BROADBAND TECHNOLOGY IN THE OFFICE: AN APPRAISAL OF THE PERCEPTION AND NEEDS OF OFFICE OCCUPIERS AND THE POTENTIAL IMPACT UPON THE OFFICE MARKET

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ABSTRACT

Rapid advances in bandwidth communication specifications have made possible a range of different working practices. Occupiers are now demanding high levels of broadband technology within their offices, providing fast and uninterrupted data connectivity. There is a heightened awareness of the potential for broadband technology, with a large amount of technical data available regarding the different technologies.

This paper examines current office occupier perceptions and needs for existing and future bandwidth and whether the use of broadband technology is changing existing working practices in a sub-sector of the UK office market. The paper identifies that the property profession will be well advised to maintain a close 'watching brief' in respect of on-going technological advancements, to promote and understand the future implications of improved broadband technology in respect of the office market. Whilst this paper refers to research undertaken in the UK, it also considers whether wider international lessons can be drawn.

Keywords: Broadband technology, office occupiers, work practice, business efficiency.

INTRODUCTION

Globally, the information and communications technology industry has seen an unprecedented level of growth in the last few years, as mobile phones, internet, TV, satellite and cable are converging to offer a mix of new telecommunication services to businesses. This has resulted in businesses becoming under pressure from technological and commercial change, as the spread of new technologies and services has the potential to transform the way we work and change our working patterns and business behaviour. In the same way that the internet has changed the way business is carried out over the last few years, the new technologies may now have the potential to change business working practices radically and impact upon the use of offices.

The key catalyst for change is the availability of a greater information carrying capacity of a communications channel, known as bandwidth. Broadband is the 'road' upon which information travels. The higher the bandwidth, the faster the speed. There are three main classifications of bandwidth, known as narrowband, wideband and broadband.

Narrowband communications are slow, connecting to the internet over a phone line, typically using a standard modem with a speed of up to 64,000 bits per second (bps). Whilst this is still by far the most common method used by people to connect to the

internet, it is estimated that one third of user time on-line is spent waiting, reducing the convenience and ease of use of e-commerce (McKinsey, 2000). Wideband technology relates to speeds of transmission of over 64,000 bps and less than 2 million bps, and is usually based upon Integrated Services Digital Network (ISDN) technology. Broadband is a term generally used to describe a high-speed delivery of multiple channels of data and interactive services over a single communication medium, that is permanently 'always on'. Advantages of broadband technology include fixed pricing, the ability to handle large files of data and fast connection to the internet. Whilst definitions vary, the simplest definition of broadband is any speed of transmission over 2 million bps (Broadband-Help, 2001).

Broadband connections can be provided by various forms of broadband technology. The most common means of gaining broadband internet access over an ordinary telephone line is by using Asymmetrical Digital Subscriber Lines (ADSL). This technology provides access to the internet up to 40 times faster than a conventional modem (British Telecom, 2001). In order to gain access to this service, existing telephone exchanges need to be upgraded.

Fibre optic cable provides an alternative to ADSL technology, using dedicated capacity cables, providing permanent high capacity telecommunications links to businesses. These are linked into the backbone fibre optic network of a telecom supplier who provides broadband bandwidth for the transmission of data. Currently, this service is only generally available in the major business centres and areas of population, provided by way of leased lines.

The third type of broadband technology is broadband fixed wireless. This allows high speed data connections using radio links between an aerial located on the user's premises and a base station, rather than using a telephone line or a cable network. This method of transmission is particularly appropriate for the more remote rural locations, where there is no access to either ADSL or cable technology.

The fourth type of broadband transmission is by satellite. At the moment, some satellites in orbit around Earth can offer broadband services. However, data transfer has been traditionally in one direction only, i.e. from the network to the end user only and the technology is still in the early stages of mass delivery development (Ward, 2001).

The Australian Government's Commonwealth Department of Communications, Information Technology and the Arts (DOCITA) co-ordinates a whole-of-government approach to facilitating the growth and development of Australia's information technology and communications industry. DOCITA ensures that there is fast and reliable broadband access to Australia, provided by an extensive network of cables and satellites. Fibre optic cable is the predominant technology, supporting over 95% of the 'backbone' network. Satellite networks are used to mostly service regional and rural areas. As a result of this extensive network, business users in the major cities have a choice of networks, access to significant bandwidth and route diversity (Axiss, 2002). In 1999, a regional survey conducted by the National University of Singapore rated Australia's telecommunications sector as the most competitive in the Asia Pacific region.

In summary, the market for higher bandwidth and broadband is at a very early stage of development. It has been put forward that business users will take a lead in deciding which services and which technologies will succeed and that the next generation of broadband will be services provided at speeds of 10 million bps and over. The UK Government predicts that all employment sites with over 500 employees, 65% of sites with 250 - 500 employees and 15% of all sites with 100-250 employees will require broadband access at rates of at least 10 million bps by 2005 (Office of the e-Envoy, 2001).

THE IMPACT UPON BUSINESS

Since the introduction of new broadband technology over the last few years, the growth of the number of business users has been significant. As a result of these technological changes, new widespread working practices are emerging for office occupiers, as the new technology allows the operation of a more flexible and remote workplace. Working practices, such as hot-desking (to select any work station on a first-come, first served basis), hotelling (reserving a work station in advance with full support), home-working and working from a virtual office (effectively a laptop with connectivity used anywhere) are now becoming far more commonplace (Almond, 2001; RICS Foundation & Gerald Eve, 2001). Empirical evidence from the above research confirms that these practices are having an important impact upon the use of office space.

