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### **Satellite Ireland: An Investigation of the Outcomes from a Government Sponsored Broadband Trial**

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#### **Abstract**

*Insufficient telecommunications bandwidth and the download delays that this causes impede the development and use of Internet applications such as multimedia for B2C commerce. The widespread adoption of broadband technologies would, it is predicted, fuel growth in electronic commerce. Such a deployment would allow consumers to embrace online retailing, telecommuting, distance learning, and all kinds of other bandwidth-hungry services. Given that so much is at stake with the successful adoption of broadband technologies the issue has public policy and economic implications. Governments can put in place policies and incentives that encourage the use of the Internet and in turn developing electronic commerce and ultimately economic growth.*

*This paper researches the outcomes of a government funded pilot implementation of satellite broadband technology, namely the Very Small Aperture Technology (VSAT). The main purpose of the government trial was to investigate the potential impact of a telecommunications broadband infrastructure. The technology was provided on a trial basis to three diverse geographically dispersed user groups. In-depth interviews were carried out with personnel in the Department of Public Enterprise – the government department responsible for implementing the pilot project. In addition, interviews were conducted with the three companies who participated in the broadband trial.*

*The research examines the electronic commerce opportunities presented to a region with the introduction of broadband, the experience the user has had with the technology and identifies the opportunities that have arisen as a result of using the technology. In addition, it outlines and explains the opportunities that have been exploited and those forgone and evaluates the importance and impact of this governmental pilot project to provide broadband connectivity.*

#### **1. Introduction**

The Internet has revolutionized the manner in which information is stored, exchanged and viewed, thereby opening up windows of opportunities for businesses that were previously inconceivable (Lawrence et al, 1998). It also fulfils the electronic payment process and facilitates marketing (Chou & Chou, 2000). However, e-commerce not only affects the

business environment but also society and the consumer (Dekleva, 2000; Turban et al, 2000). These benefits are the spin off effects of a global technology, which enables interactive communication to reach many millions of people at low cost. According to Rose, et al. (1999), even the smallest organization has the potential to market its products or services to hundreds of millions of people because of the Internet and the World Wide Web (WWW). But not alone market, the Internet also enables companies to deliver new products and services to consumers (Chou & Chou, 2000). Johnston & Mak (2000), claim that many companies are turning to the diverse range of Internet-based document distribution and presentation systems in a bid to include non-EDI compliant partners, suppliers and/or clients. They argue that the Internet is allowing the emergence of a new vision of supply chain management. The potential for real-time training and conferencing is another benefit associated with the Internet (Lawrence et al, 1998). Electronic exchanges improve sharing between buyers and sellers helping to lower the cost of logistics and promoting quick, just-in-time deliveries and reduced inventories (Bakos, 1998). Electronic marketplaces also support increased personalization and customization of product offerings plus support the aggregation and disaggregation of information-based product components to match customer needs and to support new pricing strategies (Subirane & Carvajal, 2000). The creation of electronic communities provides customers with the facility to exchange ideas and experiences on common interests (Turban et al, 2000). The Internet with its many unique characteristics has in addition the potential to facilitate various different auction methods enabling the seller to reach critical mass and facilitating immediate purchase at reduced search costs for the consumer.

## **2. Literature Review**

According to Hagel (1999) the real opportunity on the Internet is more than simply doing what you have always done cheaper and faster but rather to do things differently, uniquely leveraging the capabilities of this electronic platform. Grimes (2000) claims that major changes in the geography of economic activity can be attributed to the new information and communication technology. However there has been only limited progress made to date, especially in the diffusing of services in remote rural areas. Access to information is leading to a digital divide in terms of information rich and poor (Tan & Teo, 1999). E-commerce affects not only the commercial economy but also the social aspects of our economy. A spin-off from increased numbers working and shopping over the Internet has resulted in less air pollution and fewer traffic problems because of less auto traffic (Turban et al, 2000; Turban, McLean & Wetherbe, 1997). E-commerce facilitates the delivery of public services such as healthcare, education and government social services at a reduced cost and /or improved quality (Turban et al, 2000).

