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Investigating Broadband Diffusion in the Household: Towards Content Validity and Pre-Test of the Survey Instrument

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INVESTIGATING BROADBAND DIFFUSION IN THE HOUSEHOLD: TOWARDS CONTENT VALIDITY AND PRE-TEST OF THE SURVEY INSTRUMENT

RESEARCH-IN-PROGRESS

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Abstract

Studies on broadband diffusion are just beginning to emerge and exploratory in nature. Progress has been made to develop conceptual models to understand diffusion and adoption of broadband from the consumer perspective. However in order to test the conceptual model of broadband diffusion, a reliable survey instrument is yet to be developed and validated. Therefore, the aim of this research in progress paper is to perform content validity and pre-test a survey instrument. The objectives of this paper are: first, to ' identify' constructs and their respective items that adequately cover relevant dimensions of factors that affects consumers in the domain of broadband diffusion; second, to 'determine' whether the identified constructs and respective items sufficiently cover relevant dimensions of the factors affecting consumers in the domain of broadband diffusion; and third, to conduct a ' pre-test' on resulting survey instruments in order to obtain feedback for improvements before finalising the questionnaire. Initial items for each construct were identified from both technology adoption literature and exploratory studies on broadband adoption. Validation of the identified items was then performed employing variations of a quantitative approach to content validity. The findings obtained from content validation are then presented and discussed thereafter. Finally, the paper is concluded by emphasising the limitations of content validation and setting the future research direction towards investigating broadband diffusion in the household context.

Keywords: Broadband, diffusion, Adoption, Survey Instrument, Content Validity, Quantitative approach, Pre-test

1 INTRODUCTION

The widespread availability and diffusion of broadband are considered to be measures of international competitiveness and national economic growth (Sawyer et al 2003, Oh et al 2003). In order to appreciate the socio-economic benefits that broadband offers, governments of many countries including the United Kingdom (UK) have established ambitious targets for the deployment and diffusion of broadband services to the consumers and end users (BAG, 2003; National Broadband Task Force, 2001; Office of Technology Policy, 2002; Office of the e-Envoy, 2001). Nationwide efforts from the UK government and competition amongst the Internet service providers (ISPs) have made broadband access widely available at affordable prices (Choudrie and Lee 2004). However consumers' demand for it has not yet increased as expected (OECD 2001, Crabtree 2003). This suggests that the current growth and diffusion of broadband are 'demand constrained' and not 'supply constrained' (Crabtree 2003). The issue of demand constraints provides researchers with a motivation to investigate the issues related with broadband adoption and diffusion.

Studies on adoption and diffusion of broadband are just beginning to emerge (Oh et al 2003, Stanton et al 2004) and are exploratory in nature (Choudrie and Dwivedi, 2004ab). Progress has been made in developing conceptual models to understand consumers' adoption (Dwivedi and Choudrie, 2004) and diffusion (Choudrie and Dwivedi, 2004c) of broadband. However, in order to test the conceptual model of broadband diffusion a reliable survey instrument has yet to be developed and validated. Validating the data collection instrument is a critical step before testing the conceptual model. This is because the rigour of findings and interpretations of positivist, quantitative research is based on solid validation of the instruments that are used to gather the data (Boudreau et al 2001, Straub et al 2004).

The aim of this research-in-progress paper is to conduct content validity and the pre-test a survey instrument for broadband diffusion research. Specifically, this paper aims to achieve the following three objectives. First, to *identify* constructs and their respective items that adequately cover the relevant dimensions of factors those affect consumers in the domain of broadband diffusion. Second, to *determine* whether the identified constructs and respective items adequately cover relevant dimensions of the factors affecting consumers in the domain of broadband diffusion. Third, to conduct a *pre-test* on the resulting survey instruments in order to determine if the questions are understandable to the participants and to obtain feedback for improvements.

By achieving the set objectives, the contributions of this research-in-progress paper are to provide a reliable measure to the academic and practitioner communities who hold a particular interest in the study and management of broadband diffusion from the household consumer perspective. The survey instrument developed in this research paper is expected to provide assistance to practitioners from the telecommunications industry that is interested in determining how to improve its current strategies for increasing consumer base. This can also help policy makers in minimising the digital divide by understanding the reasons of non-adoption and accelerating the diffusion process. This paper also contributes to theory by confirming the application of the content validity approach in a new context.

Having introduced the topic of interest, this paper now proceeds to offer a brief discussion of previous research work that has addressed broadband diffusion in Section 2. Section 3 offers a brief review of the content validation procedure**.** Section 4 presents a brief discussion of the research method followed to conduct content validation and a pre-test study. The findings of the content validation and pre-test study are then presented and discussed in Section 5. Finally, the limitations and future research directions of this research are offered in the concluding section 6.