The impact of broadband technology upon global organisations has already been significant, as it allows for the introduction of a new range of working practices. These new practices include the operation of the 24-hour office, the effective use of video-conferencing and the fast transmission of large amounts of electronic data between offices on a world-wide basis. It has also allowed the breakdown of geographical restrictions enabling business users easy access to services provided abroad. Speed and the transmission of large volumes of data are not the only attractions of broadband technology. Since the 11th September 2001 terrorist attacks in America, it is predicted that the use of video-conferencing and audio-conferencing may increase as businesses reduce business travel (France, 2001). In addition, some employers may decide not to concentrate their workers and data in a single location, and this may increase the need for fast uninterrupted communication inter-site links via broadband technology.

Jones Lang LaSalle's recent survey of the New Economy (2002) canvassed more than 350 technology companies in 10 technology-orientated cities in Asia Pacific, North America and Europe. Their report confirmed that access to the worldwide internet backbone is clearly the most important issue in the New Economy. Sufficient bandwidth in the location and within the building is not a preference, but an absolute requirement. In addition, 25% of the companies surveyed operate a 24-hour, 7-day focus. The report concludes, *inter alia,* that broadband connectivity is crucial and both fibre and wireless will become essential building and location components for all office occupiers.

A report from McKinsey, 'Broadband Changes Everything' (2000), underpins the view of office occupiers. The report concludes that:

> *"To those who still think we are making excessive claims for what is basically a faster way to do things we can already do, we would say that a car is just a faster version of a horse and carriage, and a computer merely a faster mechanical*

calculator. If broadband applications have a fraction of the impact of either of these, they will indeed change everything".

CURRENT DEMAND FOR BROADBAND TECHNOLOGY

So far, the demand for broadband services has been concentrated mostly in the major urban conurbations and amongst larger business users and the higher education sector (Bray, 2001). Drivers for change include the reduced pricing of bandwidth, the relative growth in the popularity of high-speed leased lines, the increased adoption of the internet and the proliferation of computer applications requiring high bandwidth capacity. These factors appear to have led to a large growth in the use of broadband technology over the last two years. As a result, there is recent evidence to suggest that small and medium-sized businesses are now rapidly acquiring broadband connections, as well as the larger business users.

Whilst there appear to be no up-to-date published data available regarding the number of large business broadband users in the UK, a recent report published has concentrated upon the impact of broadband technology upon small and medium-sized enterprises (SMEs), defined as having less than 250 employees. Oftel's most recent UK survey (2001) found that 61% of SMEs had internet access as at September 2001. The majority of small businesses use an ordinary phone line and modem, whilst medium-sized businesses are more likely to use ISDN or leased lines. Only approximately 5% of internet connected SMEs claim to be using ADSL, cable or leased lines. 90% of users are satisfied with the overall quality of service they receive from their provider.

Huw-Davies (2001) considers that the take-up of new broadband technology for SMEs is slower than for large businesses and organisations, as SMEs often do not have Information Technology managers. He considers that this means that they lag behind their corporate counterparts in terms of acquiring new technology, as they lack the skills to understand what it is they should be acquiring and the time to investigate fully. They also find the up-front capital cost of new technology prohibitive.

The King Sturge Connectivity Report (2001) states that the demand by office occupiers for bandwidth services in the UK continues to grow exponentially. Their research shows that the index of connectivity, which provides indicative data of the speed at which internet connections are made, increased by over 600% in the last two years, as office occupiers search for better internet access speeds. Their research indicates that the average office user in the UK in 2001 is connecting at close to 1 million bps, which equates to a year-on-year growth in average access speeds of nearly 230%. 42% of their sample has broadband access, as compared to 30% of the sample who have modem access.

The widespread use of broadband technology in Singapore is well documented by the Singapore Government. It is estimated that there are 400,000 broadband users in the country (The Infocomm Development Authority of Singapore, 2002). The Government has invested heavily in broadband technology infrastructure and announced in 2001 the launch of a $30 million programme aimed at stimulating the creation of broadband value-chains to increase broadband penetration and usage for business users in Singapore (Singapore Government, 2001). The Work Environment Initiative encourages the development and deployment of broadband infrastructure access services, in order to

encourage businesses to use broadband as a high-speed advanced communications infrastructure.

Businesses in Australia are also significant users of broadband technology. A survey in 2000 indicated that 92% of small businesses (employing between 25 and 99 persons) and 99% of businesses employing over 100 persons have access to the internet. Internet access was highest in the property and business services sectors. It is estimated that there is currently 346,000 commercial broadband users in the country (Australian Bureau of Statistics, 2002).

A recent report on information technology use in New Zealand states that approximately 79% of businesses use the internet (New Zealand Government, 2001). There are no published statistics available in New Zealand to confirm the current number of commercial broadband users. In contrast, the United States of America Government has recently completed a major study on how Americans are expanding the use of the internet. Their findings show that 41.7% of businesses use the internet, with the use of broadband telecommunications increasing rapidly (U.S. Department of Commerce, 2002).

REVIEW OF LITERATURE

The impact of information and communications technology (ICT) developments on the office sector has been well documented in recent years. The attitudes to the effects of ICT developments on the demand for offices have also been researched (Garbett, 2000). None of this is, however, specific to the use of broadband technology, with the exception of Almond (2001), who comprehensively considers the implications of broadband technology upon the UK office market, concentrating upon the provision of broadband services, changing working practices and the issue of technical obsolescence. However, there appears to be a dearth of published literature concerning the perception and needs of office occupiers in respect of broadband technology. It has therefore been necessary to rely upon mostly unpublished and superficial literature to research the subject area.

