

Small and Medium-Sized Enterprises and IT Diffusion Policies in Europe

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ABSTRACT. The main argument to justify an information technology (IT) diffusion policy for small and medium-sized enterprises (SMEs) is that IT could act as a catalyzer to the SMEs' growth, which is important because of the role played by these firms in innovation and regional development. However, due to the heterogeneity of SMEs, present IT diffusion policies in Europe are reaching only a limited number of these firms. The aim of this paper is to discuss the obstacles to the implementation of an IT diffusion policy for SMEs. The main arguments that justify a policy for IT diffusion in SMEs, and the main initiatives taken for IT diffusion in these firms in European countries are summarized. The shortcomings of present policies will be discussed, together with possibilities to increase IT diffusion in SMEs.

Introduction

As the importance of small and medium-sized enterprises (SMEs) to economic development has received increasing attention in the literature, policy-makers have become increasingly aware of the need to devise specific policies for these firms. There are two main findings in the literature that have implications for economic policy concerning SMEs. The first is that the nature of innovation adoption differs according to the size of the firm. The second is that clusters of small firms or industrial districts can be important for regional development. In this context, supporting SMEs can help strengthen innovative activity and regional development, but the policy must be devised to deal with these firms' specific charac-

teristics. An IT diffusion policy for SMEs could help to achieve this aim, by increasing firms' technical capabilities, by reducing obstacles to growth linked to regional isolation and by allowing increased exchange of information between users and producers of innovation.

However, present policies for IT diffusion in European countries reach only a limited number of SMEs. The aim of this paper is to discuss the reasons of this limitation. In the first section we will present the main arguments that justify an IT diffusion policy for SMEs. In the second section we will summarize the main initiatives taken to support IT diffusion in SMEs in Europe. In the third section we will discuss the shortcomings of present policies, based on the distinction between supply and demand-oriented IT diffusion policies. As a conclusion we will discuss possible solutions to overcome present obstacles.

1. Arguments in favor of an IT diffusion policy for SMEs

Until the middle seventies, SMEs had a minor role in the debate about economic development due to the dominance of the mass production paradigm in industry. After this period, this paradigm was increasingly challenged, leading to large firms' fragmentation, unemployment growth and creation of new SMEs (Acs, 1992). The increasing importance of SMEs led to a multiplication of support programmes aimed at those firms, although in most countries a coordinated policy is still lacking (Storey, 1994). Support policies have been justified because of these firms' capacity to innovate and their potential to promote regional development. A brief review of the arguments of the studies on SMEs, innovation and regional devel-

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opment is needed to understand why an IT diffusion policy for SMEs is considered necessary.

SMEs, innovation and regional development

As authors started to analyze the potential that SMEs have for innovation, several characteristics of these firms that favor innovation adoption have been identified. Usually SMEs have diversified activities and flexible structures that allow for fast responses to market changes. In addition, SMEs can operate in niches and thus have a high innovation rate (Acs, 1992). Finally, risk-aversion of these firms is lower than that of large firms, and workers are more motivated (Pratten, 1991; OECD, 1995). However, small firms do not necessarily have a greater potential to innovate than large firms. Utterback and Suarez (1993) observe that large firms have clear advantages to innovate since they have greater chances to develop and implement what will become the 'dominant design' in an industry. Furthermore, SMEs have less access to technological information, and thus may be less prone to innovation (OECD, 1995). SMEs also tend to have a larger rate of indebtedness than large firms (Acs and Audrestch, 1993) and thus are more sensible to economic downturns. The main difficulty that faces those enterprises concerning innovation and growth comes from their low ability to obtain financial support.

Therefore, the ability of SMEs to innovate depends on several factors related to the countries' industrial organization and innovation system. As Rothwell and Dodgson (1993) warn, both SMEs and large firms have advantages in innovation adoption, but these advantages differ. While large firms have *material* advantages, due to their greater capability to support R&D, SMEs have *behavioral* advantages that stem from their greater flexibility and ability to adapt to changes in the market. While large firms are important in creating new technologies, small and medium-sized firms are innovative concerning the use of existing technologies (Thwaites and Wynarczyk, 1993).