2 PREVIOUS RESEARCH WORK

This study followed the definition of various terms such as broadband, consumer and diffusion provided in previous study (Choudrie and Dwivedi 2004); however, due to the imposed word count, these are not described within this paper.

Recently, few studies focused on consumer level adoption in the household context have appeared (Oh et al 2003, Choudrie and Dwivedi 2004 a, b). Oh et al (2003) study examined the role of experience in building attitudes towards broadband adoption and use in the South Korean context and did not include the behavioural intention variable. Stanton (2004) analysed secondary data from the perspective of American consumers. This research examined the digital divide and emphasized an understanding of the demographics and other factors affecting the broadband adopters and non-adopters (Stanton 2004). Choudrie and Dwivedi's (2004a) study examined the factors affecting broadband adoption within UK households and also investigated the role of socio-economic attributes in broadband adoption (Choudrie and Dwivedi 2004b). However the instrument validation and model testing were not the focus of the aforementioned studies.

Studies in the usage area have been in the form of user surveys that have examined the broadband users' behavior in comparison to that of the narrowband users. Results from these surveys suggest that Internet users behave differently when they have broadband access. Broadband users use the online facilities on a longer basis, utilize more services or applications (Carriere *et al* 2000, Horrigan *et al* 2001, Bouvard and Kurtzman 2001, Anderson *et al* 2002, Dwivedi and Choudrie 2003a, Lebo 2001, 2003), make more online purchases and procure more varied categories of products in comparison to the narrowband users (Carriere *et al* 2000, Dwivedi et al 2003b). Although the former studies examined the usage of broadband, they lacked theoretical underpinnings, as they are data led and exploratory in nature. Understanding the impact of broadband usage on the consumers' daily life is still untouched by previous studies.

From the aforementioned analysis of broadband adoption and usage studies, it appears that although researchers have begun to investigate broadband diffusion from the consumer perspective, the conducted studies are still in exploratory in nature. Without employing the validity measures, including, content validity to develop a reliable survey instruments, the findings and interpretations may or may not correspond to an actual situation. This research is still in progress and should lead towards a confirmatory study by developing and validating survey instruments using the content validity approach.

2.1 Broadband diffusion construct

The constructs included in this study were adopted from the framework of broadband diffusion proposed by Choudrie and Dwivedi (2004). The framework of broadband diffusion (Choudrie and Dwivedi 2004) is derived from the model of adoption of technology in households (Venkatesh and Browns 2001) and innovations characteristics (Rogers 1995). Although a detailed discussion on each construct is not possible within the scope of this paper, a list of constructs is provided in Table 2.

3 VALIDATION IN IS RESEARCH: CONTENT VALIDITY

Although utilization of statistical techniques including content validity, pre-test, pilot study, construct validity, reliability and statistical conclusion validity is critical in maintaining rigour in IS research, the application of these, particularly content validity, is undermined in the majority of IS studies (Boudreau et al 2001, Straub et al 2004). Since content validity is a main focus of this study, more discussion on it is provided in the following sub sections.

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). In general, content validity involves evaluation of a new survey instrument in order to ensure that it includes all the items that are essential and eliminates undesirable items to a particular construct domain (Lewis 1995, Kitchenham and Pfleeger 2002, Boudreau et al 2001, Straub et al 2004). Although content validity is a highly desirable and recommended practice in order to ensure rigour in any empirical research (Straub et al 2004), its application is limited in IS research (Straub et al 1989, Boudreau et al 2001, Straub et al 2004). Examples of a few studies that have utilised the content validity approach are Davis (1989), Moore

and Benbasat (1991), Kappelman (1995), Lewis et al (1995), Smith et al (1996), Storey et al (2000), Torkzadeh and Dhillon (2002), Kim et al (2002), Gefen and Ridings (2003However, it is not yet employed in any of the previous studies, which focus upon broadband diffusion and adoption related issues.

Although only two approaches that comprise judgemental and statistical are available to determine content validity, its 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 judgemental approach to establish content validity involves literature reviews and then follow-ups with the evaluation by expert judges or panels. The validation of the items is based on a high degree of consensus amongst expert panels or judges the items in question; therefore, it is judgemental in nature (Davis 1989, Moore & Benbasat 1991, Smith 1996, Storey et al 2000, Boudreau et al 2001, Torkzadeh & Dhillon 2002, Kitchenham and Pfleeger 2002, Straub et al 2004). An empirical or quantitative approach was first introduced by Lawshe (1975), which 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 termed as 'face validity' (Wacker 2004). However it is not always possible to have many experts of a particular research topic at one location. This poses a limitation to conduct validity on a survey instrument when experts are located in different geographical areas. Contrastingly, a quantitative approach may allow researchers to send content validity questionnaires to experts working at different locations, whereby distance is not a limitation. 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). This is because broadband diffusion studies are still emerging in nature; academic experts are few in numbers and located in different places. Therefore bearing these issues in mind, the procedure of the quantitative approach pursued in this research is provided in the next section.

