, or increasing productivity in existing industries. However, data to prove the theory is hard to come by"* (Analysys, June 2005).

The Analysys (2005) report supported the aforementioned claim on the basis of the secondary data obtained from the studies conducted in the USA. This research is one of initial efforts that provides primary data in the context of the UK and supports the aforementioned theory. The findings of the current study clearly illustrate that the UK broadband consumers do tend to use the Internet differently to the narrowband consumers. Both the rate of and variety of internet usage is significantly higher for the broadband consumers in comparison to the narrowband ones. That means broadband consumers use the Internet more than the narrowband ones.

Furthermore, this study also examined the usage of 41 online services and applications. The study suggests that for all online services the numbers of broadband consumers were higher than the total number of narrowband ones. It was also illustrated that for the usage of many services, the differences between the numbers of broadband and narrowband consumers were significant. Thus, the findings of this study may assist in justifying investment in the area of broadband deployment and assist policy making organisations such as DTI and Ofcom that are involved in the development and deployment of broadband in the UK.

The findings also have important implications for the electronic mass media and telecommunication industries. The mass-media industry is likely to benefit from the diffusion of broadband, as more respondents use online material rather than utilising traditional reading resources. This may encourage the online media industry to attract revenues from advertising and subscription fees. According to the findings, receiving and making phone calls have decreased for both narrowband and broadband consumers. Therefore, the telecommunication industry may have to transform in terms of its business model. For example, the new business model may find a means of pricing consumers at instances of phone calls, which makes using VoIP or other emerging applications a consequence of a broadband environment.

Bearing the aforementioned points in mind, it can be argued that the contributions of this research are substantial for both policy makers and the telecommunication industry. Therefore, this research is viewed to be pertinent for the current period of broadband deployment. The above discussion on contributions and implications of this research has led to achieve the fourth and final objective of this study which was "*to provide implications for practice and policy that may encourage consumer adoption and use of broadband*".

7.5 RESEARCH LIMITATIONS

One of the limitations of this study was related to availability of the sample frame. The Electoral Register is considered to be a most comprehensive sample frame for the UK population. However, it could not be employed to obtain the respondent addresses due to recent legal restrictions that have been placed upon utilising the Electoral Register for any data collection purposes. The UK-Info Disk V11 database, which was utilised as a sample frame for this research, is as comprehensive as the Electoral Register. This is because it is derived from Electoral Register and is regularly updated. However, it does not provide addresses in the form of lists; instead it requires an initial extraction of addresses, creation of a list and then utilisation of that list. Since the UK-Info Disk V11 does not allow extraction of all addresses available in the database, it excludes some parts of the UK population from being included in the sample frame. This limited the ability to generalise the findings for the entire UK population. Hence, even though responses were received from various parts of the UK, the findings of this study were considered to be a representative sample from which respondents were selected, instead of the whole UK population.

Although the response rate that was obtained in this research was considered acceptable in IS research, there was the possibility of a non-response bias. Though the possibility of a non-response bias cannot be ruled out completely, the non-response bias test undertaken in this research suggests that it had minimal chances of affecting the findings.

This study provides a snapshot of broadband adoption, usage and the impact of broadband in the UK households. The findings may change as technology becomes established and consumers become more experienced in its use. However, as this research has a limited completion timeframe, it is not possible to conduct further data collection in order to observe the effect of time on the adoption, usage and impact of broadband.

This study was focused upon utilising a quantitative approach that may have limited the ability of this research when attempting to obtain an in-depth view of household technology adoption and usage. However, due to the time and resources there was a constraint such that it was not possible to conduct both qualitative and quantitative research.

The data for the current study was collected using a postal questionnaire, which limited the ability to include important variables such as family life stage/life cycle. This variable considers family as a consuming unit that progresses through a series of stages and is characterised by disposable income and the total number of members in a family. As this variable is an incremental one, it offers a deeper and richer understanding. Therefore, this variable will be very useful to investigate why a particular age or income group is more oriented towards adopting broadband than others. Additionally, it will be useful to collect in-depth data by conducting interviews that examine variables such as the life stage and relationships amongst age, education, income and social class. This will provide a clearer and more complete picture of broadband adoption and will certainly be helpful in developing a further understanding of the critical segments for subject areas related to diffusion and marketing.

The impact component of this study was constrained by the following limitations. First, the findings were generalised to the household. The data was collected from only the household head in order to examine the impact of broadband upon the online habits and time allocation patterns. However, the behaviour of the household head may differ to the other members of the family. Second, the study is based on self-reports and recall measures rather than observation or diaries. Finally, although the study showed the impact of broadband, it did not reveal why and how that occurs; therefore, this is difficult to explore using only a survey research approach.

7.6 FUTURE RESEARCH DIRECTIONS

With regard to adoption and usage in the future, this research intends to examine whether the findings obtained from this study are specific to the UK households or whether the results will be the same across other countries of the world. This would require a cross-cultural approach when understanding broadband adoption.

The questionnaire findings would have been strengthened if it had been possible to also supplement them using interviews. As mentioned in the previous limitations section, this supporting tool had to be abandoned due to the limitations of time and resources. The findings would also have been reinforced if the research had been a longitudinal one. The data for this research has been collected over a short period of time and provides a snapshot. However, it could be expanded over a longer period of time to offer a longitudinal study. Further justification for undertaking a longitudinal study is the reasoning that the elimination of any variables could achieve anomalies in the obtained results.

The aforementioned limitations to study the impact of broadband can be overcome by conducting a longitudinal and qualitative enquiry that will employ a combination of data collection tools such as diary, observations, interviews and questionnaires. The research suggests a longitudinal, qualitative study to be an appropriate future direction to overcome this limitation. This will allow an in-depth understanding of the impact of broadband and its implications in the context of the household to be obtained. Further, this will lead to an examination of the usage and impact of broadband differing amongst the various members of a household.

Due to the emergence of B-2-C, C-2-C electronic commerce and e-government services, there is now an emphasis upon the diffusion of high speed Internet; therefore, studying the impact of broadband on a household consumer becomes a very broad area. There is a need to research specific areas such as new communication methods, music and software downloads, entertainment, retail, travel and tourism on an individual basis in order to determine the real impact.

Furthermore, there is a need to explore associated issues such as the positive and negative impact of these changes on the growth and development of the Internet, the diffusion and sustainability of broadband technology, family life and work, social interaction and development, and growth of the business-to-consumer, consumer-to-consumer electronic commerce and e-government services areas.

Finally, this research was focused upon considering the advantages of broadband due to the slow rate of adoption and its effect on adoption and diffusion of new electronic services. There are several negative aspects of broadband adoption; however, this issue was not included within this study due time and resource constraints. Example of the negative aspects of broadband adoption includes the problem of online security in terms of transactions such as online shopping and online banking. Furthermore, broadband also raises the issue of the security of children accessing the internet at home (Udo, 2001). Therefore, it is advisable that future

research may undertake issues into consideration such privacy and security when examining the adoption and usage of broadband.

7.7 SUMMARY

This chapter provided an overview and conclusion to the results and discussions of the research presented in this thesis. First, the contents of each chapter were discussed briefly followed by drawing the main conclusions of this research. This was followed by a discussion of the research contributions and implications that this research has made in terms of the theory, policy and practice. Following that, the research limitations were listed. Finally, the future research directions in the area of broadband diffusion and adoption were provided.

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Appendices

APPENDIX 2.1: SUMMARISING THE DEFINITIONS FOR EACH CONSTRUCT INCLUDED IN THE PROPOSED CONCEPTUAL MODEL

Constructs	Definitions of constructs and sources
Behavioural Intention (BI)	Behavioural Intention (BI) is defined as a consumer's intention to subscribe (or intention to continue the current subscription) and makes use of Broadband Internet in the future. (Ajzen, 1988; 1991; Taylor & Todd, 1995; Venkatesh & Brown, 2001).
Relative Advantage	It is defined as the degree to which broadband Internet is perceived as being better than its predecessor narrowband Internet. (Moore & Benbasat, 1991; Rogers, 1995; Tornatzky & Klein, 1982).
Utilitarian Outcomes	It is the extent to which broadband internet usage enhances the effectiveness of household activities such as, undertaking office work at home, children's homework, information or product search and purchase and home business (Brown & Venkatesh, 2003; Venkatesh & Brown, 2001).
Hedonic Outcomes	Hedonic outcomes are defined as the pleasure derived from the consumption, or use of broadband Internet. For example, the entertainment potential of the Internet via offerings such as, online radio, streaming audio and video, electronic greetings, online games, online casino (Brown & Venkatesh, 2003; Venkatesh & Brown, 2001).
Service Quality	Service quality can be defined as the perceived quality of service a consumer obtained or is obtaining from the current Internet service providers. Service quality is measured in terms of, speed of connection and security problem with Internet connections, virus and popup problems with connection and customer support obtained from the ISP providers (DeLone and McLean, 2003; Parasuraman *et al*, 1991; Parasuraman *et al*, 1991).
Primary influences	Primary influences are defined as the perceived influences from friends and family to subscribe to and use (or not to subscribe and use) broadband Internet services (Brown & Venkatesh, 2003; Venkatesh & Brown, 2001).
Secondary Influences	Secondary influences are defined as the perceived influence of information from secondary sources such as advert and news on TV, newspapers to subscribe and use (or not to subscribe and use) broadband Internet services (Rogers, 1995; Brown & Venkatesh, 2003; Venkatesh & Brown, 2001).
Knowledge	Knowledge is defined as the perceived level of knowledge about broadband Internet, its risks and benefits (Rogers, 1995; Venkatesh & Brown, 2001).
Self-efficacy	Self-efficacy is defined as the perceived ability or skill to operate computers and the Internet (narrowband or broadband) without the assistance of others (Ajzen, 1985, 1991; Bandura 1977; Compeau and Higgins, 1991; Taylor & Todd, 1995).
Facilitating Conditions Resources	Facilitating conditions resources is defined as the perceived level of resources when subscribing to broadband (Ajzen 1985; 1991; Taylor & Todd, 1995; Triandis, 1979).