The behavioral advantages of SMEs in innovation justify an IT diffusion policy for these firms. The use of information technologies can ease communication flows outside the firms, by allowing an increased interaction with users and suppliers. In addition, IT can enhance the flexi-

bility of workers in the firm by improving internal communication flows. Therefore, the innovative activity of SMEs may be enhanced with IT use. Empirical studies show that after IT introduction SMEs usually have a greater ability to produce new products, while large firms tend only to diversify the existing range of products. In the cases where IT adoption is done concurrently to modifications in management, gains are increased (Correa, 1994). Since firms that use one IT application are more prone to use other applications (Wynarczyk et al., 1995) awareness-building efforts concerning IT are cumulative, and thus can lead to a 'virtuous cycle' of productivity growth.

The importance of SMEs to regional development has been highlighted by the literature on industrial districts (clusters) and by the analysis of the links between innovation and space. The analysis of industrial districts suggests that the flexible production paradigm is linked to the organization of firms, especially small firms, in clusters or networks.¹ These clusters contribute to the region's development by preserving the flexibility of firms and at the same time enabling gains associated with scale of production. The analysis of the links between innovation and space goes further, considering networks of firms as 'attractors', i.e. industrial organization forms that can serve as catalyzers to technical progress (Camagni, 1991). The main conclusion that stems from this literature is that in post-fordism, innovation may be closely associated with regional characteristics and the organization of firms in networks.

The empirical evidence of the positive results in performance obtained by clustered SMEs in developed countries is scarce (Schmitz, 1995) and does not provide insights on whether the cluster's experience can be translated to other regions or countries (van Dijk, 1995). Nevertheless the fact that clustered firms are a feature of the new industrial paradigm is another justification for increased IT diffusion in SMEs. When those firms are gathered in a cluster or a network, they may extract more benefits from IT use by setting up a 'network of innovators' (Freeman, 1991). An advanced IT infrastructure not only supports present clusters but may encourage the formation of new ones. By encouraging the creation of new clusters, IT diffusion would bring benefits to the region where the firms are located.

Therefore, the main arguments in favor of an IT diffusion policy for SMEs are that IT can increase innovative activity and that IT can support clusters of firms, thus helping regional development. These arguments permeate the policies to support IT diffusion in Europe, as will be discussed in the next section.

2. IT diffusion policies for SMEs

As was observed in section 1, an IT diffusion policy for SMEs is considered important due to these firms' role in innovation and regional development. For instance, the Commission of European Communities states that SMEs 'are the basic operation unit of economic activity in the Community, because of their role in economic activity and regional development and also because of their dynamism, productivity, adaptability and innovation capacity' (CEC, 1990, p. 1). The European Union launched in 1994 an initiative called 'Small and Medium-sized Enterprises Action Programme' (SMEAP 2C) to support SME development. Its main objectives are to 'intensify the priority measures for enterprise policy in order to stimulate growth within the Community'. The main goals of the programme are:

- 'encouraging SMEs, including craft-industry enterprises, to adapt to structural changes and to changes brought about by the internal market;
- stimulate exchange of experiences and transnational cooperation activities;
- promote a better financial environment for enterprises;
- promote a better observation of the economic development of enterprises as part of the dynamic of effective implementation of the internal market' (ECHO, 1995)

The increased access of SMEs to information technologies is considered important to achieve the goals outlined above. The European Union has been trying to stimulate the diffusion of IT by implementing several programmes. Policies to support IT diffusion can be classified as supply-oriented policies and demand-oriented policies. As observed by Gillespie et al. (1995), IT diffusion is better understood as a series of translations: from infrastructure investment to the provision of

appropriate services and applications; from such provision to user awareness: from awareness to adoption; from adoption to effective usage; and from effective usage to competitive advantage. While supply policies ensure the first translation, demand policies ensure the others. In other words, supply policies aim to increase the number of firms that are providers of IT, while demand policies stimulate firms to use IT. Supply-oriented policies are focused on the provision of infrastructure, support for R&D, support to co-operation between firms and universities and procurement policies. Demand-oriented policies involve training of workforce, technology centers, consultancy services and provision of technical information.

In the 80's and early 90's most of the European IT diffusion policies, as well as national policies, were supply-oriented, focusing on the improvement of the infrastructure and on the building of technological capabilities. Moreover, policies tended to focus on IT 'national champions', discouraging the entry of new firms in the industry (Soete, 1993). The more recent IT-related programmes represent about one-third of the total EU budget for the period 1994–1998 (BMW, 1995). As IT is considered important for innovation and regional development, these programmes include support to research and development, regional initiatives and support for cooperation among countries. Most programmes try to encourage SMEs' participation as providers of IT, and some also aim to stimulate IT use in sectors that are dominated by SMEs.