The Internet is often defined as a loose connection of thousands of networks (Oz, 2002; Turban et al, 2000; Rose, Khoo & Straub, 1999; Lawrence et al, 1998; Furht, 1995). In addition to these interconnected networks there are the interconnected backbones, which are characterized by their international reach ability, numerous access/delivery sub networks and various private and institutional networks (Turban et al, 2000). The Internet's backbone consists of the main communication lines, which carry the bulk of the traffic and is provided by the network service providers (Oz, 2002; Lawrence et al, 1998). Each network consists of at least one host or server that is connected to the Internet's backbone and several more computers, which are connected to this server. Due to the high capacity nature of the major networks the backbone is mainly made up of optical fibre but other options such as microwaves and satellite microwaves can be utilized (Oz, 2002). Unfortunately the benefits and opportunities are often offset by costs, threats and limitations engendered by these same web technologies that enable them (Rose, Khoo &

Straub, 1999). The non-technical obstacles to e-commerce are the social legal, regulatory and business hurdles associated with the adoption of e-commerce. Turban et al (2000) identify inadequate telecommunication bandwidth as a technical limitation. Therefore the impact of such benefits is based on having a sufficient telecommunications system, as customers demand faster and more reliable connections (Turban et al, 2000; Lee, O'Keefe & Yun, 2001). Download delays impede the development and use of Internet applications such as multimedia for B2C commerce (Rose, Khoo & Straub, 1999).

The widespread adoption of broadband technologies would, it is predicted, fuel growth in e-commerce. A survey conducted by Mercer Management Consulting in Washington D.C. in 1999, revealed that users with high-speed access search for information and purchase online at approximately double the rate of those with narrowband analog modems (Bane & Bradley, 1999). Such a deployment would allow consumers to embrace online retailing, telecommuting, distance learning and all kinds of other bandwidth-hungry services. It is predicted that this level of broadband access could boost the US economy to the tune of \$500 billion a year (Mehta, 2001). The broadband connection in Korea, the world leader in the deployment of broadband infrastructure, altered the Korean's surfing patterns providing them with a much richer online experience particularly in high audio and video usage (Lee, O'Keefe & Yun, 2001). Broadband technologies provide faster access than the commonly used dial-up modem and also provide for an 'always-on' connection, which will change the patterns associated with Internet usage making them the preferred infrastructure of e-commerce (Lee, O'Keefe & Yun, 2001).

However, infrastructure alone is not sufficient and for an economy to prosper, successful application services such as video, audio, email etc. will need to be developed (Bane & Bradley, 1999). As faster, greater capacity broadband technologies are introduced, useful and bona fide new services should also emerge e.g. new forms of gambling, distance education, telemedicine, delivery of customized video news to a screen in the kitchen wall, online entertainment calendars linked to reviewer's comments and ticket ordering menus, three-dimensional virtual tours through distant attraction and automated marketplaces where smart agents will buy and sell for you (Bane & Bradley, 1999). Multimedia applications can make a very dramatic impact on web based businesses, particularly in marketing, broadcasting, advertising, news and education industries through videoconferencing, personnel training and as an interactive mechanism between management and employees (Hashmi & Guvenli, 2001; Gunasekaren & Love, 1999). However believing that broadband will some day revolutionize home TV and video entertainment, Christofferson & Gatzke (2001) are not of the opinion that the current network infrastructures, technologies or cost structure will allow this to happen in the near future.

Another key area that broadband could impact on is that of education and training. As the Internet has grown academic institutions are expanding its use beyond research, introducing many advanced opportunities in teaching and learning (Parikh & Verma, 2002). In the developing world distance learning is cited as being a critical service (Hadjitheodosiou, Ephremides & Friedman, 1999). Internet technology may facilitate the distribution of course material and enhance instructor/student communications using email. Using video and animation both for lecture purposes and on the Web is one of the major advantages of computers in teaching (Hashmi & Guvenli, 2001). Telecommuting or teleworking refers to an arranged working condition whereby the employee conducts their regular working role at home or at a location more convenient than his/her regular place of work (Golob & Regan, 2001). There are many quality of life advantages associated with teleworking (Shamir & Solomon, 1985), such as increasing employment opportunities outside the stress of an urban location, reducing commuting for the out of town commuter, lowering pollution as a result of less traffic congestion and generally

improving the environment (Callanan, 1999; Turban et al, 2000). However similar to previously mentioned broadband application services, telecommuting is based on having universal low-cost telecommunications access (Callanan, 1999).