APPENDIX 3.1: IS RESEARCH APPROACHES

IS research approaches (Adapted from Galliers, 1992; Mingers, 2003; Straub *et al*, 2005)

Minger (2003)	Galliers (1992)	Straub *et al* (2005)	
	Positivist		
		QPR	**Non-QPR**
Observation (passive), measurements, and (statistical) analysis	Laboratory experiment	Lab Experiment	Math Modeling
Experiments	Field experiment	Field Experiment	Group feedback
Survey, questionnaire, or instrument	Survey	Field Study	Participative Research
Case study	Case study	Adaptive Experiment	Case study
	Theorem proof	Opinion research	Philosophical research
	Forecasting	Archival research	
Simulation	Simulation	Free & Experimental Simulation	
	Interpretivist		
Interviews	Subjective/argumentative		
Qualitative content analysis	Reviews		
Ethnography	Action research		
Grounded theory	Descriptive/interpretive		
Participant observation	Futures research		
	Role/game playing		
	Methods involving interventions (Critical Research)		
Action research			
Critical theory			
Consultancy			

APPENDIX 3.2: DESCRIPTION OF IS RESEARCH APPROACHES

Description of IS research approaches (Adapted from Mingers, 2003)

Research method	**Description (Minger 2003, pp 237-240)**
Experiments	This category includes both laboratory and field experiments and any statistical analysis of results. Mingers defined experiment as an artificially generated situation involving the deliberate manipulation of certain conditions potentially relevant to the outcome.
(Passive) observation, measurement and (statistical) analysis	It includes internally or externally published quantitative data, observation, recording or measurement and their analysis.
Survey, questionnaire, or instrument	All forms of data production involving the circulation of a pre-structured set of questions no matter how administered. Surveys shade into observation and measurement when the questions largely result in numerical answers, and into (structured) interviews when they are administered face-to-face and allow open-ended responses. The category includes any statistical analysis of the results.
Simulation	The artificial production of data in such a way that it is representative of some aspects of a relevant real situation. It is related to experiments in that experimental design can be used in the generation and analysis of results.
Case study	In this paper, it refers to a type of positivist research, which often includes other methods such as interviews and questionnaires.
Interviews	An interview can be defined as a real-time conversation between researcher and respondent to discover the respondent's personal views. They range from structured interviews with a fixed set of questions through to unstructured, open-ended discussions. They can also involve several people as in focus groups.
Qualitative content analysis	It is concerned with the analysis of texts for the occurrence of specific categories or terms in interpretive manner by recognising the role of analyst in the process. This category can shade into grounded theory and ethnography.
Ethnography/Hermeneutics	This involves the description of a particular culture in its own terms by the involved researcher immersing themselves in the language, practices, and values of a particular organisation with the aim to understand what happens through the eyes of the people involved. Its variant hermeneutics is particularly concerned with interpreting textual material. This category can overlap with the participant observation, and with critical theory when it adopts a critical rather than descriptive perspective.
Grounded theory	It uses data from a range of sources (including quantitative) in order to generate theories that plausibly explain relationships among the concepts within the data. It is distinguished from a positivistic approach to data analysis in that it does accept an independent, pre-existing reality about which truth can be discovered. Indeed, (social) theories are always interpretations, and truth is enacted.
Participant observation	In this method the researcher becomes an active participant in the situation, usually, but not always, without the knowledge of the other people involved. It is common to distinguish degrees of involvement: complete participant, participant-as-observer, observer-as-participant and complete observer, the latter essentially being pure ethnography.
Action research	In this, the researcher explicitly becomes involved in intervening in the situation and attempting to bring about change. It is distinguished from consultancy in that the researcher enters the situation with particular theoretical or methodological tools and then uses the process and results of the intervention to evaluate the theory or method.
Critical theory	It emphasises linking theory and practice, with research being grounded in practice. This category accepts several complementary research methods from different domains.

APPENDIX 3.3: RESEARCH APPROACHES EMPLOYED IN THE TECHNOLOGY ADOPTION RESEARCH

SN	Author(s)	Year	Unit of Analysis	Research Approach
		MIS Quarterly 1994-2003		
1	Teo, *et al.*	2003	CIO, CEO, CFO	Survey
2	Gefen, *et al.*	2003	Online Shoppers	Survey
3	Venkatesh, *et al.*	2003	User Acceptance	Survey
4	Venkatesh, *et al.*	2001	Household Consumers	Survey
5	Venkatesh, *et al.*	2000	Users	Survey
6	Karahanna, *et al.*	1999	Users	Survey
7	Chau, *et al.*	1997	Senior Executives	Interviews
8	Igbaria, *et al.*	1997	Users (Small firms)	Survey
9	Gefen, *et al.*	1997	Users	Survey
10	Iacovou, *et al.*	1995	Small Organizations	Case Study
		European Journal of Information Systems (EJIS) 1997-2003		
11	Heijden, *et al.*	2003	Online Consumers	Survey
12	Teo, *et al.*	2003	Organizations	Survey
13	Caldeira, *et al.*	2003	SMEs	Case Studies
14	Zhu, *et al.*	2003	Businesses & Consumers	Survey
15	Aladwani, A.M.	2002	Online Consumers	Survey
16	Brown, *et al.*	2002	Users (Organizational)	Survey
17	Fan, *et al.*	2000	Organization (Dell)	Case Study
18	Guimaraes, *et al.*	1999	Users (Organizational)	Survey
19	Tolsby, *et al.*	1998	Organization (Army)	Case Study
20	Suomi, *et al.*	1998	Organizations	Case Study
21	Premkumar, *et al.*	1997	Organizations	Survey
		Information Systems Journal (ISJ) 1996-2003		
22	Baskerville, *et al.*	2001	Organizations	Case Study
23	Caldeira, *et al.*	2002	SMEs	Case Studies
24	Mustonen-Ollila, *et al.*	2003	Organizations	Case Studies
		Information Systems Research (ISR) 1998-2003		
25	Sussman, *et al.*	2003	Organizational Users	Survey
26	Koufaris, M	2002	Online Consumers	Survey
27	Torkzadeh, *et al.*	2002	Individual Consumer	Survey
28	Plouffe, *et al.*	2001	Business Users	Survey
29	Chwelos, *et al.*	2001	Senior Managers	Survey
30	Venkatesh, V	2000	Organizational users	Survey
31	Parthasarathy, et al	1998	Online service users	Survey

APPENDIX 3.4: RESEARCH APPROACHES EMPLOYED IN THE TECHNOLOGY ADOPTION RESEARCH IN THE HOUSEHOLD CONTEXT

Author(s)	Year	Unit of Analysis	Approach	Publication Source
Shih, *et al.*	2004	Household Consumers	Telephone Survey	*Journal of Marketing*
Anckar, B	2003	Household Consumers	Questionnaire Survey	*ECIS 2003*
Lee, H	2003	S Korean Households	Interview Survey	*The Information Society*
Shih, *et al.*	2003	Household Consumers/ Users	Telephone & Face to face Survey	*CRITO Working Paper*
Wellman, B	2002	Individual users	Web Survey	*CACM*
Lacohee, *et al.*	2001	Household Individual	Interview, Survey, and Time-use diary	*Int. J. Human-Computer Studies*
Anderson, *et al.*	2001	Household Individual	Interview and Time-use diary	*American Behavioural Scientist*
Venkatesh, A *et al.*	2001	Household Users	Ethnographic Method	*Advances in Consumer Research*
Venkatesh, V *et al.*	2001	Household Consumers	Telephone Survey	*MIS Quarterly*
Venkatesh, A *et al.*	2000	Household Individual	Secondary Analysis of US Census Population Survey data	*Home Informatics and Telematics (Edited Book)*
Venkatesh, A	2000	Household Individual	Interview Survey	CRITO Working Paper
Anderson, *et al.*	1999	Residential Customers	Questionnaire & Time Use Diaries	*BT Technol J*
Kraut, *et al.*	1996	Residential Internet Users	Postal Survey	*CACM*
Venkatesh, A *et al.*	1992	Home Computer Owner	Telephone Survey	*Management Science*
Venkatesh, A	1987	Home Computer Owner	Postal Survey	*Journal of Economic Psychology*
Vitalari, *et al.*	1985	Home Computer Users	Postal Survey	*CACM*

APPENDIX 4.1: EXPLORATORY SURVEY QUESTIONNAIRE

Department of Information Systems & Computing
Brunel University
Uxbridge, Middlesex, UB8 3PH

Dear Sir/Madam,

You are kindly requested to participate in a research project being conducted by Yogesh Dwivedi, a PhD student, and Dr Jyoti Choudrie, Director of Operations, Brunel Broadband Research Centre in the Department of Information Systems and Computing (DISC) at Brunel University.

The aim of this research is to "investigate consumer behaviour towards broadband adoption in the household". The questionnaire consists of a number of questions that should take approximately 8-10 minutes to complete. Please tick all appropriate answers. If your answer is not displayed, then please state your answer in the "other" option category. Participation is voluntary. You may omit any questions that you do not wish to answer.

None of the information provided by participants will be disclosed or used in any monetary, political or institutional way. Your name will not be revealed in any of the documents unless you grant permission. A code number will be used to protect your identity. Data will be kept with the investigator and supervisor and will be destroyed after completion of this dissertation.

Please return the completed questionnaire in the enclosed envelopes.

If you have any questions about this study, please contact the investigators on the following address: **Yogesh Dwivedi, PhD Student**, Department of Information Systems and Computing, Brunel University, Uxbridge, Middlesex UB8 3PH, United Kingdom, email: cspgykd@brunel.ac.uk, phone: (01895) 274000 Ext 3822. To confirm the validity of this research, you may reach Dr. Choudrie at the following address: **Dr. Jyoti Choudrie**, Director of Operations, Brunel Broadband Research Centre, Department of Information Systems and Computing, Brunel University, Uxbridge, Middlesex, UB8 3PH, UK. Telephone: (01895) 274000 Extn. 3769 and email: Jyoti.Choudrie@brunel.ac.uk

We would like to take the opportunity to thank you for your time and patience in completing this questionnaire!

Broadband Adoption Survey

Section A

To be completed by all the respondents

(1) What age group do you belong to?

☐ Under 16
☐ 17-24
☐ 25-34
☐ 35-44
☐ 45-54
☐ 55-64
☐ 65-74
☐ Above 75

(2) Gender

☐ Male
☐ Female

(3) Highest level of education

☐ GCSE
☐ A Level
☐ GNQV/Diploma
☐ Degree
☐ Postgraduate/Research
☐ Others (Please state)....

(4) What is your occupation?.....

(5) What is your household's annual income? (K= £1000)

☐ <10 K
☐ 10-19 K
☐ 20-29 K
☐ 30-39 K
☐ 40-49 K
☐ 50-59 K
☐ 60-69 K
☐ =>70 K

(6) Do you have a computer (PC) at home?

☐ Yes (Go to question **7)**
☐ No (Please go to question **13)**

(7) Do you have broadband Internet access at home?

☐ Yes (Please complete all the question in the **Section C)**
☐ No (Please go to **question 8** and then complete all the question in the **section B)**

(8) If you do not have broadband connection, do you access the Internet via dial-up (narrowband) at home?

☐ Yes
☐ No

Section B

To be completed by respondents who do not have broadband

(9) Which of the below factors listed in the table **led you not to subscribe** to broadband?

Please rate each of the following factors provided on a five-point scale where **1 is least important**, and **5 Very important.**

Factors that **led you not to subscribe** to broadband	**5** (Very Important)	**4**	**3**	**2**	**1** (Least Important)
Cost of purchasing/upgrading the computer (PC)					
High monthly cost of broadband subscription					
Lack of content/applications with broadband					
Lack of knowledge about broadband					
Lack of knowledge about broadband usage and benefits					
Lack of needs					
Lack of skill to use computer and Internet					
Please mention any other factors not listed above that could explain why you did not subscribe to broadband.					