2.1. Supply-oriented policies

As the early IT diffusion policies focused in the improvement of the infrastructure, Europe's telecommunications networks were upgraded. In 1996, networks of 18 countries will be 100% capable of offering ISDN, and an optical fiber network will link 19 major European cities by 1998. In addition, an European standard for mobile telephony is already in force and tends to become a global standard (BMW, 1995). The recent changes brought by globalization have turned the information infrastructure into a strategic asset for regional development (Gillespie et al., 1995). Therefore the issue of an European

integrated infrastructure has been receiving the attention of European policy-makers since 1993. In this year the White Paper on Growth, Competitiveness and Employment in Europe reckoned that European telecommunications networks needed investments of 150 billion ECU until 2003. The Bangesmann report, in 1994, recommended that communications use should increase in the EU to guarantee competitiveness of firms, especially SMEs. Increased use should be achieved by enlarging ISDN access, reducing tariffs, developing standards and increasing global connectivity. On July 1994 the Action Plan for 'Europe's Way to the Information Society' was launched. The representatives of IT industries are working with the European Union in this plan to recommend actions towards an integrated infrastructure in four different areas: regulation framework, network infrastructure, social aspects and promotional activities.

However, before the integrated infrastructure is attained some obstacles must be surpassed. The first is that Europe's telecommunications infrastructure is still fragmented, with different digital switching and videotext systems. This is because the building of the infrastructure followed the strategies of national telecommunications operators, which varied across countries. The second is that the integration of the infrastructure depends on the evolution of deregulation, which also varies widely across Europe (EITO, 1995). The third is that European countries have wide differences in IT penetration (see Table I). These differences are linked to the fact that most telecommunications operators until recently had a 'research-oriented' approach to the infrastructure, upgrading it according to their capabilities and disregarding users' needs (Grupp, 1993).

European IT diffusion programmes also aim to stimulate IT diffusion by supporting IT providers, including SMEs. The Telematics Applications programme has allocated 5% of its budget to providers that are SMEs. SME participation as IT providers is also emphasized in 15 different programmes to stimulate IT diffusion in Europe, with aims ranging from improving education to establishing Government networks. In addition, most IT diffusion programs of national Governments in Europe focus on the building of technological capability in the firms (Hana et al., 1995).

TABLE I
IT penetration rates in Europe

Country	IT investment as % of GDP	PCs per white- collar workers
United Kingdom	2.50	0.73
Denmark	2.48	0.73
Germany	2.41	0.79
The Netherlands	2.35	0.85
Finland	2.18	0.52
France	2.09	0.60
Belgium/Luxembourg	2.00	0.77
Ireland	1.71	0.59
Austria	1.67	0.60
Italy	1.37	0.50
Portugal	1.27	0.40
Spain	1.14	0.44
Sweden	1.04	1.13
Greece	0.70	0.40
Western Europe (average)	2.07	0.72

Source: EITO 1995.

However, a good infrastructure and capability to produce IT are necessary but not sufficient conditions for enhanced IT use. Although Europe's share in the total number of telephone lines is 40%, European users represent only 10% of on-line services use and 10% of Internet use (BMW, 1995). Therefore, most European users have still to make the translation from adoption to effective usage of IT. The European Council recognized this by stating in 1995 that education and training should be considered priority domains for information and communication technology programmes (DGXIII, 1995). Thus more recent IT diffusion policies, including those for SMEs, are a combination of policies to improve the infrastructure and policies to stimulate use (Correa, 1994; OECD, 1995).

2.2. Demand-oriented policies

The available evidence on IT diffusion in SMEs suggests that these firms lag behind large firms in IT usage (Blili and Raymond, 1993; Correa, 1994; DGXIII, 1995; OECD, 1995). Table II shows that even simple IT applications like e-mail have a much lower use in small than in large firms.

The evaluation of supply-oriented programmes such as STAR (Special Telecommunications

TABLE II
Electronic mail use in European Firms (%)

Country	Large firms that use e-mail	Small firms that use e-mail
Sweden	63	29
France	33	23
Benelux	42	19
United Kingdom	49	16
Italy	25	10
Germany	32	7

Source: EITO, 1995.