In addition to technical needs there exists also the need to be able to exploit the technology. As noted by Lee, O'Keefe & Yun (2001), based on the Korean study where the technology is in place, the increased Internet usage has not been converted into increased e-commerce activity. This has been attributed to the lack of innovation and the capacity to develop and exploit the broadband infrastructure. The Internet and the growth of capable and affordable computers and communication devices have made e-commerce the fastest growing sector of most western economies. In such an environment, lack of direction will result in business implementation inconsistencies (Rajput, 2000). To execute successfully a great deal of management time and resources are required (Kalakota & Robinson, 2000).

Zhang (2002) believes that with market forces alone, without the intervention of the government, the expansion of broadband services will form 'broadband islands' where the service will most likely be deployed in metropolitan, urban and populous areas. Government impetus is of great importance given that the role of the government can influence the diffusion of the Internet (Tan & Teo, 1999). Governments can put in place policies and incentives that encourage the use of the Internet and in turn developing e-commerce and ultimately economic growth (Tan & Teo, 1999). Two supporting pillars of all e-commerce applications and infrastructure are public policy and technical standards (Farhoomand, Tuuainen & Yee, 2000). In order for e-commerce to prosper within a country the government should adopt a role of support (Farhoomand, Tuuainen & Yee, 2000). Since the mid 1990's the Korean government have used policy-making mechanisms to ensure Korea is equipped with high-speed telecommunications. They have viewed this as the foundation of their knowledge based society (Lee, O'Keefe & Yun, 2001). The Government's telecommunications policy has been cited as the driving force behind the rapid penetration of broadband connections.

### **3. Research Methodology**

The primary research objective is to ascertain if increased bandwidth, provided under the aegis of Government support will influence the growth or otherwise of e-commerce activity. The sub objectives are to verify whether or not broadband is a driving force of e-commerce activity, determine the role of the government in the provision of broadband, identify e-commerce activities that have become possible as a result of improvements in the telecommunications infrastructure and to compare and contrast projects in order to determine success factors. The research was carried out on sites that were part of a government-sponsored trial of Very Small Aperture (Satellite) Terminal (VSAT) – a broadband access medium. The research method chosen for this study is a qualitative exploratory research design, primarily because exploratory research is about establishing trends, behaviours and patterns that are previously unknown. In depth interviews were carried out with the help of a semi-structured questionnaire to provide orientation and direction. This questionnaire was divided into four sections with each section based on an objective of the study. The interviews were conducted with the project coordinator of each of the four projects and the Government Official managing the Pilot Trial. Co-operation was requested by telephone.

#### **4. Case Study**

The Department of Public Enterprise (DPE) in Ireland holds responsibility for communications, energy and transport. In relation to the communication division, the DPE holds responsibility for telecommunications, cable and radio development and postal. The division's objective is to ensure Ireland is recognized as having an outstanding communications sector, aiming to contribute to sustaining national macro-economic growth and competitiveness. Currently Ireland is ranked 27<sup>th</sup> among the top 30 OECD countries for broadband connectivity (OECD, 2001). The Communications goals are currently guided by a vision of placing Ireland within the top 10% of OECD countries within the next three years. It is the intention of the Department that there will be widespread availability of open-access, affordable, 'always-on' broadband infrastructure and services for businesses and citizens throughout the state. This vision's success is dependent on the resolution of the challenge of the need to introduce and roll out affordable broadband services rapidly and to maintain and develop the core infrastructure. The recommended solution is to create competition between different networks and networks with different technologies (OECD, 2001). In January 2001, EU regulation requiring all 15-member states to unbundled access to the local loop came into force. However the Commission notes that progress regards Local Loop Unbundling in Ireland has been considerably slow therefore competition in the last mile has not been sufficiently developed (ODTR, 2001b). In Ireland access to broadband is poor for all but the larger companies located in Dublin (Forfás, 2001). According to a survey by the ODTR more than 60% of SMEs did not have Integrated Services Digital Network (ISDN) and approximately 90% did not have leased lines (ODTR, 2001).

Magaziner (2002) claims that in order for Ireland to become a leading world economy over the next two decades, Ireland must create a state of the art Internet infrastructure, providing broadband access to all business and virtually all homes. The availability of broadband telecommunications in all parts of the country with high capacity international links is a prerequisite for the development of the digital economy. Therefore, the Irish Government in a bid to prepare Ireland for the Information Society compiled an action framework which addressed issues such as the development of e-commerce and business opportunities, improving security concerns, electronic payment mechanisms, legislative and regulatory measures, creating public awareness, increasing ICT skills and improving the communications infrastructure. In relation to the latter, the plan identified priority areas that needed to be addressed such as international connectivity, regulatory issues, unbundling of the local loop and providing nationwide broadband access.