The perceived advantages and benefits of broadband technology to businesses are clearly documented by many broadband suppliers (Telstra, Cable & Wireless, British Telecom *et al*, 2002) within their marketing literature. These advantages include improved business efficiency, with no wasted time, always on-line access improving customer service, increased productivity, with reduced costs, and the ability to use a variety of communication services enabling remote working.

There is evidence that demand for fast and uninterrupted broadband internet connectivity by office occupiers is resulting in landlords providing added-value services with their properties (France, 2001; Barnes, 2001). A number of landlords are now equipping or 'lighting' as it is known as in the telecommunications industry, their buildings with broadband connectivity in order to deliver added value to occupiers. The aim is to enhance the landlord's service to the tenant, to ensure that buildings are more competitive and generate additional income to the landlord. SMEs particularly benefit from a landlord's supply, as they may lack the economy of scale of larger organisations. Usual arrangements for the use of a leased line include a flat fixed cost, guaranteed speed of delivery, dedicated lines and technical support. Some services also include an

'e-valve' which allows users to increase the megabytes needed on any one day for activities such as videoconferencing and the back-up of data.

Barnes (2001), however, reports that over the last 12 months, a number of major US telecommunication companies, such as Broadband Office, Allied Riser and First Mark Communications, have ceased their proposed major roll out plans on a global basis. Reasons given include their plummeting share values and the cultural differences relating to the office sectors in different countries. Barnes reports that UK broadband providers are now also taking a cautious approach and that there is still little evidence of a broadband revolution as the take-up of services is slow by occupiers.

The UK Government's Report, "UK Online: The Broadband Future" (Office of the e-Envoy, 2001) indicates that businesses are rapidly adopting wider intranet procedures, increasing the use of information and communication applications relying upon broadband technology. In particular, the report predicts that collaborative working, videoconferencing and large-volume file transfer across sites will drive the demand for greater bandwidth. It considers that this is true for businesses of all sizes, whether inter-site communication is across large corporate networks, multi-site SMEs or between homes and office as a result of flexible working practices. It reports that business to business e-commerce and the development of 'digital trading environments' are also factors driving the take-up of broadband services. It also predicts that the price of higher bandwidth services is unlikely to be a hurdle to its uptake. The report concludes by forecasting that the growth in demand for bandwidth will be significant.

Fletcher Advisory has recently published "A Survey of the Impact of Broadband on SMEs in the UK" (2001), working in conjunction with British Telecom. This report provides some useful research findings relating to the impact of broadband technology upon small and medium sized business users, with less than 100 employees, and provides some useful background information for this research project. The research concentrated on how these smaller businesses use the new technology in practice and their general attitude towards broadband. It aimed to establish which of the specific functions of broadband was most valued. The general survey results very clearly demonstrate that most SMEs are very enthusiastic about broadband and its benefits, with 47% of the sample reporting improvement in company productivity now, and 78% of the sample expecting improvements within the next 2 years. 35% of the sample stated that the new technology had saved them money, and 69% of the sample expected more savings in the future.

The survey indicates that the use of broadband technology increases employee satisfaction. 49% of the sample stated that their employees were happier at work since the implementation of broadband technology, and 69% expected this in the future. The principal explanation for this has to do with giving people the tools they need to do their jobs adequately. For example, the increased bandwidth has ceased the frustration caused by not being able to access the internet instantly, or being unable to send or download large files.

The research indicated that for most SMEs, the real benefit of broadband technology is seen in what the connectivity allows you to do, rather than any specific product features. 41% of the sample valued the 'always on' feature of broadband the most, as compared to 40% who rated the high-speed feature the highest. The flat fee / capped cost feature

was stated as the most important feature by only 19% of the sample. The report concludes by forecasting that, by 2005, approximately 40% of all SMEs will be connected to the internet via broadband technology.

The RICS Foundation and Gerald Eve "Overcrowded, Under-utilised or Just Right? Office Space: How Much is Enough?" Report (2001) provides some useful findings in respect of the effects of the introduction of new working practices upon the use of office space. Almost two-thirds of the respondents in the survey indicated that the use of new working practices, such as home working, hot-desking and hotelling, had a positive effect on business operating efficiency. The virtual office had been adopted on at least an occasional basis by 21% of staff within the survey. Home working was the most popular new working practice indicated in the survey, with 21% of staff undertaking it on at least an occasional basis. Hot desking was used by 24% of the staff surveyed on an occasional or permanent basis. The survey indicates that this practice is growing in popularity, as 38% of the organisations surveyed had implemented this working practice in the last two years alone. Home working was the most popular new working practice, used at least occasionally by 42% of the staff surveyed.

Research by the author (Spurge, 2001) in respect of the impact of information technology in the home in the UK indicated that there is a significant proportion of workers who work from home on a permanent or occasional basis. Of the sample of home occupiers canvassed, 45% have members of the household who work from home on a regular basis. Of this sample, 19% for up to 5 hours per week, and 31% between 10 to 20 hours per week. 13% worked from home on a full time basis. The research also indicated that working practices are changing, as 62% of the current non-home workers canvassed hope or intend to work full or part-time from home within the next two years. Of the sample currently working from home on an occasional basis, 34% hope or intend to extend their working hours from home within the next two years.

RESEARCH METHODOLOGY

It is evident that minimal empirical work exists in the area of evaluating the perception and needs of office occupiers in respect of broadband technology, and the potential impact upon the office market. The aim of the research was therefore to provide empirical evidence to assess the potential to incorporate broadband technology into new and existing offices and, in particular, to understand occupier perceptions of the benefits and implications upon their working practices. In addition, the research attempted to address whether the increasing use of broadband technology and resulting changes to working practices will have a significant effect upon the level of future demand for office accommodation.