Action for Regional Development) revealed that the demand for new IT services was lower than expected after the improvement of the IT infrastructure, especially in the case of SMEs. Therefore, supply-oriented policies must be complemented by policies to encourage IT demand. Since small firms have difficulties to assess costs and benefits of IT, demand for IT must be stimulated. Stimulating demand is not easy, especially in the case of firms that constitute a universe as heterogeneous as the SMEs. Empirical studies show that demand for IT is greater in new SMEs than in traditional ones (Computer Industry Report, 1994). In the latter, family-type management hinders adoption of new technologies and orientation to external markets, thus restricting the efforts to increase competitiveness that frequently generate an increase in IT use (Granger, 1995).

Furthermore, IT implementation is different according to the sector in which the firm is located. While in the manufacturing sector IT can support *process innovations*, in the services sector IT can also be *product innovations*. Product innovations have different requirements of investment and skills training compared to process innovations (Antonelli, 1993). Therefore a demand-oriented diffusion policy must take into account sectoral and organizational characteristics of SMEs. It must also cater to SMEs' needs by encouraging exploratory use of new services by a group of selected firms and by reviewing the portfolio of applications periodically (Eurostaf, 1994). In addition, it is essential to analyze user/producer relationships that shape demand for IT applications, to assess how the policy can stimulate future demand (Mansell, 1994). The location of the firms

is also important: Gillespie et al. (1995) note that the use of IT applications can vary in different regions of a country.

The challenges involved in defining an IT demand-oriented diffusion policy for SMEs explain the limited scope of concrete initiatives. One of the first examples of an IT demand-oriented policy was the European initiative to support networks of firms in 1988. This initiative was based on information diffusion, creation of European centers of information and building of information networks aimed to improve cooperation between enterprises. These centers favored IT diffusion, stimulating access to information networks and creation of networks of firms. Thanks to those efforts, 25,000 proposals of cooperation between SMEs in the period 1988–1992 were evaluated (CEC, 1990). These results are clearly limited, since the total of SMEs in Europe reaches 13 million. Therefore national Governments in some countries have been setting up IT demonstration centers, aiming to increase awareness of the benefits of use (Hana et al., 1995). The more recent European initiatives to support SMEs as users of IT are found in nine projects included in the IMPACT programme, whose goal is to establish an internal market for information services and to improve the competitiveness of European firms. Eight of these projects are sector-specific, destined to SMEs in the plastics, publishing, footwear, textile, ship-building, freight, building and music industries. The other project is focused on creating a network of subcontracting firms. In addition, the 'Telematics Applications' programme that aims to develop new telematic services, recently made a call for proposals to provide services to train staff of SMEs.

Initiatives such as the European IT Work Programme 1994 aim to have feedback from users in projects that support software, technologies for components and subsystems, multimedia systems, open microprocessor systems, high performance computing and networking, technologies for business processes and integration in manufacturing. SMEs would be stimulated to participate, by the concession of exploratory awards to cover the costs of preparing proposals for the programme. User participation would be ensured by networks of excellence, that gather centers of

excellence across Europe, and user-supplier collaboration.

Although these projects represent an important step in stimulating IT diffusion in SMEs, they do not reach all European SMEs, being limited to the SMEs that are in networks of excellence or in specific sectors. In the next section we will discuss the difficulties involving the implementation of a policy to stimulate IT diffusion in SMEs.

3. Obstacles to policy implementation

There are several reasons that explain the gap between policy-makers' intentions and concrete results concerning IT diffusion in SMEs. European countries were slow to ensure the first translation of IT diffusion, i.e. the provision of appropriate services in their infrastructure. As observed by Burgelman (1995), the experience of Minitel and Internet show that the success of new communication services depend on a 'strong central commitment, a coordinated and long-term dedicated financial support, a stable regulatory environment (...) and almost unlimited room for users to experiment with it'. The deregulation of the telecommunications sector that has been taking place in Europe does not allow such conditions. On the other hand, if Europe achieves an integrated infrastructure and surpasses the obstacles mentioned in section 2.1, there will be possibilities for increased diffusion of new services. The translation from provision of services to awareness is also taking place slowly, as demonstrated by the low rates of use of IT. The European and national initiatives to set up information centers, as well as networks of firms, aim to increase awareness. As these initiatives continue and the integration of the infrastructure is discussed, awareness about the benefits of IT tend to increase.