#### **5. VSAT Pilot Trial**

This paper investigates the impact of one initiative funded by the Department and launched in July 2001 - the Very Small Aperture (Satellite) Terminal (VSAT) Pilot Trial. This Pilot Trial was established to support and accelerate the implementation of the Information Society in Ireland. The initiative involved the deployment of VSAT technology in a number of diverse user communities. The Call for Proposals was open to all players in the ICT sector who were capable of providing suitable VSAT infrastructure and application services (VSAT Pilot Trial Call for Proposals). All sites received government funding for the installation of the VSAT equipment and one PC, with one exception, which received funding for the VSAT installation and 20 PCs. The sites also receive funding from the Government to cover the first 12 months prearranged service charge. All 35 sites were fully deployed with VSAT in December 2001. The Government chose this method of achieving broadband over other possibilities such as 3G, Wireless

LANs or cable modems as there existed in Ireland an embryonic satellite service, which could be brought into the limelight and it would bypass the local loop bottleneck. The Government also wanted to send a signal to the existing fixed line network operators that there are alternatives to their services and prompt them into action, into unbundling, into lowering prices and into addressing the need for getting access into rural areas.

VSAT is a platform, which uses satellite terminals upon which broadband application services and electronic commerce activity have the potential to advance and develop. VSAT offers satellite based, 'always-on' Internet access. A VSAT network consists of three components: a central hub, a satellite and a virtually unlimited number of VSAT earth stations. The user's computer is connected to the satellite dish generally located at the user's building. This dish sends and receives digital information to and from a satellite. The hub or earth station manages, controls and monitors the network. When a client requests data from the Internet, the client's local VSAT dish transmits a signal to the satellite, which passes the message onto the central hub. From here it is routed to the Internet. The data from the Internet to a local VSAT dish follows a reverse path.

Organizations within the Pilot Trial are all community related organizations either of charitable status, voluntary organizations or partially funded by the Department of Education. In all cases, budgetary resources were scarce and broadband access even less so. Some of the organizations participating are The Mayo Education Centre, Lake District Enterprise Ltd., Navan Education Centre and The West Offaly Task Force.

## **6. Findings**

The lack of broadband was hindering the development of these organizations and all participants sought VSAT as a means of bringing IT facilities and an Internet connection that would be faster and increasingly more reliable. The fact that the pilot trial was Government funded played a major role in the participation of these particular projects. The capital investment that the Government was providing made a significant difference, from the point of view of installing and introducing VSAT. Without the Government funding none of the organisations would have taken the financial risk of investing in the VSAT technology themselves. The funding reduced the risk factor allowing for experimentation with the technology. Prior to the pilot trial none of the organizations had heard of the VSAT technology. The technology was viewed as a means of enhancing how the participants conducted their business operations and in turn allowed them to be developed further. There was a belief that by demonstrating that VSAT worked and in turn demonstrating that the development of broadband application services, spin-off effects such as increased employment into the regions would occur.

The broadband facility has introduced huge changes in the area of training. Educational institutions that once focused training curricula on software package training are now able to conduct courses on the Internet and e-mail. This in turn has increased both the ICT awareness and the level of ICT skills of the people in the related vicinity. Comparing the broadband access to ISDN and PSTN connections, VSAT enables tutors to cover more material utilizing the Internet effectively. Faster access to the Internet has also helped to enhance existing projects – the reach of these projects can be extended. The VSAT access has also developed the potential of distance learning. In rural areas where schools were isolated geographically they can now interconnect via a satellite link. Additionally because of the broadband access a form of videoconferencing is possible. This system has the ability to reach increased numbers at decreased costs. Many of the community projects utilized the fast connection to the Internet for research purposes and to establish global links with similar community initiatives and related organisations. Rural libraries

and other public access points who previously only had a PSTN line, now offer commercial Internet access service to the public, which is fast, more reliable and is anticipated to be less expensive than the modem connection even in the absence of funding. Additionally phone lines are no longer tied up on data calls.

Depending on the different uses made of VSAT there have been different benefits identified. There are also spin-off implications that the technology has influenced. The increased awareness of the role ICT can play in educational facilities and community developments has resulted in even larger developments. Some of the projects have made further investments in bigger systems and networked their whole system with the VSAT technology as a result of the Pilot Trial. Having broadband access also influenced what equipment was purchased. Most projects purchased very high spec equipment, which had advanced functionality to make use of the VSAT technology when it came on stream. In relation to up-grading skills and enhancing employment opportunities, broadband access has also played a role. Some of the community initiatives trainees have gone onto third level education while others have entered the work-place more ICT aware.

