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Abstract

Broadband has been introduced to the business community as a fast and easy way of exploiting the Internet. The benefits of its use (fast reliable connection, always on) are widely advertised and broadband diffusion is one of the items at the top of the agenda for technology related policies worldwide. In this paper, we argue that broadband research within small and medium size enterprises (SMEs) has not been studied enough. We examine diffusion of innovation (DOI) theory as a possible theoretical approach to the area but we believe as it is the case with similar technologies that DOI needs to be supported by a socio-technical framework. Thus, we proposed a framework for the examination of broadband diffusion to SMEs using notions from the social construction of technology theory. An initial application of the framework shows perception gaps between SMEs and other groups that could explain the lack of full use of the internet by SMEs today. We use data obtained from a field work carried out to apply this framework. We believe that our research can be useful for Internet diffusion studies in general and broadband in particular.

Keywords: Broadband, SMEs, DOI, social construction of technology (SCOT)
Introduction

Broadband is a relatively new phenomenon that has attracted some attention in the last few years. According to Firth and Kelly (2001), the term broadband has no established definition and varies from country to country. Broadband technology is an umbrella term which covers varying high-speed access technologies including Asymmetric Digital Subscriber Line (ADSL), cable modems, satellite, and Wireless Fixed (Wi-Fi) Networks. Broadband provides an ‘always on’ and faster Internet connection than dial up. It is an emerging technology that promises to improve Internet use. There are many benefits that have been related to the adoption and use of broadband such as productivity (Lee, 2002). Small/medium size enterprises (SMEs) in particular could experience growth from an increase in productivity resulting from greater process efficiency and improved information exchange (OECD, 2003). The United Kingdom (UK) government’s target was to have the most extensive and competitive market in the G7 by the year 2005 (Ofcom, 2004). Previously it seemed that the rate of adoption especially within the SME community would not match up with these expectations. According to Ofcom (2004), 68% of UK SMEs are connected to the Internet, of which 37% use broadband, 65% use narrowband, 23% use integrated services digital network (ISDN), 32% use a narrowband un-metered service, 21% use a narrowband metered service and 6% unsure of what type of narrowband connection they have. More recently however, 84% of SMEs use the Internet of which 73% use broadband (Ofcom, 2006). The numbers mentioned above provide information on the number of SMEs which have adopted broadband. However, there is little research on factors affecting broadband adoption.

There has been some provision of government initiatives aimed at improving broadband adoption by SMEs. The UK government sees broadband as the “next leap forward for the Internet” and expects SMEs in particular to benefit from the technology (BSG, 2004).

While we are not assuming that all SMEs will benefit from broadband, there are some possible benefits for SMEs that choose to take up broadband. One of the benefits is the ability to trade and conduct business electronically at a faster rate. SMEs could potentially experience large transactions costs savings and productivity improvements should they choose to adopt broadband (BSG, 2004). Potential benefits of broadband to SMEs and the government’s interest in promoting it makes it worthwhile to look into the different ways that broadband can be beneficial to them and factors influencing its effective uptake.

Broadband has been used for educational, financial and entertainment purposes. Its adoption may be influenced by a number of factors such as government policies, stakeholder interests, geography and demographics, cost and user benefits (Lee and Choudrie, 2002). In previous studies for home uses, emphasis has been put on the educational and entertainment benefits of adopting broadband (Choudrie et al., 2003a).

Broadband has also been stated to have a significant impact on users’ on-line habits. Dwivedi and Choudrie (2003) investigated the impact of broadband on users’ habits and Internet usage and concluded that with broadband, users spent more time online. According to Stanton (2004), users with access to broadband access the Internet a lot more often and for a greater variety of transactions than users with narrowband connection.

There has been considerable interest in home use of broadband to find out which broadband services should be made available to residential and commercial users (Aronsson et al., 2003). Stanton (2004) also carried out an investigation into factors affecting the adoption of the residential broadband connections to the Internet. The high cost and lack of content of broadband were identified as factors affecting the adoption. Despite all the interest in broadband, there seems to be little or no information on its use within the SMEs.

In addition to the fact that little research has been done on broadband and SMEs, Lee et al., (2003), highlight the fact that there is little research on how SMEs can adopt new technologies at a faster rate. Therefore, there is a need to look at theories that can analyse the phenomenon.