The Thames Valley Corridor, which is located to the west of London, and centred upon Berkshire and the towns of Reading, Slough and Maidenhead, and Heathrow Airport, was selected as the geographical area for the sample. It is a major established office location and, in recent years, the Thames Valley Corridor has attracted a wide range of new office occupiers, to include existing office occupiers either relocating from Central London or multi-national companies setting up new UK headquarters. In particular, there is a dominance of IT, value added finance and business services and telecommunications businesses in the area (Insignia Richard Ellis, 2001). This location

could be compared with other similar office locations, such as North Ryde in Sydney, Silicon Valley in California and Suntec City in Singapore.

It is widely reported that the Thames Valley Corridor has been amongst the most buoyant economies in the UK. The office market has experienced strong rental and capital value growth over the last two years (Lambert Smith Hampton, 2001). The rate of urban growth in Berkshire is one of the highest in the UK, with a projected change from rural land use to urban land use at a rate of over 2% from 1991 – 2016 (Department of the Environment, 1995). It is also reported that over the next five years, economic forecasts suggest that the Thames Valley Corridor economy will grow at a faster rate than that of other areas of the south east of the UK (Thames Valley Economic Partnership, 2001).

250 detailed questionnaires were submitted to the information technology directors of a wide range of businesses and organisations, all employing more than 50 employees. The questionnaire contained 12 questions. The sample comprised a cross-section of office occupiers in a number of office sub-sectors, such as financial services companies, public sector organisations, professional firms and research and development companies. 86 questionnaires were returned, representing a response rate of 34%. The questionnaires were piloted upon a sample group of businesses. As a result of their responses, selective alterations were made to the content of two questions included within the questionnaire.

RESEARCH FINDINGS

The questionnaires were sent to a wide variety of businesses and organisations in the Thames Valley corridor. The first question explored the nature of the office occupiers canvassed.

**Question 1: What is the nature of your business or organisation?**
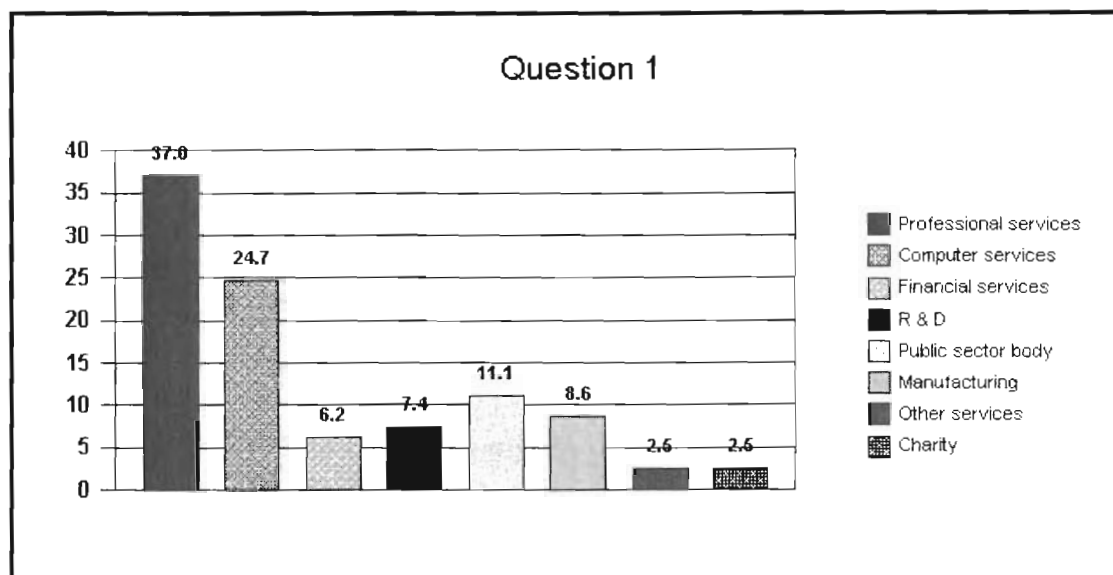
* Vertical axis is percentage in each category

The range of occupier response was not unexpected, roughly reflecting the office occupier profile of the region and providing a reasonable balance of office occupiers from a spread of businesses and organisations. The professional services companies canvassed comprised mostly law and accountancy practices, management consultants and other professional and business consultants. The computer services companies represented the second largest sub-sector, which is not surprising, as the Thames Valley corridor is sometimes regarded as "The Silicon Valley" of the UK (Lambert, Smith Hampton, 2001). It was also considered important to seek the views of non-profit making organisations, such as local authorities, charities, health authorities and government departments located in the region, in order to gain as wide and unbiased view as possible from a range of office occupiers. The research and development organisations and businesses canvassed all worked in office accommodation, rather than in laboratory or manufacturing premises.

Whilst it had been intended to only target the research at office occupiers with over 50 employees, the sample range was as follows:

Question 2: How many staff are employed within your business or organisation?
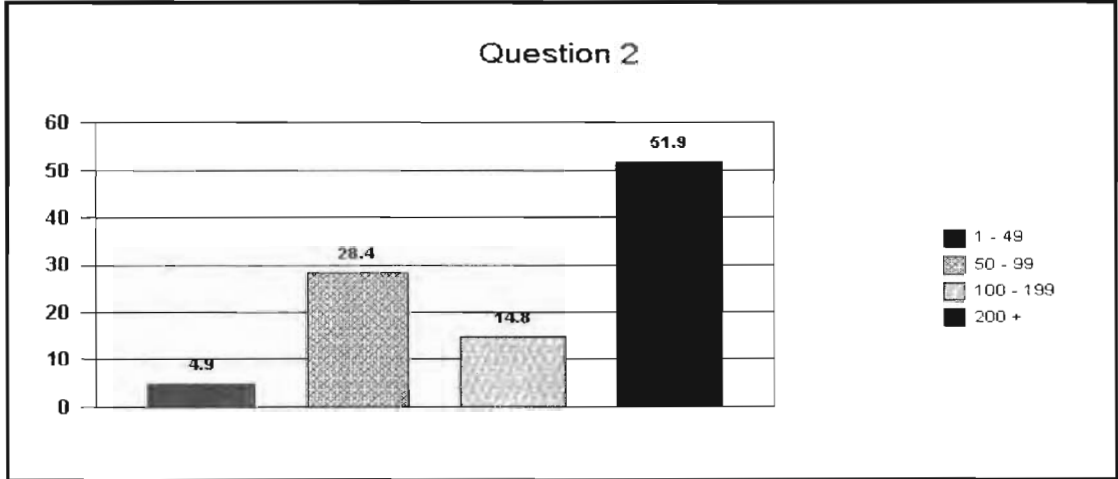
* Vertical axis is percentage in each category

As there appears to be negligible published evidence relating to the importance of the transmission of electronic data to office occupiers, the following question was asked:

Question 3: How important is the high speed and high capacity of the transmission of electronic data to your organisation?
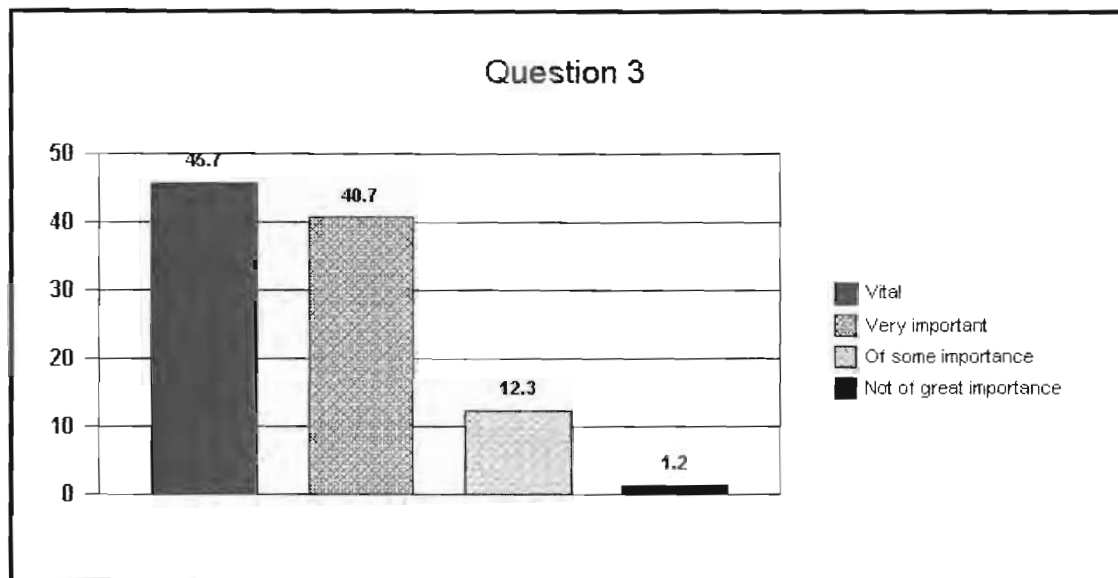
Question 3

* Vertical axis is percentage in each category

The response to this question indicated the extent to which broadband technology is now being used by organisations and businesses. Over 86% of the respondents considered it to be vital or very important. There is, of course, an argument relating to bias, in so far that it could be argued that the questionnaires were mostly returned by the respondents who had an interest and experience in the use of broadband technology. There is a risk that parties canvassed who had little or no interest or requirement for the transmission of electronic data and / or the use of the internet would not be inclined to respond. However, this strong positive response indicates that broadband technology is of great importance and relevance to office occupiers.

The computer services, R&D and financial services companies comprised the three sectors that stated that broadband technology was vital to their business. Comments written against the answer reinforced the vital importance of high speed connectivity:

".... our business is now totally reliant upon internet connections."

" ... five years ago, we needed internet access for only a few functions, now we need it for all our services."

In general terms, charities and public sector bodies considered that it was not of great importance.

The next question was aimed at establishing the current bandwidth adopted by office occupiers.

Question 4: What is your business or organisation's current IT bandwidth specification?

Current IT bandwidth

Legend:
- Narrowband
- Wideband
- Broadband
- Leased line

Values: 4.9, 17.3, 76.5, 1.2
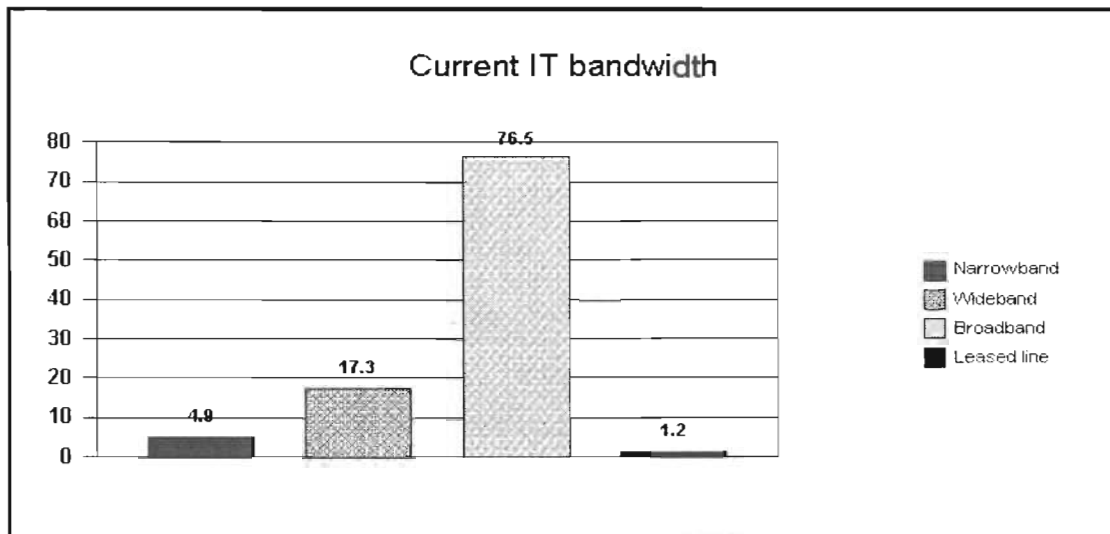
* Vertical axis is percentage in each category