(10) Are you planning to subscribe to broadband in future?

☐ Yes (Go to question **11 and then complete Section C)**
☐ No (Go to question **13)**

(11) If your answer is 'Yes' then when are you planning to subscribe to broadband?

☐ Within Three Month
☐ Within an year
☐ Within Six Month
☐ Other (Please state).....

Section C

To be completed by those respondents who have or planning to subscribe a broadband connection

(12) What are the factors listed in the table below that **led you to subscribe OR led you planning** to subscribe broadband? Please place an "X" in the appropriate box that best describes your reasons on a five-point scale where **1 is least important reason**, and **5 very important.**

Factors that **led you to subscribe** the broadband	**5** (very important)	**4**	**3**	**2**	**1** (Least important)
Faster access to the Internet					
Always-on access to the Internet					
Free home phone line					

Un-metered access to Internet					
To perform job-related tasks					
To find educational/research materials					
To perform home business					
To download files faster					
To help with children's homework					
To perform the personal and household activities i.e. online shopping & information search					
To play online games					
For entertainment, such as music and movies					
To communicate with family, friends and relatives					
My family members and relatives influenced me to subscribe a broadband					
My friends influenced me to subscribe to broadband					
I saw TV/News advert and thought of trying it out.					
My kids influenced me to subscribed to broadband.					
Having broadband enhances my social status					
Please mention any other factors not listed above that you believe driving broadband adoption in households.					

(13) Would you be willing to provide 5-10 minutes for an interview on this issue?

☐ Yes ☐ No

If you agree to an interview, then can you please provide your phone number, email or home address whereby we can contact you:

Phone number/E-mail/.....

Thank you very much for your valuable time and patience for completing this questionnaire!

APPENDIX 4.2: SUMMARY OF STATISTICS OBTAINED FROM EXPLORATORY SURVEY

Adoption/Rejection factors	TI	Mean	SD	R (α)
INDICATORS FOR BROADBAND ADOPTION (TOTAL RESPONSES N=51)				
ATTITUDINAL FACTORS				
1. RELATIVE ADVANTAGE	**5**	**4.17**	**0.56**	**0.235**
Faster access to the Internet		4.88	0.33	
Always-on access to the Internet		4.13	1.0	
Free home phone line		3.22	1.7	
Un-metered access to Internet		4.49	0.83	
To download files faster		4.12	1.25	
2. UTILITARIAN OUTCOMES	**6**	**2.89**	**.87**	**0.66**
To perform job-related tasks		3.06	1.55	
To find educational/research materials		3.31	1.22	
To perform home business		2.63	1.45	
To help with children's homework		2.33	1.49	
To perform the personal & household		2.96	1.35	
To communicate with family, friends and relatives		3.03	1.46	
3. HEDONIC OUTCOMES	**2**	**2.34**	**1.85**	**0.54**
To play online games		1.78	1.15	
For entertainment such as music and movies		2.90	1.45	
NORMATIVE FACTORS				
1. PRIMARY INFLUENCE	**3**	**2.47**	**1.7**	**0.84**
Influence from family members and relatives		2.56	1.88	
Influence from friends		2.38	1.77	
Influence from Kids		2.28	1.94	
2. SECONDARY INFLUENCE	**1**	**---**	**---**	**---**
Influence from TV/News advert		2.60	1.78	
INDICATORS FOR BROADBAND NON-ADOPTION (N=78)				
CONTROL FACTORS				
1. FACILITATING CONDITIONS RESOURCES	**2**	**3.60**	**1.17**	**0.50**
Cost of purchasing/upgrading the computer		2.94	1.64	
High monthly cost of broadband subscription		4.25	1.18	
2. KNOWLEDGE	**2**	**2.35**	**1.37**	**0.94**
Lack of knowledge about broadband		2.28	1.43	
Lack of knowledge about broadband usage and benefits		2.33	1.41	
3. SELF-EFFICACY	**1**	**---**	**---**	**---**
Lack of skills to use computer and Internet		1.95	1.41	
4. OTHER ITEMS	**2**	**3.19**	**0.97**	**0.34**
Lack of need to subscribe the broadband		3.83	1.25	
Lack of content/applications with broadband		2.55	1.25	

[**Legend: TI**= Total number of items, **SD**= Standard Deviation, **R (α)**= Reliability (**Cronbach's α**)]

APPENDIX 4.3: CONTENT VALIDITY QUESTIONNAIRE

Subject: Research help in content validation of broadband diffusion survey instrument

Dear Sir/Madam

I am Yogesh Kumar Dwivedi, pursuing a PhD (IS) under the supervision of Dr Jyoti Choudrie, Director of Operations, Brunel Broadband Research Centre in the Department of Information Systems and Computing (DISC) at Brunel University. The aim of my PhD research is to "investigate broadband diffusion in the UK household".

At this stage I am conducting a content validation of the survey instrument. I would be much obliged if you could participate in the content validation of the survey instrument prepared to investigate broadband diffusion.

I am contacting you since I am aware about your knowledge and academic or industrial expertise in one of the following areas: telecommunication management research, broadband diffusion, technology diffusion, technology diffusion in the household, electronic commerce and e-business adoption, diffusion and adoption in general and consumer behaviour. The details about how to complete the questions are provided in the beginning of attached questionnaire.

We would like to take this opportunity to thank you for your valuable time and patience for participating in content validity survey on broadband diffusion study!

Looking forward to your reply,

Sincerely,

Yogesh K. Dwivedi

Content Validity: Questionnaire

This questionnaire contains 11 constructs, its domain definition and associated items to rate. In order to rate each item, please read at first the domain definition for each construct and then tick/highlight one of the following three options for each item: ☐Essential ☐Useful but not essential ☐Not necessary.

I would like to emphasise that you are kindly requested to complete questionnaire as an expert of the area, but not as a consumer or user of broadband. It means you have to judge that how important each item are in order to measure its domain construct. For instance in the following example, you have to judge if following item is essential to measure Behavioural Intention construct or not and according to that you select your answer from three choices.

E.g. I intend to subscribe to broadband (or continue my subscription of the current broadband Internet service) in the future.

☐**Essential** ☐Useful but not essential ☐Not necessary

If you would like to complete the electronic version of the questionnaire then please make your answer visible by highlighting it in bold and or underling it as shown above. Please save the completed questionnaire before returning it to me at my email id: cspgykd@brunel.ac.uk.

If you are returning the completed questionnaire by post then please indicate your answers by writing a tick for the relevant option and send it at following address: **Mr. Yogesh Kumar Dwivedi, PhD Student, Department of Information Systems and Computing (DISC), Brunel University, Uxbridge, Middlesex UB8 3PH, United Kingdom.**

Also if any of the items are confusing and need re-wording or you are aware of any other improvements that might be made, please provide your comments and suggestions. If you would like to suggest any new items for any of the constructs, please add them in the provided space at the end of each construct. Your feedback and critique are much appreciated and will enable me to improve and validate the content of the questionnaire.

1. Behavioural Intention (BI)

Domain Definition: Behavioural Intention (BI) is defined as a consumer's intention to subscribe (or intention to continue current subscription) and makes use of Broadband Internet in future (Ajzen 1988, 1991, Taylor and Todd 1995, Venkatesh and Brown 2001).

Initial Items for Content Validation

BI1: I intend to subscribe to broadband (or continue my subscription of current broadband Internet service) in the future.

☐Essential ☐Useful but not essential ☐Not necessary

BI2: I intend to subscribe to broadband (or continue my subscription of current broadband Internet service) to do work, household and entertainment related activities.

☐Essential ☐Useful but not essential ☐Not necessary

BI3: I do not intend to subscribe to broadband (or do not intend to continue my current subscription of current broadband Internet service) in the future

☐Essential ☐Useful but not essential ☐Not necessary

Please suggest any other item if it is missed in the aforementioned list

1.
2.
3.

2. RELATIVE ADVANTAGE

Domain Definition: It is defined as the degree to which broadband Internet is perceived as being better than its predecessor narrowband Internet (Rogers 1995, Tornatzky and Klein 1982, Moore and Benbasat 1991, 1996, Venkatesh et al 2003).

Initial Items for Content Validation

RA1: Broadband has an advantage over dial-up/narrowband because it offers faster access to Internet

☐Essential ☐Useful but not essential ☐Not necessary

RA2: Broadband has an advantage over dial-up/narrowband because it provides faster download of files from Internet

☐Essential ☐Useful but not essential ☐Not necessary

RA3: Broadband has an advantage over dial-up/narrowband because it offers un-metered access to the Internet

☐Essential ☐Useful but not essential ☐Not necessary

RA4: Broadband has an advantage over dial-up/narrowband because it offers an always-on access to Internet

☐Essential ☐Useful but not essential ☐Not necessary

RA5: Broadband has an advantage over dial-up/narrowband because it offers a free home phone line whilst connected to the Internet

☐Essential ☐Useful but not essential ☐Not necessary

RA6: There would be not enough function (content/applications) to subscribe to broadband

☐Essential ☐Useful but not essential ☐Not necessary

RA7: A broadband monthly subscription is too expensive in comparison to narrowband

☐Essential ☐Useful but not essential ☐Not necessary

RA8: The advantages of broadband is/will outweigh the disadvantages

☐Essential ☐Useful but not essential ☐Not necessary

RA9: Overall, subscribing and using the broadband is/will be advantageous

☐Essential ☐Useful but not essential ☐Not necessary

Please suggest any other item if it is missed in the aforementioned list

1.
2.

3. UTILITARIAN OUTCOMES

Domain definition: It is the extent to which using Broadband Internet enhances the effectiveness of household activities such as doing office work at home, children's homework, information or product search and purchase and home business (Venkatesh and Brown 2001, Brown and Venkatesh 2003).

Initial Items for Content Validation

UO1: Broadband Internet can be useful to find educational/research materials at home

☐Essential ☐Useful but not essential ☐Not necessary

UO2: Broadband Internet can be useful for distance learning and accessing library resources at home

☐Essential ☐Useful but not essential ☐Not necessary

UO3: Broadband Internet can be helpful to perform job-related tasks at home

☐Essential ☐Useful but not essential ☐Not necessary

UO4: Broadband Internet can provide good a medium of communication such as email, chat, web cam etc.