In this paper, we propose a framework for diffusion of broadband to SMEs. We start by looking at the innovation diffusion theory. In previous studies of diffusion of technologies, the innovation diffusion theory as presented by Rogers (1995) has been widely used to understand the reasons behind adoption of innovations. We argue that the diffusion theories are one-sided trying to identify characteristics of the innovation that would make the users adopt the innovation while the perceptions of other stakeholders are not taken into consideration. Thus, we examine the use of social construction of technology (SCOT) to help us examine the different viewpoints involved in the innovation diffusion process. We then investigate these viewpoints in the case of broadband adoption using empirical data.
The paper is structured as follows. In the next section we present an analysis of diffusion of innovations theory supported by the social construction of technology (SCOT) in order to present the proposed framework. In section three we present our research approach. In section four, the framework is discussed using fieldwork where representatives of the identified social groups were asked to offer their opinions, which will be analysed with a view to get a better understanding of broadband diffusion by SMEs. In section five we discuss the results and finally in section six, we conclude and offer recommendations for future research.

A framework examining the different viewpoints in the diffusion of broadband

Rogers (1995) defines innovation, as ‘an idea, practice or object perceived as new by an individual or other unit of adoption’ and diffusion as ‘the process by which an innovation is communicated through certain channels over time among members of a social system’. Additionally King et al. (1994) define diffusion as “the spread of the capacity to produce and/or use innovation, and its use in practice”. Roger’s theory has been used for the study of several technologies (Rajagopal, 2002; Karahanna et al., 1999; Kumar and Swaminathan, 2003). However, it also has been criticised for varying reasons (Elliot and Loebbecke, 2000; Kautz and Pries-Heje, 1996; Lyytinen and Damsgaard, 2001). For example, the theory is criticised for portraying diffusion as a simple linear process (Kautz and Pries-Heje 1996). It is argued that his view failed to sufficiently consider the relationship between suppliers and adopters and an active participation of potential adopters in the diffusion process. Beynon-Davies and Williams (2003) highlight the fact that technological diffusion is usually portrayed as a rational process but postulate that diffusion process is similar to broader social movements. Finally, Lyytinen and Damsgaard (2001) showed in their observations that complex technologies will not necessarily diffuse in a specific order.

In order to understand and explain how a new technology is adopted many studies have used the theory of diffusion of innovations developed by Rogers. According to his work an individual’s decision to adopt a new technology is a process that occurs over a period of time and consisting of a series of actions and decisions rather than an instantaneous act. This theory implies that businesses would decide to adopt an innovation mainly because of its characteristics, thus missing out other influences such as nature and size of business, background of business owners. Additionally, different views, opinions and agendas of various groups involved in the process of the adoption of an innovation are not adequately represented in the theory of diffusion of innovation (Papazafeiropoulou et al., 2005). In this paper we take a similar stand and we try to identify the different viewpoints in the innovation diffusion process. We believe this way we may identify possible gaps in perceptions that explains reasons for adoption or non-adoption. Thus we propose the use of social construction of technology (SCOT) (Pinch and Bijker, 1984) where the role of the various social groups in the production and use of an innovation is of great importance.

With SCOT, the development of a technological artefact is described as alternating between variation and selection, thereby resulting in a multidirectional model that contrasts linear models (Pinch and Bijker, 1984). In SCOT where the introduction of an innovation is faced with objections from different social groups, one seeks to find a solution that would make the innovation desirable for reasons that would supersede reasons for objections.

The point of SCOT is that the successful stages in the development of an artefact are not the only possible ones.

Steps involved in SCOT include:

- Identifying the relevant social groups
- Describing them in more detail
- Identifying the problems each of these groups has with respect to the artefact
- Around each of these problems, several variants of the solution can be identified.

This way of describing the developmental process brings out all the different kinds of possible conflicts. This model highlights the multidirectional character of a technological artefact. The interpretative flexibility of an artefact must be shown.

In this case, the technological artefact is broadband and there are different social groups (SMEs inclusive) involved in its diffusion. In our model, we propose to extend the innovation diffusion model
by identifying the different social groups involved in the diffusion of broadband as described in SCOT. We also use interviews to obtain the views of the different social groups in relation to the technological characteristics of the innovation.