4 RESEARCH METHOD

Content validity of the broadband diffusion instrument was performed employing a quantitative approach (Lawshe 1975). With regard to IS research, this approach has been successfully applied to validate information resource management instruments (Lewis et al 1995). In order to validate content of broadband diffusion survey instruments by utilizing the quantitative approach (Lawshe 1975, Lewis et al 1995) the following steps were followed. A sample of items for each construct was identified by employing an exhaustive review of literature on generally, technology adoption, specifically, broadband adoption and diffusion. The literature review led to identification of a total of 95 items for adoption, 38 items for usage and 43 items for impact related constructs. A content validity questionnaire was then generated that comprised definitions of constructs and associated items on a 1-3 scale. The identified experts engaged in broadband diffusion related research were then approached. A total of 12 academic experts were identified on the basis of publications in journal and leading conferences (10 experts) or their engagement (2 experts) to the research area related to broadband diffusion. The content validity questionnaire was then sent to the experts via email attachments. The purpose of the study and instructions to complete the questionnaire were detailed in the covering email. The experts were requested to rate each item's relation to 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 items were not understandable or if items need to be reworded or new items need to be added. Responses from all experts were then collated by counting the number indicating "essential" for each item. For the each item the CVR was estimated and evaluated for a statistical significance level of 0.05. This was done employing Lawshe's (1975) method that was mentioned in the above paragraph. Those items eliminated from the list that were not significant at the 0.05 level. The list of items along with CVR values is presented and discussed in section 5 (see Tables 1 and 2).

A pre-test of the resulting instrument was conducted with respondents from broadband industry (3), an IT manager of a county council (1), academics and researchers (10) and household consumers (6). The respondents were asked to judge whether they could understand the wording of the questions and to suggest improvements. The outcomes of the pre-test are provided in the following section.

5 FINDINGS AND DISCUSSIONS

Due to the space limitation an inclusion of the complete list of items with CVR and the final questionnaire are not possible within this paper. However, a brief summary of CVR is provided in Tables 1 and 2. The CVR questionnaire comprised a total of 175 items. From the 175 items, 95 belonged to adoption, 37 to usage and 43 impact related constructs. The findings presented in Table 2 illustrate that from the 95 items from the adoption domain, 40 were considered essential to include in the final questionnaire by the majority of respondents, as the CVR value was significant at the 0.05 level. From the total of 43 impact related items, only 10 considered essential. However all 37 usage items are considered essential. Table 2 illustrates the overall items, average CVR and average mean for each construct. From the overall 17 constructs, 5 constructs had no items significant at the 0.05 level. Also the experts commented that the constructs were not essential to investigate broadband diffusion. Furthermore, since most of the people had access to the Internet either at the work place, educational institutions, library, or Internet café, constructs like Trialability do not have much relevance. The average CVR value for the remaining 12 constructs fell 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 construct universe (Table 2).

CVR	**AI**	**UI**	**II**
0.90-0.99	5	32	0
0.80-0.89	10	5	2
0.70-0.79	0	0	0
0.60-0.69	12	0	4
0.50-0.59	13	0	4
0.40-0.49*	0	0	0
0.30-0.39*	18	0	4
0.20-0.29*	0	0	0
0.10-0.19*	11	0	4
0-0.09*	13	0	5
Total	82	37	23
RLH	13	0	20
Grand Total	95	37	43
Legend: ***= Not Significant, **RLH** = Items that rated essential by less then half participants, **AI**= Adoption Items, **UI**= Usage Items, **II**= Impact Items			

Table 1. Summary of content validity ratio

Constructs	**TI**	**SI**	**ACVR**	**AM**
Behavioural Intention	3	2	0.83	2.83
Relative Advantage	9	4	0.61	2.79
Utilitarian Outcomes	14	7	0.69	2.88
Hedonic Outcomes	4	3	0.78	2.89
Service Quality	13	5	0.73	2.80
Primary Influences	4	3	0.57	2.78
Secondary Influences	4	2	0.75	2.88
Requisite Knowledge	6	3	0.61	2.69
Skills	7	3	0.56	2.61
Facilitating conditions	9	5	0.70	2.78
Usage	37	37	0.98	2.99
Impact	43	10	.634	2.77
Total	157	87	---	---
Legend: **TI**= Total number of items, **SI**= Number of significant Items, **ACVR** = Average content validity ratio, **AM**= Average mean				