☐Essential ☐Useful but not essential ☐Not necessary

UO5: Broadband Internet can help in performing personal and household activities such as online shopping and information search

☐Essential ☐Useful but not essential ☐Not necessary

UO6: Broadband Internet can be helpful to establish and operate a home business

☐Essential ☐Useful but not essential ☐Not necessary

UO7: Broadband Internet can help children to do their homework

☐Essential ☐Useful but not essential ☐Not necessary

UO8: Broadband can enable to finish Internet related work more quickly

☐Essential ☐Useful but not essential ☐Not necessary

UO9: Broadband Internet cannot improve work performance amongst household members

☐Essential ☐Useful but not essential ☐Not necessary

UO10: Broadband Internet generally increases the productivity of household members

☐Essential ☐Useful but not essential ☐Not necessary

UO11: Broadband Internet cannot enhance the effectiveness of household members

☐Essential ☐Useful but not essential ☐Not necessary

UO12: Broadband Internet makes household work easier

☐Essential ☐Useful but not essential ☐Not necessary

UO13: Broadband Internet is not useful to an individual's household work

☐Essential ☐Useful but not essential ☐Not necessary

UO14: Subscribing to and using broadband is compatible with most aspects of my everyday life

☐Essential ☐Useful but not essential ☐Not necessary

UO15: Overall broadband Internet is useful to me and other members in the family.

☐Essential ☐Useful but not essential ☐Not necessary

Please suggest any other item if it is missed in the aforementioned list

1.
2.
3.

4. HEDONIC OUTCOMES

Domain definition: hedonic outcomes are defined as the pleasure derived from the consumption, or use of broadband Internet. For example, the entertainment potential of the Internet via offerings such as, online radio, streaming audio and video, electronic greetings, online games, online casino.

Initial Items for Content Validation

HO1: Broadband Internet can provide a good medium of entertainment such as listening and downloading of music and movies

☐Essential ☐Useful but not essential ☐Not necessary

HO2: Broadband Internet can provide a good medium of playing online games

☐Essential ☐Useful but not essential ☐Not necessary

HO3: Broadband Internet can provide a good medium for online casino

☐Essential ☐Useful but not essential ☐Not necessary

HO4: Broadband Internet can provide a good medium for sending and receiving electronic greetings and to participate in virtual groups.

☐Essential ☐Useful but not essential ☐Not necessary

Please suggest any other item if it is missed in the aforementioned list

1.
2.
3.

5. SERVICE QUALITY

Domain Definition: Service quality can be defined as the perceived quality of service consumer obtained or are obtaining from their current Internet service providers in terms of speed of connection and security problem with Internet connections, virus and popup problems with connection and customer support obtained from the ISP providers.

Initial Items for Content Validation

SQ1: I am satisfied with the speed of Internet access (narrowband or broadband) obtained from my current service providers

☐Essential ☐Useful but not essential ☐Not necessary

SQ2: I am not satisfied with the speed of Internet access (narrowband or broadband) from my current service providers

☐Essential ☐Useful but not essential ☐Not necessary

SQ3: I am satisfied with the security measures provided with Internet access (narrowband or broadband) obtained from my current service providers

☐Essential ☐Useful but not essential ☐Not necessary

SQ4: I am not satisfied with the security measures provided with Internet access (narrowband or broadband) obtained from my current service providers

☐Essential ☐Useful but not essential ☐Not necessary

SQ5: I get too many popups with my current Internet access (narrowband or broadband)

☐Essential ☐Useful but not essential ☐Not necessary

SQ6: My current Internet connection (narrowband or broadband) is free from the problem of too many popups

☐Essential ☐Useful but not essential ☐Not necessary

SQ7: I frequently face virus attack problems associated with the current Internet access (narrowband or broadband)

☐Essential ☐Useful but not essential ☐Not necessary

SQ8: I do not face virus attack problems associated with my current Internet access (narrowband or broadband)

☐Essential ☐Useful but not essential ☐Not necessary

SQ9: I obtained satisfactory customer/technical support from my current service providers whenever I needed it

☐Essential ☐Useful but not essential ☐Not necessary

SQ10: Customer/technical support from my current service providers is not satisfactory.

☐Essential ☐Useful but not essential ☐Not necessary

SQ11: Overall service quality of my current Internet connection is good and I will continue using it

☐Essential ☐Useful but not essential ☐Not necessary

SQ12: Overall service quality of my current Internet connection is not satisfactory and I will discontinue it and will not subscribe to any other providers in the near future.

☐Essential ☐Useful but not essential ☐Not necessary

SQ13: Overall service quality of my current Internet connection is not satisfactory and I will discontinue it but will subscribe to other providers in the near future.

☐Essential ☐Useful but not essential ☐Not necessary

Please suggest any other item if it is missed in the aforementioned list

1.
2.
3.

6. PRIMARY INFLUENCES (INFLUENCES FROM FRIENDS AND FAMILY)

Domain definition: Primary influences are defined as the perceived influences from friends and family to subscribe to and use (or not to subscribe and use) broadband Internet services (Venkatesh and Brown 2001, Brown and Venkatesh 2003).

Initial Items for Content Validation

PI1: My friends would think that I should subscribe to and use (or continue current subscription) broadband at home

☐Essential ☐Useful but not essential ☐Not necessary

PI2: My collogues will think that I should subscribe to and use (or continue current subscription) broadband

☐Essential ☐Useful but not essential ☐Not necessary

PI3: My family members (i.e. spouse, kids) think that I should subscribe (or continue current subscription) to broadband

☐Essential ☐Useful but not essential ☐Not necessary

PI4: My relatives think that I should subscribe (or continue current subscription) to broadband

☐Essential ☐Useful but not essential ☐Not necessary

Please suggest any other item if it is missed in the aforementioned list

1.
2.
3.

7. SECONDARY INFLUENCES (MEDIA INFLUENCES)

Domain definition: Secondary influences are defined as the perceived influence of information from secondary sources such as advert and news on TV, newspaper etc. to subscribe and use (or not to subscribe and use) broadband Internet services (Venkatesh and Brown 2001, Brown and Venkatesh 2003).

Initial Items for Content Validation

SI1: TV and radio adverts influence me in my decisions of subscribing to broadband

☐Essential ☐Useful but not essential ☐Not necessary

SI2: TV and radio adverts influence me when I subscribe to broadband

☐Essential ☐Useful but not essential ☐Not necessary

SI3: Newspaper adverts influence me when subscribing to broadband

☐Essential ☐Useful but not essential ☐Not necessary

SI4: Newspaper adverts influence me not when subscribing to broadband

☐Essential ☐Useful but not essential ☐Not necessary

Please suggest any other item if it is missed in the aforementioned list

1.
2.

8. REQUISITE KNOWLEDGE

Domain definition: Requisite knowledge is defined as the perceived level of knowledge about broadband Internet, its risks and benefits (Rogers, 1995, Venkatesh and Brown 2001).

Initial Items for Content Validation

RK1: I have difficulty in explaining why adopting broadband Internet may be beneficial

☐Essential ☐Useful but not essential ☐Not necessary

RK2: I could communicate to others the pros and cons of adopting broadband

☐Essential ☐Useful but not essential ☐Not necessary

RK3: I have no difficulty in telling others about the results of adopting and using broadband

☐Essential ☐Useful but not essential ☐Not necessary

RK4: I have difficulty in telling whether it is good or bad to adopt broadband Internet

☐Essential ☐Useful but not essential ☐Not necessary

RK5: I do not know how broadband Internet is different from narrowband Internet

☐Essential ☐Useful but not essential ☐Not necessary

RK6: I do not know the benefits that broadband offer and cannot be obtained by narrowband

☐Essential ☐Useful but not essential ☐Not necessary

Please suggest any other item if it is missed in the aforementioned list

1.
2.
3.

9. SELF EFFICACY (Skills of using PC and Internet)

Domain definition: Self-efficacy defined as the perceived ability or skill to operate computer and Internet (narrowband or broadband) without help of others (Taylor and Todd, 1995).

Initial Items for Content Validation

SE1: I would feel comfortable using the computer and Internet on my own

☐Essential ☐Useful but not essential ☐Not necessary

SE2: I would be able to use the computer and Internet even if there was no one around to show me how to use it.

☐Essential ☐Useful but not essential ☐Not necessary

SE3: Learning to operate the PC and Internet is easy for me

☐Essential ☐Useful but not essential ☐Not necessary

SE4: I clearly understand how to use the PC and Internet

☐Essential ☐Useful but not essential ☐Not necessary

SE5: I find the computer and Internet inflexible to interact with

☐Essential ☐Useful but not essential ☐Not necessary

SE6: It is not easy for me to become skilful in using broadband Internet

☐Essential ☐Useful but not essential ☐Not necessary

SE7: I find the computer and Internet easy to learn and use

☐Essential ☐Useful but not essential ☐Not necessary

Please suggest any other item if it is missed in the aforementioned list

1.
2.
3.

10. FACILITATING CONDITIONS (RESOURCES AND TECHNOLOGY)

Domain definition: Facilitating condition is defined as the perceived level of resources (income) and availability of requisite technologies (computer and telephone line) when subscribing to broadband (Rogers, 1995, Taylor and Todd, 1995).

Initial Items for Content Validation

FC1: My current PC is not good enough to access Internet

☐Essential ☐Useful but not essential ☐Not necessary

FC2: I cannot subscribe to broadband at home because it is too costly to purchase a new computer or to upgrade my old computer.

☐Essential ☐Useful but not essential ☐Not necessary

FC3: There is no problem of broadband Internet availability in my locality

☐Essential ☐Useful but not essential ☐Not necessary

FC4: I cannot subscribe to broadband even if I wanted to, because it is not available in my area

☐Essential ☐Useful but not essential ☐Not necessary

FC5: My annual household income level is enough to afford subscribing to broadband

☐Essential ☐Useful but not essential ☐Not necessary

FC6: My annual household income level is not enough to afford subscribing to broadband

☐Essential ☐Useful but not essential ☐Not necessary

FC7: There are no barriers preventing me from subscribing to broadband

☐Essential ☐Useful but not essential ☐Not necessary

FC8: It is too costly for me to subscribe to broadband at its current subscription fee.

☐Essential ☐Useful but not essential ☐Not necessary

FC9: It is not too costly for me to subscribe to broadband at its current subscription fee.

☐Essential ☐Useful but not essential ☐Not necessary

FC10: I would be able to subscribe to and/or use broadband Internet if I wanted to

☐Essential ☐Useful but not essential ☐Not necessary

Please suggest any other item if it is missed in the aforementioned list

1.

11. VARIETY OF BROADBAND USE: ACTIVITIES COVERED BY BROADBAND USE

Domain Definition: The variety of broadband use refers to the different ways that broadband is used by the consumers or users of technology. The following categories are adopted from the Pew Internet Project Survey and Anderson et al (2001) study. This is because adopting the same categories will help to compare the findings of previous research with this current one.

Please rate if the following usage of broadband categories is essential to include. Also please include new usage if you think it is not included in the following list. Space for this is provided at end of list.