In this study, we will base our model on the information systems variance model (Agarwal and Prasad, 1998; Cooper and Zmud, 1990; Crum et al., 1996) by examining compatibility, complexity and relative advantage as the attributes that are of the most importance in Information Technology (IT) innovations. We nevertheless extend this model by identifying the various social groups involved in the production and use of the innovation. Furthermore, as opposed to the aforementioned authors’ use of the perceived attributes in a positivist manner, we use the framework in an exploratory way, not explaining any relationship between the factors.

The social groups involved in the diffusion of broadband to SMEs include: the SMEs, the government, (Choudrie et al., 2003b, Office of the e-Envoy, 2001), professional associations (Intellect, 2003), Independent bodies striving for broadband adoption (BSG, 2004), private consultants (Philpott, 2004) and vendors (Cisilion, 2002; BTOpenworld, 2002). Vendors constantly portray broadband as much better than dial-up. They present the fact that broadband is better as common sense (Cisilion, 2002; BT Openworld, 2002).

**Figure 1A framework examining the different viewpoints in broadband adoption**

In the next section we examine and analyse the different viewpoints that shape the diffusion of broadband using the UK as an example of a dynamic broadband market.

**Research approach**

This research utilises qualitative research methods and adopts an interpretive stance. We do this in order to reflect the researchers’ efforts to identify multiple social groups and their interpretations.

Information systems research can be classified as *interpretive* if it is assumed that our knowledge of reality is gained only through social constructions such as language, consciousness, shared meanings, documents, tools and other artefacts. Interpretive research does not predefine dependent and independent variables, but focuses on the complexity of human sense making as the situation emerges (Kaplan and Maxwell, 1994). Interpretive research methods aim at the “understanding of the context of
the information system and the process whereby the information system influences and is influenced by the context” (Walsham 1993) (p. 4-5).

This paper explores broadband diffusion to SMEs using data obtained from interviews conducted in England in 2006. Using available literature, we identified the relevant social groups involved in broadband diffusion. Of these groups, we then selected representatives to collect empirical data. We interviewed fifteen SMEs, one vendor, one private consultant and one employee of a government agency. Twelve of the SMEs that were selected are currently using broadband. Some of these used dial-up previously while others have only used broadband for Internet access. The SMEs businesses range from furniture sales, to estate agents, Internet cafes, uniform wholesalers, training institutions and travel agents. The reason for selecting such SMEs was to represent the various categories of industries that SMEs can be involved in.

The interviews were conducted between April and May 2006 and lasted between 15-40 minutes. In each meeting we used an interview guide which contained 9 questions for each of the social groups. These questions covered themes relating to the diffusion attributes previously mentioned and were open ended to glean more information than was anticipated.

This is a pilot study that will be further examined in future research. In the next section we present an analysis of the different views obtained from the field work.

Analysis of broadband diffusion

As we mentioned previously, the various groups associated with the diffusion of broadband have differing views about its attributes. These views are presented below.

Compatibility

This attribute is the degree to which broadband, as an innovation, is seen to be consistent with existing values, needs and past experiences of SMEs as the potential adopters. The vendor like the interviewee from the government agency felt that all SMEs would find broadband integral to running their businesses. In contrast however, in the private consultant’s opinion, broadband would not suit all SMEs and “would only be of benefit with suitable training in the advantages the Internet can bring to a business.” The vendor said that broadband is easy to install and integrate into SMEs existing systems “Installation of our services is very simple. With plug and play devices the setup process would be completed within about 2 minutes. There are very little details that are customer specific so the human intervention is limited”. Similarly the interviewee from the government agency said that: Hardware is cheap and provided you get the right support you really shouldn’t have any problems using broadband. For some of the SMEs however, they thought having broadband installed would be too costly for them. Some SMEs felt broadband was very useful as it helped to save money on the cost of communication. For example, a furniture supplier used broadband connection to send and receive invoices and make online orders for stock while another furniture supplier said he had no use for broadband. This shows some disparity in the views of the social groups regarding the compatibility attribute of broadband.