Table 2. Summary of constructs, TI, SI, ACVR and AM

The experts also provided a number of suggestions regarding rewording the items. These suggestions were incorporated during the pre-test questionnaire design. However due to the space limitations the discussion on the improvements is not provided within this paper. Also the experts 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 1-5 scale and have more choices to select. This prevents a respondents' bias by just selecting a neutral value. Therefore, 1-7 is considered to be the Likert scale for the final study. The experts who evaluated the content of the instrument belonged to several countries, namely, the UK, Denmark, the USA, Australia and Canada. Therefore, the content of the questionnaire is not only valid to the UK, but to the aforementioned countries as well. Therefore, in order to conduct a comparative study it may possible to pre-test and further validate

the questionnaire in the context of a number of countries such as the USA, Australia, Canada and EU member states.

The findings also suggest that the content validity experts rated essential mainly those items that were adopted from the previous exploratory studies on broadband adoption (Oh at al 2004, Choudrie and Dwivedi 2004) and usage (Horrigan and Rainie 2001). In contrast the items adopted from the general technology adoption studies (Davis 1989, Taylor and Todd 1995) were mostly rated but considered not essential. Therefore this study confirms that the items investigated in the exploratory studies are important to understand the consumers' broadband adoption and usage behaviour.

The respondents from the pre-test studies supported the content of the questionnaire. However they noticed a few spelling and typographical errors. The respondents also expressed concern about the length of the questionnaire. They suggested that the current questionnaire length is extensive and may lead to a low response rate. Therefore the length of the questionnaire should be reduced without losing the measurement content. Following the responses from the pre-test participants, a number of changes have been incorporated within the final questionnaire.

5.1 Remaining research work

To complete the confirmatory study that will investigate broadband diffusion, the next step is to conduct a pilot test of the questionnaire using respondents from a target population. The primary aim of the pilot will be to determine the initial response rate, ensure appropriate levels of the initial scale reliability. Further, the pilot could establish any difficulties that respondents could face when completing the questionnaire. For example, whether the questionnaire's length, wording and the instructions were adequate enough to complete the questionnaire (Moore and Benbasat, 1991). Following the pilot test an appropriate sample frame will be considered in order to select the survey participants. In the context of the UK, the electoral register is considered to be the most appropriate sample frame, especially, if the researchers are planning to conduct a postal survey (Rice 1997). This is because it will provide an exhaustive list of people living in the country and also regular updates will be provided. The sampling techniques will be determined according to the type of sample frame. For example, if one has to draw a random sample from the electoral register, it is appropriate to consider a stratified random sampling technique. This allows selection of the participants from each district, ward and sub ward. In order to generate enough data, determination of an appropriate sample size should be based on the initial response rate obtained from the pilot. Once the above steps are completed the questionnaires will be administered and monitored for response rates. If necessary, a reminder will be sent to the participants after two weeks. Late responses will be considered to examine for a non-response bias.

6 CONCLUSIONS

This research is an initial step towards a confirmatory study that examines broadband diffusion in the household context. Further, this study validated the contents of a survey instrument utilising a quantitative approach. It also pre tested the survey questionnaire that resulted from an approach containing content validation. Although this is an initial step towards the confirmatory study, the paper contributes to both theory and practice. This paper contributes to theory by confirming the application of the content validity approach in a novel context. The survey instrument developed and validated in this research paper will contribute to practice by assisting professionals from the telecommunications industry. This will be fulfilled by this research by demonstrating how an improvement to current services and the consumer base can be obtained. This can also provide assistance to policy makers by minimising the digital divide. Understanding the reasons of non-adoption and accelerating the diffusion process will achieve this. The final survey instrument will also help researchers interested in examining the diffusion of new electronic services such as e-government and other emerging communication technologies such as mobile Internet and wireless within household context.

6.1 Limitations and Future research directions

There were the following three limitations encountered whilst conducting content validity for broadband diffusion survey instruments. These are: first, locating the experts related to the specific research area; second, conducting content validity with experts located at different places; and third, the length of content validity instruments. Considering researchers located in other countries but working on similar topic could overcome the first problem. Sending comprehensible details about the purpose of survey and to answer their queries and clarifying the context of content validity could overcome the second limitation. Also, since the content validity questionnaire comprised a definition of each construct and related items, it increased the length of the instrument. For example, the content validity instruments in this study were 18 pages long. That discouraged many experts from participating in the content evaluation at a first instance. Since the number of experts who validated the content was few in numbers, the generalisability of finding is limited. However, conducting confirmatory study will overcome this problem and will provide opportunity to do further analysis on findings. Although this study is focused upon utilising quantitative approach, it is also advisable to employ qualitative methods such as observation and interviews to investigate the broadband diffusion. It will help to obtain in-depth and divers view of household adoption and will compliment the findings obtained from quantitative study.

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