Broadband does exactly what a narrowband PSTN line or an ISDN connection can do i.e. provide access to the Internet. But broadband access is much quicker, enabling users to do the same amount of Internet browsing in less time. Some of the projects stated that VSAT did not dramatically change business processes but just increased their speed and efficiency. Other projects felt that it has changed their business processes drastically. Prior to VSAT the opportunities that are now being exploited were not possible. How important VSAT is to the users appears to depend on what they ultimately use it for. For those sites that use it only to increase the speed of their activities, the broadband access is of little importance but for those where VSAT has made an impact, the service was deemed vital.

All of the sites studied were government funded; they were all supplied with VSAT, yet the technology had a more dramatic impact on some sites relative to others. The management structure of the sites is not the cause of the differences as all the sites have a similar managerial hierarchy consisting of a project coordinator whose role is to liaise with the DPE, individual sites under their management and the VSAT supplier and the site coordinator who works in close contact with the project coordinator to monitor the smooth operation of plans at ground level. It also became apparent that none of the users had any problems adapting to the new technology. In some cases the VSAT technology was transparent with only the increased speed of access noticeable.

In order for the optimal utilization of the technology to emerge, innovative and more advanced uses of the technology needed to be identified. In one project it was discovered that the technology was utilized solely for what the organization was always doing. The remaining projects utilized the technology for innovative uses generated by brainstorming sessions and vision. In these projects where there was a greater degree of freedom and experimentation provided by a visionary project coordinator, greater use was made of the technology. At this time, all sites want to keep the VSAT connection upon completion of the Pilot Trial. However the financial situation of the organization will play a large role in whether or not that occurs. The majority of projects are likely to scale back the service in that only selected users will retain their connection.

A result of the Pilot Trial is that all selected regions have a broadband connection that was previously considered not possible or not needed. It has transpired that because of the provision of broadband a need for it has been created and now because of that need there exists a demand for broadband.

## 7. Conclusion

Both organizations and regions have benefited from the Government sponsored VSAT Pilot Trial. These benefits include increased public access points, which are now faster and more reliable, training facilities have been improved, educational institutions are now making increased use of the potential of distance learning and the ability to use interactive audio, video and multimedia materials. The spin off effects have included increased ICT awareness in the more remote regions, more productive training courses, more educated people and children, social benefits for the users and with the possibility of providing broadband access via a satellite link the regions are now more attractive as a location for companies.

Without the support of the Government none of these organizations would have been able to take the risk of investing in this unknown technology. However providing the users with technology alone is not sufficient. In order for the project to be successful it needs a vision and someone to motivate, maintain and develop the vision throughout the project. The projects that did this had a higher level of e-commerce activity than those projects that didn't. It has also emerged that as people become more familiar with the technology they recognize additional uses for it, thereby also increasing the organizational reliance on the technology. By creating a substitute for fixed line terrestrial broadband the Government anticipates that market operators will be forced into accelerating the pace at which the local loop becomes successfully unbundled.

## References

- Bakos, Y., (1998), The emerging Role of Electronic Marketplaces on the Internet, *Communications of the ACM*. 41(8), 35-42.
- Bane, P.W., S.P. Bradley, (1999), "The Light at the end of the Pipe", *Scientific American*. 28(4), 110-115.
- Callanan. T.A., (1999), *New Ways of Living and Working Teleworking in Ireland*, Report of the National Advisory Council, Ireland on Teleworking.
- Chou, D.C., A.Y. Chou, (2000), A guide to the Internet Revolution in Banking, *Information Systems Management*. 17(2), 51-57
- Christofferson, S.A., M.A.Gatzke, (2001), Broadband media: Look before you leap, *The McKinsey Quarterly*. Issue 4, 48-58.
- Dekleva. S., (2000), Electronic Commerce: a Half-Empty Glass?, *Communications of the Association for information Systems*. 3(18), 1-99.
- Farhoomand, A.F., V.K.Tuunainen, L.W. Yee, (2000), Barriers to Global Electronic Commerce: A Cross-Country Study of Hong Kong and Finland, *Journal of Organizational Computing and Electronic Commerce*. 10(1), 23-48.
- Forfás; (2002), "Broadband Investment in Ireland Review of Progress and Key Policy Requirements Update 2002", <http://www.forfas.ie/publications/bband02.htm>
- Furht, B., (1995), Where Are information Superhighways Headed?, *ACM Computing Surveys*. 27(4), 552-557.
- Golob, T. F., A. C. Regan, (2001), Impacts of information technology on personal travel and commercial vehicle operations: research challenges and opportunities, *Transportation Research Part C: Emerging Technologies*, 9(2), 87-121.