Complexity

This is described as the degree to which broadband as an innovation is perceived as relatively difficult to understand and use. The interviewee from the government agency opined that all SMEs would benefit from using broadband. In his words “Competition is using broadband and so should you. You should do it to keep up with them or they’ll take your business away.” However, he felt that using broadband would create some adverse issues for the SMEs: “they have to develop new skill set such as using the internet to transfer files and things like voice over IP as well”. The vendor in contrast thought that using broadband was quite easy and that “SMEs would wonder why they waited so long to use it”. Some of the SMEs were quite happy using broadband while one of the SMEs was experiencing a problem with his broadband connection while the interview was going on and did not know what to do about it. Another SME, which had previously used a different vendor, had a problematic service for 3 months and did not know what to do at such times. The interviewee said: “Unfortunately, the connection wasn’t working properly and despite several attempts to contact the company we did not get them to fix it and that messed up business for 3 months”. Again, the social groups do not view complexity of broadband in the same light.

Relative advantage
This is described as the degree to which an idea which an innovation is perceived as being better than the idea it supersedes and is usually expressed in terms of economic profitability, social prestige or other benefits. The vendor says that broadband is better than dial up. Similarly, the interviewee from the government agency agreed that broadband is definitely better than dial-up because “it is flat rate and a lot quicker”. He however raised the issue of susceptibility to viruses: “They will have to deal with the fact that using broadband will make them more vulnerable to viruses and privacy issues as well”. The private consultant also thought that broadband was better but that economic benefits would not emerge immediately. “If they have been using dial-up, very easy if it’s a new user to the internet there is probably a 12 month period until usage is optimised”. The SMEs that used dial-up previously also agree that broadband is better than dial-up. Unlike the other attributes, there is a general consensus on the relative advantage attribute of broadband. Apart from the security issues raised by the interviewee from the government agency, the social groups agree that broadband is better than dial-up.

In the next section, we discuss the results from this analysis.

Discussion

In this research, the views that have been sourced from the social groups show the differences in the way broadband is perceived. The innovation is seen as the next big thing by both the vendors and the government. As a result several government policies and initiatives have been aimed at broadband diffusion (BSG, 2004). From the data collected, the SMEs do not share these views and it does not seem that they have been impacted by these initiatives. Training was a point that was raised by the private consultant. He said the SMEs would not realise economic gain from using broadband if they were not trained on the advantages it could give. The SMEs that were interviewed had not received any funding nor had they received any training on the advantages using broadband could give. This was evident among the SMEs even though they were using broadband, they only used it to send and receive mails and a few used it to upload and send pictures but only one of them had considered trading online and only two were using VoIP. This leads to the conclusion that broadband has not necessarily changed the way the Internet is used. Further investigation will be necessary to determine whether more SMEs would adopt broadband if they knew all they could use it for and how beneficial, in economic terms, it could be.

Broadband providers, the UK government and other interest groups have continually stressed the importance of broadband but with little results where SMEs are concerned. There are many factors that could influence SMEs in deciding whether or not they would adopt a new technology such as broadband. In this research, we have considered three main innovation attributes of broadband and have looked at the different social groups and their views about these attributes.

Relative advantage seems to be the only attribute where there is a general consensus among the social groups. Nevertheless the government agency employee raised the issue of security because SMEs susceptibility would be heightened with the use of broadband. On the issue of compatibility and complexity the SMEs that have adopted broadband use it to send and receive mails. A few others use it to make purchases. However, the vendor and the government agency interviewee say broadband provides several other advantages such as flexibility to change existing practices, target new customers, greater productivity, improvement in business processes, and greater independence while allowing them to take advantage of associated technologies. The SMEs seem to be unaware of these advantageous uses.

We analysed the perceived attributes of broadband and the different views of the social groups involved. We argued that the perception gaps between different social groups could explain reasons for adoption or non-adoption. Our initial findings show that in the case of broadband adoption and diffusion it seems that there is no consensus as to how the technology is useful, cheap or convenient for SMEs to use. There are a number of assumptions taken by the vendors and the government about broadband adoption that seem to not be shared by SMEs. This seems to be mainly due to a lack of awareness from the SMEs about the benefits of broadband and its opportunities for e-business. Our research showed that was one issue that needs to be further analysed.