Email	☐Essential	☐Useful but not essential	☐Not necessary
Instant messaging	☐Essential	☐Useful but not essential	☐Not necessary
Chat rooms	☐Essential	☐Useful but not essential	☐Not necessary
News	☐Essential	☐Useful but not essential	☐Not necessary
Job related research	☐Essential	☐Useful but not essential	☐Not necessary
Look for product info	☐Essential	☐Useful but not essential	☐Not necessary
Research for school or training	☐Essential	☐Useful but not essential	☐Not necessary
Look for travel info	☐Essential	☐Useful but not essential	☐Not necessary
Look for medical info	☐Essential	☐Useful but not essential	☐Not necessary
Share computer files	☐Essential	☐Useful but not essential	☐Not necessary
Create content	☐Essential	☐Useful but not essential	☐Not necessary
Display/develop photos	☐Essential	☐Useful but not essential	☐Not necessary
Store files on the Internet	☐Essential	☐Useful but not essential	☐Not necessary
Download games	☐Essential	☐Useful but not essential	☐Not necessary
Download video	☐Essential	☐Useful but not essential	☐Not necessary
Download pictures	☐Essential	☐Useful but not essential	☐Not necessary
Download music	☐Essential	☐Useful but not essential	☐Not necessary
Download movie	☐Essential	☐Useful but not essential	☐Not necessary
Download free software	☐Essential	☐Useful but not essential	☐Not necessary
Video streaming	☐Essential	☐Useful but not essential	☐Not necessary
Listen to music/ Radio station	☐Essential	☐Useful but not essential	☐Not necessary
Watch movies	☐Essential	☐Useful but not essential	☐Not necessary
Online banking	☐Essential	☐Useful but not essential	☐Not necessary
Bill paying	☐Essential	☐Useful but not essential	☐Not necessary
Buy a product	☐Essential	☐Useful but not essential	☐Not necessary
Buy a travel service	☐Essential	☐Useful but not essential	☐Not necessary
Auction	☐Essential	☐Useful but not essential	☐Not necessary
Buy groceries	☐Essential	☐Useful but not essential	☐Not necessary
Buy/sell stocks	☐Essential	☐Useful but not essential	☐Not necessary
Play lottery	☐Essential	☐Useful but not essential	☐Not necessary
Hobby information	☐Essential	☐Useful but not essential	☐Not necessary
Just for fun	☐Essential	☐Useful but not essential	☐Not necessary
Play a game	☐Essential	☐Useful but not essential	☐Not necessary
Adult content	☐Essential	☐Useful but not essential	☐Not necessary

Please suggest any other item if it is missed in the aforementioned list

1.

Once again we would like to take this opportunity to thank you for your valuable time and patience in completing this questionnaire!

APPENDIX 4.4: ESTIMATION OF CONTENT VALIDITY RATIO (CVR) FOR ADOPTION ITEMS (N=12)

SN	I. No.	3	2	1	n	Mea	CV	SN	I. No.	3	2	1	n	Mean	CVR
1	BI1	12	0	0	12	3	1	39	SQ8	6	2	4	6	2.17	0
2	BI2	5	4	3	5	2.167	-0.17	40	SQ9	12	0	0	12	3	1
3	BI3	10	0	2	10	2.67	0.6	41	SQ10	4	2	6	4	1.83	-0.33
4	RA1	10	2	0	10	2.83	0.6	42	SQ11	9	1	2	9	2.58	0.5
5	RA2	9	3	0	9	2.75	0.5	43	SQ12	6	1	6	6	2.17	0
6	RA3	6	4	2	6	2.33	0	44	SQ13	9	1	2	9	2.58	0.5
7	RA4	11	1	0	11	2.92	0.8	45	PI1	9	3	0	9	2.75	0.5
8	RA5	9	2	1	9	2.67	0.5	46	PI2	10	2	0	10	2.83	0.67
9	RA6	6	4	2	6	2.33	0	47	PI3	9	3	0	9	2.75	0.5
10	RA7	8	2	2	8	2.5	0.33	48	PI4	7	3	2	7	2.42	0.17
11	RA8	6	3	3	6	2.25	0	49	SI1	11	1	0	11	2.92	0.83
12	RA9	8	2	2	8	2.5	0.33	50	SI2	6	3	3	6	2.25	0
13	UO1	12	0	0	12	3	1	51	SI3	10	2	0	10	2.83	0.67
14	UO2	11	1	0	11	2.92	0.8	52	SI4	6	2	4	6	2.17	0
15	UO3	12	0	0	12	3	1	53	RK1	9	2	1	9	2.67	0.5
16	UO4	11	1	0	11	2.92	0.8	54	RK2	8	3	1	8	2.58	0.33
17	UO5	11	1	0	11	2.92	0.8	55	RK3	8	1	3	8	2.42	0.33
18	UO6	9	2	1	9	2.67	0.5	56	RK4	7	2	3	7	2.33	0.167
19	UO7	10	1	1	10	2.75	0.6	57	RK5	11	0	1	11	2.83	0.83
20	UO8	7	1	4	7	2.25	0.17	58	RK6	9	1	2	9	2.58	0.5
21	UO9	6	3	3	6	2.25	0	59	SE1	10	0	2	10	2.67	0.67
22	UO10	6	3	3	6	2.25	0	60	SE2	7	2	3	7	2.33	0.167
23	UO11	4	5	3	4	2.08	-0.33	61	SE3	9	1	2	9	2.58	0.5
24	UO12	6	2	4	6	2.17	0	62	SE4	9	1	2	9	2.58	0.5
25	UO13	5	2	5	6	2.0	-0.17	63	SE5	5	5	2	5	2.25	-0.167
26	UO14	9	2	1	9	2.67	0.5	64	SE6	7	2	3	7	2.33	0.167
27	UO15	9	2	1	9	2.67	0.5	65	SE7	7	0	5	7	2.17	0.167
28	HO1	11	1	0	11	2.92	0.8	66	FC1	11	0	1	11	2.83	0.83
29	HO2	10	2	0	10	2.83	0.6	67	FC2	10	1	1	10	2.75	0.67
30	HO3	9	3	0	9	2.75	0.5	68	FC3	11	1	0	11	2.92	0.83
31	HO4	11	1	0	11	2.92	0.8	69	FC4	8	0	4	8	2.33	0.33
32	SQ1	12	0	0	12	3	1	70	FC5	9	3	0	9	2.75	0.5
33	SQ2	6	1	5	6	2.08	0	71	FC6	6	0	6	6	2	0
34	SQ3	10	2	0	10	2.83	0.6	72	FC7	6	1	5	6	2.08	0
35	SQ4	4	3	5	4	1.92	-0.33	73	FC8	10	0	2	10	2.67	0.67

36	SQ5	5	3	4	5	2.08	-0.17	74	FC9	4	1	7	4	1.75	-0.33
37	SQ6	4	3	5	4	1.92	-0.33	75	FC10	10	2	0	10	2.83	0.67
38	SQ7	8	2	2	8	2.5	0.33								

Legend: N= Total number of experts completed the content validity questionnaire, n= number of experts rated items as essential, **I. No.**= Item Number, **CVR** (Content Validity Ratio)= n-N/2/N/2

APPENDIX 4.5: ESTIMATION OF CONTENT VALIDITY RATIO (CVR) FOR USAGE ITEMS (N=12)

Online services	N	3	2	1	n	Mean	CVR
Email	12	12	0	0	12	3	1
Instant messaging	12	12	0	0	12	3	1
Online Chat	12	12	0	0	12	3	1
Online News	12	12	0	0	12	3	1
Job related research	12	12	0	0	12	3	1
Look for product info	12	12	0	0	12	3	1
Research for school or training	12	12	0	0	12	3	1
Look for travel information	12	12	0	0	12	3	1
Look for medical information	12	12	0	0	12	3	1
Share computer files	12	12	0	0	12	3	1
Create content (e.g. Web pages)	12	12	0	0	12	3	1
Store/display/develop photos	12	12	0	0	12	3	1
Store files on the Internet	12	12	0	0	12	3	1
Download games	12	12	0	0	12	3	1
Download video	12	12	0	0	12	3	1
Download pictures	12	12	0	0	12	3	1
Download music	12	12	0	0	12	3	1
Download movie	12	12	0	0	12	3	1
Download free software	12	12	0	0	12	3	1
Video streaming/downloading	12	12	0	0	12	3	1
Listen to music (streaming/MP3)	12	12	0	0	12	3	1
Listen to the radio station	12	12	0	0	12	3	1
Watch movies (downloading/streaming)	12	12	0	0	12	3	1
Undertake online banking	12	12	0	0	12	3	1
Online bill paying	12	11	0	1	11	2.83	0.83
Purchase a product	12	12	0	0	12	3	1
Purchase a travel service	12	12	0	0	12	3	1
Online auctions e.g. e-bay	12	12	0	0	12	3	1
Purchase groceries (household goods)	12	11	1	0	11	2.92	0.83
Buy/sell stocks (online share trading)	12	12	0	0	12	3	1
Play lottery	12	12	0	0	12	3	1
Obtain information on hobby	12	12	0	0	12	3	1
Use it for fun e.g. Web surfing	12	11	1	0	11	2.92	0.83
Play online game	12	11	1	0	11	2.92	0.83
View or visit Adult content Websites	12	12	0	0	12	3	1

Legend: N= Total number of experts completed the content validity questionnaire, n= number of experts rated items as essential, **I. No.**= Item Number, **CVR** (Content Validity Ratio)= n-N/2/N/2

APPENDIX 4.6: PRE-TEST QUESTIONNAIRE: PART I

School of Information Systems, Computing and Mathematics (SISCM)
Department of Information Systems and Computing (DISC)
Uxbridge, Middlesex, UB8 3PH, UK

PRE-TEST (Part-I)

On

"An empirical study to investigate the diffusion (Adoption) of broadband in the UK households"

Undertaken by

Yogesh K. Dwivedi, PhD (IS) Candidate (0024624)

Supervised by

Dr Jyoti Choudrie, Lecturer

Broadband Adoption Survey

[A] Who is (with reference to household/family heads) completing the questionnaire?

- ☐ Head of household or Family
- ☐ Spouse
- ☐ Son/daughter
- ☐ Son/daughter-in-law
- ☐ Parents
- ☐ Cohabitee
- ☐ Relative
- ☐ Boarder/Lodger
- ☐ Others (Please specify)…

[B] What age group do you belong to?

- ☐ Under 16
- ☐ 17-24
- ☐ 25-34
- ☐ 35-44
- ☐ 45-54
- ☐ 55-64
- ☐ 65-74
- ☐ Above 75

[C] Gender

- ☐ Male
- ☐ Female

[D] Highest level of education

- ☐ GCSE
- ☐ A Level
- ☐ GNQV/Diploma
- ☐ Degree
- ☐ Postgraduate/Research
- ☐ Others (Please state).....

[E] What is your occupation?