The research indicates that over 77% of the respondents are currently using broadband technology. The use of narrowband is very small, but perhaps is of no surprise, given the size and nature of the organisations canvassed.

There appeared to be a significant proportion of the sample with broadband connections well over 2 million bps. Several respondents stated that their current bandwidth capacity was around 8 – 10 million bps.

Factors influencing office occupiers to change from narrowband and wideband technology to broadband technology, as highlighted by the respondents, appear to include the following:

- The relative high cost of ISDN lines.

- Poor customer support.

- Frequent disconnection.

- Lack of speed.

- The need to use new software applications.

71% of the sample were satisfied with the performance and use of their current bandwidth.

Problems reported relating to the use of broadband technology included the following comments:

"... the implementation process takes too long, to include procurement, installation and commissioning."

"... we have problems sharing leased lines, in terms of accessibility at peak times and poor customer service."

"... security is the big issue, especially relating to the threat of hacking and viruses."

"... sometimes our shared leased line does not allow us to download large amounts of information."

The need to regularly upgrade to keep up with the rapid increase in the demand for wider bandwidth was raised by a number of respondents. In particular, problems appear to arise when new software applications are installed, requiring wider broadband bandwidth technology.

63% of the sample are considering upgrading their bandwidth within the future. A frequent response was that the demand for wider bandwidth is rapidly increasing. In the case of organisations and businesses, who already have broadband technology, it appeared that many were considering the widening of their bandwidth to achieve greater bandwidth and capacity. Bandwidth speeds of up to 10 million bps were quoted as being used or required.

A number of respondents wrote comments relating to the need to frequently review their bandwidth, such as the following:

"... we need to upgrade continually to keep up the rapid change in our software programmes."

"... demand is continually outstripping capacity."

"... there is a need for flexible bandwidth capacity, namely steady bandwidth for most of the time but higher bandwidth, for say 20 mins or so for the file transfers."

Of this sample, 67% are proposing to upgrade their bandwidth in the next 12 months, and 28% within 12 months to 24 months. 94% of the sample intend to upgrade their bandwidth utilising broadband technology, and only 4% to wideband technology.

The cost of the new technology was raised by several respondents, with the following comments made:

"... we would like to move to broadband from ISDN but ADSL is not available and leased lines are too expensive."

"... we have investigated broadband but we cannot justify the expense. It costs too much."

"... we are not convinced that we need to upgrade our connections as it the costs do appear to be very high, so we will manage with our current bandwidth provision for as long as possible, hopefully until the prices come down."

"... the cost of leased line technology is too high in the UK causing a drag on the uptake of new technology."

Question 7: If your organisation currently has broadband bandwidth, please state what type it is:
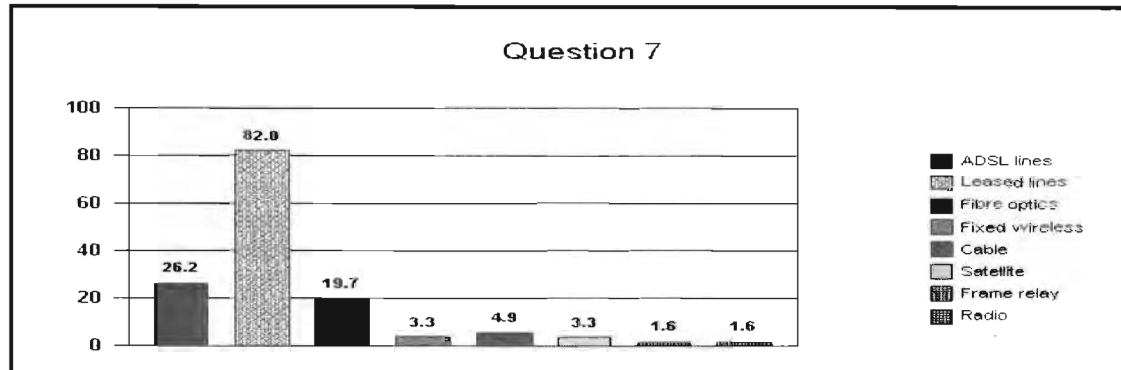
* Vertical axis is percentage in each category

The results of this graph indicate that there are a number of telecommunications companies providing leased cable lines in the Thames Valley Corridor. Major suppliers include British Telecom, Cable & Wireless and NTL. The use of leased cable lines dominates the survey, even though ADSL is widely available in the region. The results of the research confirmed that the computer, business and financial services sectors predominately used leased lines.

84% of the sample with broadband technology were satisfied with the service provided by their service operator. The sample was asked if they were intending to upgrade their system to increase bandwidth capacity. Of the positive responses given, 60% of the sample indicated that they would most likely obtain a service from a direct provider, and only 4% would consider joining a group provider. 36% of the sample were unsure.