Awareness

The vendor raised the issue of awareness and this has been mentioned by the interviewee from the government agency but the SMEs that have adopted broadband did not do so as a result of awareness programmes aimed at them. Some other issues came to light which were not included in the framework
guiding this research and they are equally related to lack of awareness. Such issues include cost and funding, full use, quality of service and access.

Cost
The cost of obtaining broadband was a recurring issue in the interviews conducted. Many of the SMEs that had not adopted broadband said it was an unnecessary expense. The government agency interviewee said that cost might have been a deterrent originally but that the cost of obtaining broadband has reduced significantly in recent times. While the vendor was of the opinion that as a result of costs, SMEs might want to cut corners: “Some users are initially looking for the cheapest package, but don’t realise that they are losing quality”. The cost of obtaining broadband would also require further investigation because in the literature review the government and vendors all say it would save money on the long run. If SMEs were shown how broadband could save them money then their response could possibly be different.

In section two we revealed that there are government initiatives to fund broadband adoption by SMEs. However, the SMEs that were interviewed said they had received no funding and were unaware of any such initiatives. The government agency interviewee agreed that funding was available but was unavailable in some urban areas. Further research would require investigation into the kind of funds available to SMEs and how the government agencies decide which SMEs get funded.

Full use
Previously, in section five, we mentioned that there are several advantageous uses for broadband. These include opportunities for e-business, efficient data back-up, video conferencing and Voice over Internet Protocol (VoIP). The SMEs that were interviewed have been using broadband to send and receive mails while a few others use it to make purchases. This shows that SMEs are not making full use of broadband. Further research will be required to determine if the lack of full use is due to a lack of awareness and if training will improve the use possibly resulting in a better uptake of the technology thereby providing opportunities for expansion and growth through e-business.

Quality of service
Another issue that came up and was not previously considered by our framework is quality of service. The vendor mentioned quality as a reason to select a broadband provider carefully. Some of the SMEs that were interviewed have experienced poor quality of service from their broadband providers. One of the SMEs was experiencing a problem with his broadband connection while the interview was going on and did not know what to do about it. Another SME, which had previously used a different vendor, had an epileptic service for 3 months and did not know what to do about it either. Such experiences would possibly deter other SMEs who would have otherwise decided to adopt broadband.

In terms of the application of SCOT in this paper we started by identifying the relevant social groups and have made an initial attempt to see their viewpoints. The UK government set out to have the most extensive and competitive broadband adoption in the G7 by 2005 and sees broadband as the next leap forward for the Internet (BSG, 2004). They expect SMEs in particular to benefit from its adoption. From the data we have collected the social groups have differing viewpoints on the issue of broadband diffusion. The SMEs that have adopted broadband have done so for communication purposes and the SMEs that have not adopted feel they have no use for it but the government and vendors think there are numerous beneficial uses. This leads to the conclusion that broadband has not necessarily changed the way the internet is used. On the issue of costs as well, funding is available but none of the SMEs interviewed have benefited from it. Drawing from one of the elements of SCOT (Pinch and Bijker, 1984), closure can only be achieved if the government and vendors educate the SMEs about the benefits of broadband. The SMEs also have to be informed about the types of services provided by vendors and the initiatives available to them should they decide to adopt broadband. Then the SMEs can make an informed choice to adopt or reject.

Conclusions/Further research directions
We have looked at broadband and its adoption by SMEs in the UK. We presented our research approach and discussed the framework using fieldwork where representatives of the identified social groups were asked to offer their opinions, which we analysed to get a better understanding of
broadband diffusion to SMEs. This led us to the conclusion that broadband has not necessarily changed the way the Internet is used.

Considering the usefulness and inherent limitations of the diffusion of innovations theory, we developed a model based on the first three innovation attributes (Agarwal and Prasad, 1998; Cooper and Zmud, 1990; Crum et al., 1996). This model uses innovation attributes and takes into consideration the various social groups and views that are related to broadband uptake by SMEs using SCOT.

Future research will include consideration of awareness under which we will look at cost, full use and quality of service and the perceptions of the social groups on these issues. We will also be considering the views of the two social groups that have not been represented in the pilot study. We believe that our research could be useful for SMEs considering adoption of new technologies such as broadband as well as policy makers that seek to apply effective technological adoption policies as well as researchers in the field of innovation diffusion.

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