- Grimes, S., (2000), Rural areas in the information society: diminishing distance or increasing learning capacity?, *Journal of Rural Studies*. 16, 13-21.
- Gunasekaran, A., P.E.D. Love, (1999), Current and future directions of multimedia technology in business, *International Journal of Information Management*. 19(2), 105–120.
- Hadjitheodosiou, M. H., A.Ephremides, D. Friedman, (1999), Broadband access via satellite, *Computer Networks*, 31(4), 353–378.
- Hagel, J., (1999), Net Gain: Expanding Markets through Virtual Communities, *Journal of Interactive Marketing*. 13(1), 55-65
- Hashmi, M.A., T. Guvenli, (2001), Multimedia Content on the Web: Problems and Prospects *Managerial Finance*. 27, 34–41.
- Johnston, R.B., H.C. Mak, (2000), An Emerging Vision of Internet – Enabled Supply-Chain Electronic Commerce, *International Journal of Electronic Commerce*. 4(4), 43–59.
- Kalakota. R., M. Robinson. (2000) *E-Business: Roadmap for Success*, Addison Wesley Longman Publishing.
- Kearney, A.T, (2000) *Positioning not Market Makers for Success*, Building the B2B Foundation.
- Lawrence, E., B. Corbitt, A. Tidwell, J. Fisher, and J.R. Lawrence. (1998) *Internet Commerce*. John Wiley & Sons, Brisbane.
- Lee, H., B. O’Keefe, K. Yun,. (2001), The Growth of Broadband Internet Connections in South Korea: Contributing Factors, 14th Bled Electronic Commerce Conference, Bled, Slovenia, 432–445.
- Magaziner, I., (2002), Presentation on the New Economy, Department of An Taoiseach, Dublin, Ireland.
- Mehta, S. N. (2001). How to get broadband moving again. *Fortune* 144(12), 207-211.
- Operation of Economic Cooperation and Development (OECD), (2001), *The Development of Broadband Access in OECD Countries*.
- Office of the Director of Telecommunications Regulation (ODTR), (2001a), *The Internet in Ireland – Communications Transmission and Delivery Issues*, Document No. ODTR 01/47;
- Office of the Director of Telecommunications Regulation (ODTR), (2001b), *The Irish Communications Market Quarterly Review*, Document No. ODTR 01/93;
- Oz, E. (2002), *Foundations of E-Commerce*. Prenticehall: New Jersey.
- Parikh. M., S. Verma, (2002), Utilizing Internet technologies to support learning: an empirical analysis, *International Journal of Information Management*. 22(1), 27–46.
- Rajput, W.E. (2000), *E-Commerce systems architecture and applications*. Artech House Publishers, Norwood MA.
- Rose. G., H. Khoo. D.W. Straub, (1999), Current Technological Impediments to B2C Electronic Commerce, *Communications of the Association for Information System*, 1 (16), 1-74.
- Shamir, B., I. Salomon, (1985), Work-at-home and the quality of working life: Some theoretical considerations, *Academy of Management Review* 10(3), 455–463.

- Subirana, B., P. Carvajal, (2000), Transaction streams: theory & examples related to confidence in internet-based electronic commerce, *Journal of Information Technology*. 15(3), 3-16.
- Tan, M., T.S.H.Teo, (1999), The Diffusion of the Internet in a pro-IT Cultural Environment: A Content Analysis of the Singapore Experience, *Communications of the Association of Information Systems*, 2(21), 1-49.
- Turban, E., J. Lee, D. King, H. M. Chung, (2000) *Electronic Commerce A Managerial Perspective*. Prentice Hall, New Jersey.
- Turban, E. E. McLean, J. Wetherbe. (1997), *Information Technology for Management Improving Quality and Productivity*. John Wiley & Sons, Inc., New York.
- Zhang, B; (2002), Case Study Understanding the impact of convergence on broadband industry regulation: a case study of the United States, *Telematics and Informatics*. 19,37-59.