- ☐ Higher managerial/professional (Directors, doctors, lawyers, professors)
- ☐ Intermediate managerial (Managers, teachers, computer programmers)
- ☐ Junior managerial, supervisory, clerical, administrative (Foremen, shop assistants)
- ☐ Skilled manual labour (Electricians, mechanics, plumbers and other crafts)
- ☐ Semi- and unskilled manual labour (Machine operators, assembly, cleaning)
- ☐ Pensioners, casual workers, unemployed, students
- ☐ Others (Please specify)…

(F) What is your household's annual income? (K= £1000)

- ☐ <10 K
- ☐ 10-19 K
- ☐ 20-29 K
- ☐ 30-39 K
- ☐ 40-49 K
- ☐ 50-59 K
- ☐ 60-69 K
- ☐ =>70 K

(G) Do you have Internet access at home?

- ☐ Yes (Please complete all the question in the **question G)**
- ☐ No (Please go to **question J)**

(H) If you have Internet access, what would you describe your Internet is?

- ☐ Narrowband or dial-up metered
- ☐ Broadband with **DSL/ADSL**
- ☐ Wireless
- ☐ Narrowband or dial-up un-metered
- ☐ Broadband with **CABLE MODEM**
- ☐ Other (Please specify)…

(I) How long have you been accessing the Internet for?

- ☐ Less then 12 Month
- ☐ 25-36 Month
- ☐ Others (Please state)…
- ☐ 12-24 Month
- ☐ More then 36 Month

(J) If you do not have Internet access at home, then where else do you obtain access it?

- ☐ Work place
- ☐ University or college
- ☐ Public access points
- ☐ Local library
- ☐ Internet cafe
- ☐ Other (Please specify)…

(K) Please rate each of the following statements provided on a 1-7 point scale where: 7 = Extremely agree **6** = Quite agree **5** = Slightly agree **4**= Neutral **3**= Slightly disagree **2**= Quite disagree **1**=Extremely disagree

1. I intend to subscribe to broadband (or continue my subscription of current broadband Internet service) in the future

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

2. I do not intend to subscribe to broadband (or do not intend to continue my current subscription of current broadband Internet service) in the future

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

3. Broadband has an advantage over dial-up/narrowband because it offers faster access to Internet

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

4. Broadband has an advantage over dial-up/narrowband because it provides faster download of files from Internet

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

5. Broadband has an advantage over dial-up/narrowband because it offers an always-on access to Internet

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

6. Broadband has an advantage over dial-up/narrowband because it frees up the phone line whilst connected to the Internet

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

7. Broadband can be useful to find educational materials and accessing library resources at home

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

8. Broadband can be useful for distance learning

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

9. Broadband can be helpful to perform work-related tasks at home

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

10. Broadband will help me communicate better via email, chat, Web cam

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

11. Broadband can help in performing personal and household activities such as online shopping

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

12. Broadband can help in performing personal and household activities such as information search

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

13. Broadband can be helpful to establish and operate a home business

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

14. Broadband can help children to do their homework

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

15. Overall broadband will useful to me and other members in the family

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

16. I will enjoy using broadband to listen and download music and movies

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

17. I will enjoy using broadband to play online games

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

18. I will enjoy using broadband to play online gambling/casino

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

19. I like using broadband for sending and receiving electronic greetings

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

20. Subscribing to broadband is compatible with most aspects of my everyday life

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

21. Subscribing to broadband fit well my work style

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

22. Before deciding upon whether or not to subscribe to broadband I will have to use it on a trial basis

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

23. I am satisfied with the speed of Internet access (dial-up/narrowband or broadband) obtained from my current service providers

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

24. I am satisfied with the security measures provided with Internet access (narrowband or broadband) obtained from my current service providers

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

25. I obtained satisfactory customer/technical support from my current service providers whenever I needed it

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

26. Overall service quality of my current Internet connection is good and I will continue using it

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

27. Overall service quality of my current Internet connection is not satisfactory and I will discontinue it but will subscribe to other providers in the near future

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

28. My friends think that I should subscribe to (or continue current subscription) broadband at home

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

29. My collogues think that I should subscribe to (or continue current subscription) broadband

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

30. My family members (i.e. spouse, kids) think that I should subscribe (or continue current subscription) to broadband

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

31. TV and radio advertising encourages me to try broadband

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

32. Newspaper advertising encourages me to try broadband

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

33. I have the resources, opportunities, and knowledge for subscribing to broadband

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

34. I would be able to subscribe to and/or use broadband if I wanted to

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

35. I have difficulty in explaining why adopting broadband may be beneficial

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

36. I do not know how broadband is different from dial-up/narrowband Internet

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

37. I do not know the benefits that broadband offer and cannot be obtained by dial-up/narrowband

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

38. I would feel comfortable using the Internet on my own

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

39. Learning to operate the Internet is easy for me

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

40. I clearly understand how to use the Internet

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree

☐ 1= Extremely disagree

41. My current PC is not good enough to access Internet

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

42. I cannot subscribe to broadband at home because it is too costly to purchase a new computer or to upgrade my old computer

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

43. There is no problem of broadband Internet availability in my locality

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

44. My annual household income level is enough to afford subscribing to broadband

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

45. It is too costly for me to subscribe to broadband at its current subscription fee

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

46. There is no real difference between broadband and dial-up/narrowband for me

☐ 7=Extremely agree ☐ 5= Slightly agree ☐ 3= Slightly disagree
☐ 6= Quite agree ☐ 4= Neutral ☐ 2= Quite disagree
☐ 1= Extremely disagree

[L] Any other suggestion …

Thank you very much for your valuable time and patience for completing this questionnaire!

APPENDIX 4.7: PRE-TEST QUESTIONNAIRE: PART II

School of Information Systems, Computing and Mathematics (SISCM)
Department of Information Systems and Computing (DISC)
Uxbridge, Middlesex, UB8 3PH, UK

PRE-TEST (Part-II)

On

An empirical study to investigate the diffusion (Usage of broadband in the UK households

Undertaken by

Yogesh K. Dwivedi (0024624), PhD (IS) Candidate

Supervised by

Dr Jyoti Choudrie, Lecturer

Broadband Usage Survey

[A]. How often do you access the Internet from home?

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often

[B]. How long do you spend on the Internet everyday?

☐ Less than a half-hour
☐ Half-hour or more but less than 1 hour
☐ About an hour
☐ More than 1 hour but less than 2 hours
☐ More than 2 hour but less than 3 hours
☐ More than 3 hour but less than 4 hours
☐ More than 4 hour but less than 5 hours
☐ More than 5 hour but less than 6 hours
☐ More than 6 hour but less than 7 hours
☐ More than 7 hour but less than 8 hours
☐ More than 8 hours
☐ Others (Please state)...

[C]. How often do you access the following online services from home?

(1) Email

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(2) Instant messaging

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(3) Online Chat

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(4) News

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(5) Job related research

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(6) Look for product info

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(7) Research for school or training

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(8) Look for travel information

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(9) Look for medical information

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(10) Share computer files

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(11) Create content (e.g. Web pages)

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(12) Store/display/develop photos

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(14) Store files *on the Internet*

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(15) Download games

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(16) Download video

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(17) Download pictures

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(18) Download music

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(19) Download movie

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(20) Download free software

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(21) Watch video clips

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(22) Streaming media

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(23) Listen to music (streaming/MP3)

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(24) Listen to the radio station

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(25) Watch movies (downloading/streaming)

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(26) Undertake online banking

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(27) Bill paying

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(28) Purchase a product

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(29) Purchase a travel service

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(30) Online auctions e.g. e-bay

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(31) Purchase groceries (household goods)

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(32) Buy/sell stocks (online share trading)

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(33) Play lottery

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(34) Obtain information on hobby

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(35) Use it for fun e.g. Web surfing

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(36) Play online game

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(37) View or visit Adult content Websites

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(38) Use the Internet for security purposes at home

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(39) Video conferencing

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(40) Voice over Internet (VoIP) or Internet telephony

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(41) Real time collaboration (video, text support)

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(42) Online lectures and collaboration with schoolmates

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(43) Online dating and matrimonial services

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

(44) Accessing and using e-government services e.g. Council tax, housing & council tax benefits, child benefit claims, carer's allowance, jobcentre-plus, self assessment online

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks
☐ About once a day ☐ 1-2 days a week ☐ Less often ☐ Never

[E]. Are you aware about online Government Gateway?

☐ **Yes**
☐ **No**

[F]. Have you registered with online Government Gateway?

☐ **Yes**
☐ **No**

Thank you very much for your valuable time and patience for completing this questionnaire!

APPENDIX 4.8: PILOT QUESTIONNAIRE

Department of Information Systems & Computing
Brunel University
Uxbridge, Middlesex, UB8 3PH

Dear Sir/Madam,

You are kindly requested to participate in a pilot study that is part of a nationwide survey research being conducted by Yogesh Dwivedi, a PhD candidate, under the supervision of Dr Jyoti Choudrie, Director of Operations, Brunel Broadband Research Centre in the School of Information Systems, Computing and Mathematics, Brunel University.

The aim of this research is to "investigate broadband adoption, usage and impact in the UK household". The questionnaire consists of a number of questions that should take approximately 15 minutes to complete. Please tick all appropriate answers. If your answer is not displayed, then please state your answer in the "other" option category. Participation is voluntary. You may omit any questions that you do not wish to answer.

Since this is a pilot study your comments will be valuable to improve the questionnaire. Please suggest how long it takes to complete questionnaire, if the length is appropriate and if the questions are understandable.

None of the information provided by the participants will be disclosed or used in any monetary, political or institutional way.

Your name will not be revealed in any of the documents unless you grant permission. A code number will be used to protect your identity.

Data will be kept with the investigator and supervisor and will be destroyed after completion of this dissertation.

Please return the completed questionnaire in the self addressed stamped envelopes enclosed with the questionnaire.

If you have any questions about this study, please contact the investigators on the following address: **Yogesh Dwivedi**, **PhD Student**, School of Information Systems, Computing and Mathematics, Brunel University, Uxbridge, Middlesex UB8 3PH, United Kingdom, email: cspgykd@brunel.ac.uk, phone: (01895) 265969. To confirm the validity of this research, you may contact Dr. Choudrie at the following address: **Dr. Jyoti Choudrie**, Director of Operations, Brunel Broadband Research Centre, School of Information Systems, Computing and Mathematics, Brunel University, Uxbridge, Middlesex, UB8 3PH, UK. Telephone: (01895) 266012 and email: Jyoti.Choudrie@brunel.ac.uk

We would like to take this opportunity to thank you for your time and patience in completing this questionnaire!

Broadband Diffusion Survey

[1] Who is (with reference to household/family heads) completing the questionnaire?

☐ Head of household ☐ Son/daughter ☐ Parents ☐ Relative
☐ Spouse ☐ Son/daughter-in-law ☐ Cohabitee ☐ Boarder/Lodger ☐ Others

[2] What age group do you belong to?

☐ Under 16 Year ☐ 25-34 Years ☐ 45-54 Years ☐ 65-74 Years
☐ 17-24 Years ☐ 35-44 Years ☐ 55-64 Years ☐ Above 75 Years

[3] Gender

☐ Male ☐ Female

[4] Highest level of education

☐ GCSE ☐ A Level ☐ Postgraduate Taught (MA, MSc
☐ GNQV/Diploma ☐ Degree ☐ Postgraduate Research (PhD)

[5] What is your occupation?