A number of respondents stated that the geographical coverage of the availability of broadband has impeded the use of the technology. In particular, the inability to access ASDL technology was highlighted by 8 respondents.

Having established the basic information above relating to the extent of the use of broadband technology, the core research centred upon the occupiers' perceptions as to the impact of the new technology upon their working practices and their use of office accommodation. As a prerequisite to this, it was considered important to understand the occupiers' views as to their perceptions of the benefits of broadband technology, by asking the following question:

Question 10: The Benefits of Broadband Technology

The respondents, who had broadband technology, were asked to rank from 1 (highest) to 8 (lowest) their opinion as to the advantages of broadband technology. The lowest bars indicate the greatest preference expressed.

Mean scores for questions 10a to 10h
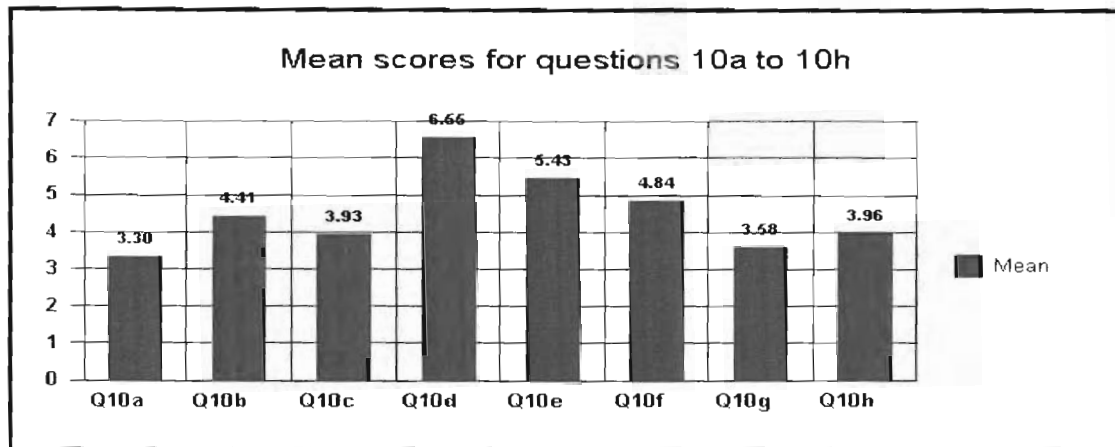
The results can be interpreted, as follows:

QUESTION 10 REFERENCE	AN ADVANTAGE OF BROADBAND TECHNOLOGY	RANKING
A	Fixed connection to the internet	1st
G	High speed delivery of data	2nd
C	Ability to handle large amounts of data	3rd
H	"Always on" instant internet access	4th
B	Fixed cost	5th
F	Enables remote working	6th
E	Enables new ways of doing business	7th
D	Ability to use a full range of multi-media	8th

The results of this question were expected. They appeared to reflect the secondary research, in so far that the fixed connection to the internet and the ability of broadband technology to transmit the high speed delivery of data are ranked by office occupiers as being the two main advantages of broadband technology. The benefits of broadband technology, in so far as changing the way of working and enabling remote working, is ranked lower than other perceived benefits. The advantage of the ability to use a full range of multi-media related to such applications as advanced software programmes and videostreaming. This appeared to be the least favoured advantage of broadband technology.

THE IMPACT ON BROADBAND TECHNOLOGY UPON BUSINESS EFFICIENCY

As there appears to be little published evidence in this area, the next question aimed to establish whether office occupiers' perceived that the new technology has a positive effect upon business efficiency and whether they considered that the procurement costs represented value for money.

It was suggested within the questionnaire that this could be measured by a range of business indicators such as profitability, return upon capital cost, productivity, lower costs or any other appropriate business indicator(s) appropriate to their business or organisation.

Two overwhelming responses were given from the respondents with broadband technology:

- 93% of the sample considered that it had had a positive effect upon business efficiency.

- 92% of the sample considered that the initial capital cost of installation had proved to be value for money.

The responses from all of the occupier sectors researched appeared to be equally weighted for this question.

Generally, the respondents appeared to have little specific evidence to support their response to this area of questioning. Two relevant comments generally sum up the general tone of the responses received:

"...it should be saving us money, as we pay a fixed cost for out internet connection, but we have not carefully checked this."

"...we have not looked at this area, but my guess is that it must be a more efficient use of our resources."

Further research is required to understand in what ways business efficiency has improved, during the second phase of the research project.

THE IMPACT ON BROADBAND TECHNOLOGY UPON WORKING PRACTICES

One aim of the research was to establish whether the way office workers undertake their work has changed since the introduction of broadband technology. The respondents with broadband technology confirmed a number of interesting insights into changing working practices which have resulted as a result of the introduction of the new technology, as follows:

- 81% of the sample with broadband technology confirmed that it had had a significant impact upon the working practices of employees within their office.

Question 11: Has your organisation or business initiated or increased the use of different working practices, on either an occasional or regular basis, since the introduction of the use of broadband technology your office?

The results of this question are set out below:

Working Practice	Use by Sample
Home working	62%
Hot-desking	43%
Hotelling	42%
Operating a 'virtual' office	40%
Videoconferencing	18%

The close weighting given to the use of hot-desking, hotelling and operating from a virtual office confirms that office workers are now adopting a range of new working practices, although home working appears to be the dominant practice.

Written comments by respondents echoed the widespread use of new working practices, such as the following comments:

"... broadband is more useful for individual home working staff than for group use on the office environment."

"... we are currently undertaking a review of how we regulate home working to enable more staff to do so."