☐ Directors, doctors, lawyers, professors
☐ Managers, teachers, computer programmers
☐ Foremen, shop assistants, office workers
☐ Electricians, mechanics, plumbers and other crafts)
☐ Machine operators, assembly, cleaning
☐ Pensioners, casual workers, unemployed, students
☐ Others (Please specify)…

[6] What is your household's annual income? (K= £1000)

☐ <10 K ☐ 20-29 K ☐ 40-49 K ☐ 60-69 K
☐ 10-19 K ☐ 30-39 K ☐ 50-59 K ☐ =>70 K

[7] Do you have Internet access at home?

☐ Yes (Please complete all the questions below) ☐ No (Please go to **question 10)**

[8] If you do have Internet access, what would you describe the type of Internet is that you do have?

☐ Dial-up metered ☐ Broadband with **DSL/ADSL** ☐ Wireless
☐ Dial-up un-metered ☐ Broadband with **CABLE MODEM** ☐ Other

[9] How long have you been accessing the Internet for?

☐ <12 Month ☐ 12-24 Month ☐ 25-36 Month ☐ >36 Month ☐ Others (Please state)…

[10] Where else do you obtain access to the Internet? (Please tick all applicable options)

☐ Work place ☐ Public access points ☐ Internet cafe
☐ University or college ☐ Local library ☐ Other (Please specify)…

[11]. How often do you access the Internet (From work place, Internet café or library)?

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks ☐ Other (Please specify)…
☐ About once a day ☐ 1-2 days a week ☐ Less often

[12]. How long do you spend on the Internet on a daily basis?

☐ <1/2 hour ☐ >1-2 hour ☐ >3-4 hour ☐ >5-6 hour ☐ >7-8 hour ☐ >9-10 hour
☐ 1/2-1 hour ☐ >2-3 hour ☐ >4-5 hour ☐ >6-7 hour ☐ >8-9 hour ☐ Others ....

[13] Please rate each of the following statements provided on a 7-1 point scale where: **7**= Extremely agree **6**= Quite agree **5**= Slightly agree **4**= Neutral **3**= Slightly disagree **2**= Quite disagree **1**=Extremely disagree. **The following statements only represent your perception so it is alright to rate them even if you do not have an Internet connection at home.**

BI1. I intend to subscribe to (or continue my current subscription) broadband in the future

Extremely agree ☐ **7** ☐ **6** ☐ **5** ☐ **4** ☐ **3** ☐ **2** ☐ **1** Extremely disagree

BI2. I intend to continue my current subscription but will change the current service provider

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree** ☐ **NA**

BI3. I intend to use (or intend to continue use) broadband Internet service in the future

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree**

RA1. Broadband has an advantage over dial-up/narrowband because it offers faster access to Internet

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree**

RA2. Broadband has an advantage over dial-up because it provides faster download of files from Internet

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree**

RA3. Broadband has an advantage over dial-up because it offers an always-on access to Internet

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree**

RA4. Broadband has an advantage over dial-up because it frees up the phone line whilst connected to the Internet

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree**

UO1. Broadband can be useful to find educational materials and accessing library resources at home

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree**

UO2. Broadband can be useful for distance learning

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree**

UO3. Broadband can be helpful to perform work/job-related tasks at home

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree**

UO4. Broadband will help me communicate better via email, chat, Web cam

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree**

UO5. Broadband can help in performing personal and household activities i.e. *online shopping*

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree**

UO6. Broadband can help in performing personal and household activities i.e. *information search*

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree**

UO7. Broadband can be helpful to establish and operate a home business

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree**

UO8. Broadband can help children to do their homework

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree**

U9. Subscribing to broadband is compatible with most aspects of my everyday life

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree**

U10. Overall broadband will be useful to me and other members in the family

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree**

HO1. I will enjoy using broadband to listen to and download music

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree**

HO2. I will enjoy using broadband to watch to and download movies

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree**

HO3. I will enjoy using broadband to play online games

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree**

HO4. I will enjoy using broadband to play online gambling/casino

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree**

SQ1. I am satisfied with the speed of Internet access (dial-up or broadband) obtained from my current service providers

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree** ☐ **NA**

SQ2. I am satisfied with the security measures provided with Internet access (dial-up or broadband) obtained from my current service providers

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree** ☐ **NA**

SQ3. I obtained satisfactory customer/technical support from my current service providers

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree** ☐ **NA**

SQ4. The overall service quality of my current Internet connection is satisfactory

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree** ☐ **NA**

PI1. My friends think that I should subscribe to (or continue the current subscription) broadband at home

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree**

P12. My colleagues think that I should subscribe to (or continue the current subscription) broadband

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree**

P13. My family members (i.e. spouse, kids) think that I should subscribe to (or continue the current subscription) to broadband

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree**

SI1. TV and radio advertising encourages me to try broadband

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree**

SI2. Newspaper advertising encourages me to try broadband

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree**

K1. I do not have difficulty in explaining why adopting broadband may be beneficial

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree**

K2. I know how broadband is different from dial-up/narrowband Internet

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree**

K3. I know the benefits that broadband offer and cannot be obtained by dial-up/narrowband

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree**

SK1. I would feel comfortable using the Internet on my own

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree**

SK2. Learning to operate the Internet is easy for me

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree**

SK3. I clearly understand how to use the Internet

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree**

FCT1. My current PC is good enough to access the Internet

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree**

FCT2. There is no problem of broadband Internet availability in my locality

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree**

FCR1. My annual household income level is enough to afford subscribing to broadband

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree**

FCR2. It is not too costly to purchase a new computer or to upgrade my old computer

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree**

FCR3. It is not too costly for me to subscribe to broadband at its current subscription fee

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree**

FCR4. I would be able to subscribe to broadband if I wanted to

Extremely agree ☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 **Extremely disagree**

[14] Are you aware about online Government Gateway?

☐ Yes ☐ No

[15] Have you registered with online Government Gateway?

☐ Yes ☐ No

[16] Do you access the following online services from home or from any other location such as, the Work Place, Internet Café, Library or Public Access Point? Please place a tick on 'Yes' or 'No' in both the sections. Also would you like to access the following services in the future as well? Please place a tick in the 'Yes' or 'No' sections of the last column.

Online services	From Home	From Work Place, Interne Café, Library	Would you like to use it in the future?
Email	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Instant messaging	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Online Chat	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Online News	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Job related research	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Look for product info	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Research for school or training	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Look for travel information	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Look for medical information	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Share computer files	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Create content (e.g. Web pages)	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Store/display/develop photos	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Store files on the Internet	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Download games	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Download video	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Download pictures	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Download music	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Download movie	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Download free software	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Video streaming/downloading	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Listen to music (streaming/MP3)	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Listen to the radio station	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Watch movies (downloading/streaming)	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Undertake online banking	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Online bill paying	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Purchase a product	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Purchase a travel service	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Online auctions e.g. e-bay	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Purchase groceries (household goods)	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Buy/sell stocks (online share trading)	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Play lottery	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Obtain information on hobby	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Use it for fun e.g. Web surfing	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Play online game	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
View or visit Adult content Websites	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Video conferencing	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Voice over Internet (VoIP)	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Online dating and matrimonial services	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Online lectures	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Collaboration with schoolmates	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Accessing e-government services	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No

[17] Has the use of the Internet increased, decreased or had no change on the amount of time you spend on the following activities?

Watching television/cable/satellite	☐ Increased	☐ No change	☐ Decreased
Shopping in stores	☐ Increased	☐ No change	☐ Decreased
Working at home	☐ Increased	☐ No change	☐ Decreased
Reading newspapers/books/magazines	☐ Increased	☐ No change	☐ Decreased
Working in the office	☐ Increased	☐ No change	☐ Decreased
Commuting in traffic	☐ Increased	☐ No change	☐ Decreased
Spending time with family	☐ Increased	☐ No change	☐ Decreased
Spending time with friends	☐ Increased	☐ No change	☐ Decreased
Attending social events	☐ Increased	☐ No change	☐ Decreased
Time spent on sport	☐ Increased	☐ No change	☐ Decreased
Time spent on hobbies	☐ Increased	☐ No change	☐ Decreased
Time spent on sleeping	☐ Increased	☐ No change	☐ Decreased
Time spent alone (doing nothing)	☐ Increased	☐ No change	☐ Decreased
Studying	☐ Increased	☐ No change	☐ Decreased
Household work	☐ Increased	☐ No change	☐ Decreased
Receiving/ making phone calls	☐ Increased	☐ No change	☐ Decreased
Doing charity and social works	☐ Increased	☐ No change	☐ Decreased
Outdoor recreation (DIY, pet care)	☐ Increased	☐ No change	☐ Decreased
Outdoor entertainment (concerts, cinema)	☐ Increased	☐ No change	☐ Decreased
Visiting or meeting friends or relatives	☐ Increased	☐ No change	☐ Decreased

[18] Since this is a pilot study your feedback will be valuable to improve the questionnaire. Therefore, we request you to provide the following information about this questionnaire:

(a) How long did it take to complete the questionnaire?

☐ 10 minute ☐ 15 minute ☐ 20 minute ☐ Others (Please specify…)

(b) Is the length of the questionnaire appropriate? ☐ Yes ☐ No

(c) Are the questions understandable? ☐ Yes ☐ No

(d) Is the layout of the questionnaire ok? ☐ Yes ☐ No

(e) If you would like to suggest any improvement to the questionnaire, then please feel free to write your comments below:

[19] Would you like to help the researcher by participating in a half an hour interview about your experiences on broadband adoption and usage? ☐ Yes ☐ No

If you agree to an interview, then could you please provide your phone number, email or home address whereby we can contact you:

Home Address……

Phone no……..

E-mail ……

Thank you very much for your valuable time and patience for completing this questionnaire!

APPENDIX 4.9: FINAL QUESTIONNAIRE

Department of Information Systems & Computing
Brunel University
Uxbridge, Middlesex, UB8 3PH

Dear Sir/Madam,

You are kindly requested to participate in a nationwide survey research being conducted by Mr. Yogesh Dwivedi, a PhD candidate, under the supervision of Dr Jyoti Choudrie, Director of Operations, Brunel Broadband Research Centre in the School of Information Systems, Computing and Mathematics, Brunel University.

The aim of this research is to "investigate broadband adoption, usage and impact in the UK household". The questionnaire consists of a number of questions that should take approximately 15 minutes to complete. Please tick all appropriate answers. If your answer is not displayed, then please state your answer in the "other" option category. Participation is voluntary. You may omit any questions that you do not wish to answer.

None of the information provided by the participants will be disclosed or used in any monetary, political or institutional way. Your name will not be revealed in any of the documents unless you grant permission. A code number will be used to protect your identity.