"... we have increased the number of work stations dedicated for our staff who visit on an occasional basis by 50% this year. Next year we may need for more as we are encouraging staff to work from home if they want to do so."

IMPACT OF BROADBAND TECHNOLOGY UPON FLOOR SPACE REQUIREMENTS

In order to gain a crude assessment as to whether there is any correlation between the use of broadband technology and the amount of office accommodation occupied by an office occupier, the following question was asked:

Question 12: Has the use of broadband technology had an impact upon your office floorspace requirements?

Question 12
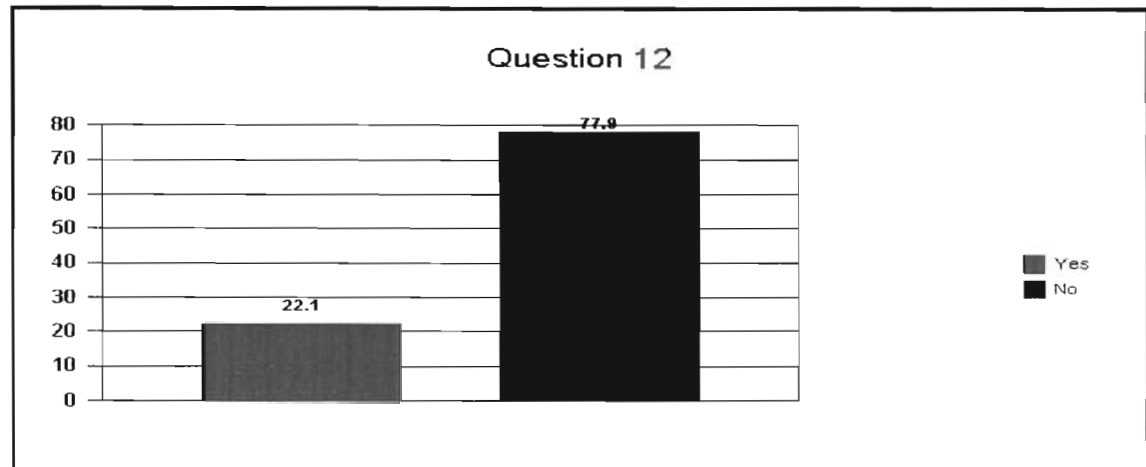
* Vertical axis is percentage in each category

Of the respondents who answered positively:

- 46% stated that they had the need for more office space. Of this sample, 80% stated that this was for space within their existing site, rather than in another location.

- 54% stated that they had the need for less office space.

In particular, it appeared that the financial services and the computer services companies canvassed considered that they had the need for more office space. The R&D and public sector organisations appeared generally to require less office space.

However, further research is required in this area, as the respondents provided very little insight into reasons why there was a need for more or less office accommodation. In particular, research needs to be conducted to establish whether the requirement for the additional use of office accommodation specifically relates to the use of broadband technology, rather than because of other drivers for growth.

CONCLUSION

Whilst there is a wide range of technical information available concerning the availability of broadband technology, there is limited published evidence relating to office occupiers' perceptions regarding to the use of broadband technology. This is matched by a lack of empirical evidence available to establish current and future broadband needs of office occupiers.

Evidence gathered for this study indicates that office occupiers greatly depend upon the high speed and high capacity transmission of electronic data for the operation of their businesses and organisations. In addition, a high proportion of the office occupiers canvassed already have broadband technology. They regard it as particularly beneficial for the high speed delivery of electronic data and the 'always on' fixed connection to the internet.

There is also little published evidence available concerning the impact of these technological changes upon existing working practices of office occupiers. The findings of this study indicate that new working practices, such as hot-desking and hotelling, are being frequently adopted by office occupiers and that home working or working from a 'virtual' office is now an established working practice.

Commercial property advisers and office developers should not ignore broadband technology. The importance of understanding the latest technology and keeping up to date with technological improvements is crucial. Slowly, a standard broadband specification is evolving for office properties, as both investors and occupiers decide what level of bandwidth is required and the preferred channel of communication. As office occupiers become increasingly dependent upon broadband technology, they will demand a greater bandwidth provision in office buildings, as part of the standard institutional specification provided by the landlord. There is evidence that this is beginning to happen, as landlords form strategic alliances with telecommunication companies.

Commercial property advisers appear to becoming aware as to the potential impact of these technological changes upon the demand for office accommodation. A number of the major global property consultancies have recently producing market reports and research bulletins referring to the availability and use of broadband technology. The commercial property consultancies will be well advised to become more technologically aware and to understand the broadband needs of office occupiers. Awareness is also required to be aware of the cultural changes in business behaviour resulting from changing working practices evolving from the use of broadband technology.

Commercial property advisers also need to maintain a 'watching brief' over future broadband developments to fully understand the future implications of broadband technology upon the office market. As working practices appear to be changing to embrace the opportunity for remote working, the way we use office accommodation is also changing. There is a need to research the full impact of these changing working practices upon the location, specification, size, layout and use of office accommodation.

It is important to recognise the limitations of this survey. As the study concentrated upon only one sub-sector of the office market in the UK, further research is required to establish whether the evidence gathered may be regarded of relevance to other conurbations and regions of the UK and on a wider international basis. It is therefore proposed to widen the primary research to other similar high technology and office markets in a variety of countries in the Pacific Rim region, to establish the perception and needs of office occupiers in respect of broadband technology in different office locations.

It is proposed that future research will also concentrate upon a more detailed examination of the impact of broadband technology upon changing working practices. An assessment will be made of the potential impact of these changes upon the level of demand for office accommodation and the specification required by office occupiers, in a variety of selected number of world-wide office centres.

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