Data will be kept with the investigator and supervisor and will be destroyed after completion of this dissertation.

If you have any questions about this study, please contact the investigators on the following address: **Mr. Yogesh Dwivedi, PhD Student**, School of Information Systems, Computing and Mathematics, Brunel University, Uxbridge, Middlesex UB8 3PH, United Kingdom, email: cspgykd@brunel.ac.uk, phone: (01895) 265969. To confirm the validity of this research, you may contact Dr. Choudrie at the following address: **Dr. Jyoti Choudrie**, Director of Operations, Brunel Broadband Research Centre, School of Information Systems, Computing and Mathematics, Brunel University, Uxbridge, Middlesex, UB8 3PH, UK. Telephone: (01895) 266012 and email: Jyoti.Choudrie@brunel.ac.uk

We would like to take this opportunity to thank you for your time and patience in completing this questionnaire!

Note: In this questionnaire the term **dial-up/narrowband** refers to the Internet connection that offers a speed below 128 Kilobits per second. **Broadband** refers to a high speed, always on and un-metered Internet connection. The offered speed is above 128 Kilobits per second. The term **un-metered** refers to a fixed subscription fee and **metered** means cost per usage.

Broadband Diffusion Survey

[1] Who is (with reference to household/family heads) completing the questionnaire?

☐ Head of household ☐ Son/daughter ☐ Parents ☐ Relative
☐ Spouse ☐ Son/daughter-in-law ☐ Cohabitee ☐ Boarder/Lodger
☐ Others (Please specify)…

[2] What age group do you belong to?

☐ Under 16 Years ☐ 25-34 Years ☐ 45-54 Years ☐ 65-74 Years
☐ 17-24 Years ☐ 35-44 Years ☐ 55-64 Years ☐ Above 75 Years

[3] Gender

☐ Male ☐ Female

[4] Highest level of education

☐ GCSE ☐ A Level ☐ Postgraduate Taught (MA, MSc)
☐ GNQV/Diploma ☐ Degree ☐ Postgraduate Research (PhD)

[5] What is your occupation?

☐ Directors, doctors, lawyers, professors
☐ Managers, teachers, computer programmers
☐ Foremen, shop assistants, office workers
☐ Electricians, mechanics, plumbers and other crafts)
☐ Machine operators, assembly, cleaning
☐ Pensioners, casual workers, unemployed, students
☐ Others (Please specify)…

[6] What is your household's annual income? (K= £1000)

☐ <10 K ☐ 20-29 K ☐ 40-49 K ☐ 60-69 K
☐ 10-19 K ☐ 30-39 K ☐ 50-59 K ☐ =>70 K

[7] Do you have Internet access at home?

☐ Yes (Please complete all the questions below) ☐ No (Please go to **question 10)**

[8] If you do have Internet access, what would you describe the type of Internet is that you do have?

☐ Dial-up metered ☐ Broadband with **DSL/ADSL** ☐ Wireless
☐ Dial-up un-metered ☐ Broadband with **CABLE MODEM** ☐ Other

[9] How long have you been accessing the Internet for?

☐ <12 Months ☐ 12-24 Months ☐ 25-36 Months ☐ >36 Months ☐ Others

[10] Where else do you obtain access to the Internet? (Please tick all applicable options)

☐ Work place ☐ Public access points ☐ Internet cafe
☐ University or college ☐ Local library ☐ Other (Please specify)…

[11]. How often do you access the Internet (From work place, Internet café or library)?

☐ Several times a day ☐ 3-5 days a week ☐ Once every few weeks ☐ Other
☐ About once a day ☐ 1-2 days a week ☐ Less often

[12]. How long do you spend on the Internet on a daily basis?

☐ <1/2 hour ☐ >1-2 hour ☐ >3-4 hour ☐ >5-6 hour ☐ >7-8 hour ☐ >9-10 hour
☐ 1/2-1 hour ☐ >2-3 hour ☐ >4-5 hour ☐ >6-7 hour ☐ >8-9 hour ☐ Other

[13] Please rate each of the following statements provided on a 1-7 point scale where:
1=Extremely disagree 2= Quite disagree 3= Slightly disagree 4= Neutral 5= Slightly agree 6= Quite agree 7= Extremely agree.

The following statements only represent your perception so it is alright to rate them *even if you do not have broadband Internet connection at home.*

BI1. I intend to subscribe to (or continue my current subscription) broadband in the future

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

BI2. I intend to continue my current subscription but will change the current service provider

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree** ☐ **N/A**

BI3. I intend to use (or intend to continue use) broadband Internet service in the future

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

RA1. Broadband has an advantage over dial-up/narrowband because it offers faster access to Internet

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

RA2. Broadband has an advantage over dial-up because it provides faster download of files from Internet

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

RA3. Broadband has an advantage over dial-up because it offers an always-on access to Internet

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

RA4. Broadband has an advantage over dial-up because it frees up the phone line whilst connected to the Internet

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

UO1. Broadband can be useful to find educational materials and accessing library resources at home

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

UO2. Broadband can be useful for distance learning

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

UO3. Broadband can be helpful to perform work/job-related tasks at home

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

UO4. Broadband will help me communicate better via email, chat, Web cam

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

UO5. Broadband can help in performing personal and household activities i.e. *online shopping*

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

UO6. Broadband can help in performing personal and household activities i.e. *information search*

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

UO7. Broadband can be helpful to establish and operate a home business

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

UO8. Broadband can help children to do their homework

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

U9. Subscribing to broadband is compatible with most aspects of my everyday life

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

U10. Overall broadband will be useful to me and other members in the family

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

HO1. I will enjoy using broadband to listen to and download music

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

HO2. I will enjoy using broadband to watch to and download movies

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

HO3. I will enjoy using broadband to play online games

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

HO4. I will enjoy using broadband to play online gambling/casino

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

SQ1. I am satisfied with the speed of Internet access (dial-up or broadband) obtained from my current service providers

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree** ☐ **N/A**

SQ2. I am satisfied with the security measures provided with Internet access (dial-up or broadband) obtained from my current service providers

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree** ☐ **N/A**

SQ3. I obtained satisfactory customer/technical support from my current service providers

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree** ☐ **N/A**

SQ4. The overall service quality of my current Internet connection is satisfactory

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree** ☐ **N/A**

PI1. My friends think that I should subscribe to (or continue the current subscription) broadband at home

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

P12. My colleagues think that I should subscribe to (or continue the current subscription) broadband

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

P13. My family members (i.e. spouse, kids) think that I should subscribe to (or continue the current subscription) to broadband

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

SI1. TV and radio advertising encourages me to try broadband

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

SI2. Newspaper advertising encourages me to try broadband

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

K1. I do not have difficulty in explaining why adopting broadband may be beneficial

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

K2. I know how broadband is different from dial-up/narrowband Internet

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

K3. I know the benefits that broadband offer and cannot be obtained by dial-up/narrowband

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

SK1. I would feel comfortable using the Internet on my own

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

SK2. Learning to operate the Internet is easy for me

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

SK3. I clearly understand how to use the Internet

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

FCT1. My current PC is good enough to access the Internet

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

FCT2. There is no problem of broadband Internet availability in my locality

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

FCR1. My annual household income level is enough to afford subscribing to broadband

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

FCR2. It is not too costly to purchase a new computer or to upgrade my old computer

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

FCR3. It is not too costly for me to subscribe to broadband at its current subscription fee

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

FCR4. I would be able to subscribe to broadband if I wanted to

Extremely disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Extremely agree**

[14] Do you access the following online services from home or from any other location such as, the Work Place, Internet Café, Library or Public Access Point? Please make 'Yes' or 'No' bold and underline it in both the sections.

Also would you like to access the following services utilising home Internet connection in the future as well? Please make 'Yes' or 'No' bold and underline it in the last column.

Online services	From Home	From Work Place, Interne Café, Library	Would you like to use it in the future?
Email	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Instant messaging	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Online Chat	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Online News	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Job related research	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Look for product info	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Research for school or training	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Look for travel information	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Look for medical information	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Share computer files	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Create content (e.g. Web pages)	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Store/display/develop photos	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Store files on the Internet	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Download games	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Download video	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Download pictures	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Download music	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Download movie	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Download free software	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Video streaming/downloading	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Listen to music (streaming/MP3)	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Listen to the radio station	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Watch movies (downloading/streaming)	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Undertake online banking	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Online bill paying	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Purchase a product	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Purchase a travel service	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Online auctions e.g. e-bay	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Purchase groceries (household goods)	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Buy/sell stocks (online share trading)	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Play lottery	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Obtain information on hobby	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Use it for fun e.g. Web surfing	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Play online game	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
View or visit Adult content Websites	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Video conferencing	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Voice over Internet (VoIP)	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Online dating and matrimonial services	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Online lectures	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Collaboration with schoolmates	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Accessing e-government services	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No

[15] Has the use of the Internet increased, decreased or had no change on the amount of time you spend on the following activities? Please highlight your answer by making it bold and underlining it.

Watching television/cable/satellite	☐ Increased	☐ No change	☐ Decreased
Shopping in stores	☐ Increased	☐ No change	☐ Decreased
Working at home	☐ Increased	☐ No change	☐ Decreased
Reading newspapers/books/magazines	☐ Increased	☐ No change	☐ Decreased
Working in the office	☐ Increased	☐ No change	☐ Decreased
Commuting in traffic	☐ Increased	☐ No change	☐ Decreased
Spending time with family	☐ Increased	☐ No change	☐ Decreased
Spending time with friends	☐ Increased	☐ No change	☐ Decreased
Attending social events	☐ Increased	☐ No change	☐ Decreased
Time spent on sport	☐ Increased	☐ No change	☐ Decreased
Time spent on hobbies	☐ Increased	☐ No change	☐ Decreased
Time spent on sleeping	☐ Increased	☐ No change	☐ Decreased
Time spent alone (doing nothing)	☐ Increased	☐ No change	☐ Decreased
Studying	☐ Increased	☐ No change	☐ Decreased
Household work	☐ Increased	☐ No change	☐ Decreased
Receiving/ making phone calls	☐ Increased	☐ No change	☐ Decreased
Doing charity and social works	☐ Increased	☐ No change	☐ Decreased
Outdoor recreation (DIY, pet care)	☐ Increased	☐ No change	☐ Decreased
Outdoor entertainment (concerts, cinema)	☐ Increased	☐ No change	☐ Decreased
Visiting or meeting friends or relatives	☐ Increased	☐ No change	☐ Decreased

[16] Are you aware about online Government Gateway?

☐ Yes ☐ No

[17] Have you registered with online Government Gateway?

☐ Yes ☐ No

[18] If you would like to enter the prize draw then please state your address below. If the candidate is successful, then the prize will be sent to the stated address by post.

Home Address.....

E-mail .....

Thank you very much for your valuable time and patience for completing this questionnaire!