The translation from awareness to adoption, usage and competitiveness is more complex, especially in the case of SMEs. First, there are several types of SMEs. SMEs can be classified in four different types, according to the market structure where they are located, to the prevalent innovation rate and to their organization. SMEs can be individually in competitive markets with low innovation rates. They can also be individually in highly dynamic industries with high innovation rates. On the other hand, SMEs can be organized

as production cooperatives (clusters), or in networks under the dominance of a large firm (Souza, 1993). Each type of SME has specific contributions to economic growth, and will accordingly perceive IT in different ways. The first type perceives IT as a cost reduction tool, while the second perceives IT as a business opportunity. The third and the fourth use IT in their productive processes and in their relations with the other firms, thus improving their interface with the market. Supply-oriented policies benefit mainly the second type of SME, that is operating in a high innovation rate environment and therefore is less risk-averse. The limited range of demand-oriented policies leaves most SMEs outside the reach of IT diffusion policies.

In addition, demand-oriented policies have been limited because defining them is a complex process. A demand-oriented IT policy for SMEs must take into account these firms' specific characteristics: individuality of the firm, lack of formal management system and sectoral/local characteristics (OECD, 1993). Awareness-building of IT potential must be directed towards the firm's owners or managers, which in turn can diffuse this awareness among employees. Information about IT and IT-based management techniques must be provided concurrently and experiments encouraged. Development of IT-based applications that correspond to the firm's needs must also be supported. Finally, IT applications should enable SMEs to have closer relationships with users, which can contribute to the innovation process (Gibbons and Weijers, 1992).

The third problem is defining the level of policy implementation. Policies should not be limited to the regional level, since chances of success vary between countries: Hassink (1996) observes that regional policies have more success in countries where there is a strong tradition of decentralized government, such as Germany. Although most European national Governments have been publishing reports on the 'Information Society', few are making efforts to define policy guidelines and resources that will generate a demand for new IT services (Melody, 1995). In addition, national policies are mostly supply-oriented, and most demand-oriented initiatives are limited to the setting up of demonstration centers (Hana et al. 1995). On the other hand, policies defined at a

supra-national level, as those of the European Union, also have limits. European policies are based on optimistic assumptions about the 'Information Society' that are failing to materialize. Although these policies emphasize SMEs' participation, most disregard the fact that IT applications for large and for small firms may not be the same (Garnham, 1994).

Fourth, it should be noted that the priority given to SMEs does not necessarily mean a participation of these firms in European projects. As observed by Pyke and Charles (1995), participation in EU projects involves several costs that result from the effort to raise financial resources, the dealing with the bureaucracy and other legal issues. The variety of EU programmes can also be a hindrance for SMEs (DG XIII, 1995). SMEs have few incentives to participate in EU projects since their planning is mostly on a short-term basis. The STAR evaluation, for instance, highlighted the fact that the main beneficiaries of European programmes are large firms. The European Union 'Technology Stimulation Measures for SMEs' programme is trying to address this problem by offering awards to outlines of proposals that can be presented by two SMEs from two Member States. SMEs that have these awards can proceed to prepare a full proposal. As an alternative, SMEs can join research teams already established, by contacting 'Focal Points', i.e., research-related institutions in specific areas. However, these efforts are reaching a limited number of SMEs: in one year of implementation, the programme gave 600 awards and funded 120 projects, reaching 2000 firms (CORDIS, 1996).

Fifth, there is the problem of reconciling macro and microeconomic policy goals. For instance, the deregulation of the telecommunications sector that is taking place in Europe does not benefit SMEs. This is because the elimination of cross subsidies in the pricing schemes of public telecommunication operators increases the price of local calls (Gillespie and Williams, 1989). In addition, the deregulation process has been developed by defining access according to geographical range criteria, not affordable prices (Mansell, 1993). Thus special actions for SMEs must be envisaged in order to ensure their access to the integrated infrastructure.

Finally, the heterogeneity of situations leads to

mixed results concerning IT implementation. According to the OECD (1995) IT adoption in networks of firms can lead to a more rigid division of roles between SMEs, thus restricting their flexibility. Besides, in SMEs the strategy of IT adoption is not proactive, but a reaction, usually partial, to pressures from clients and providers. Most SMEs introduce innovations in an ad-hoc manner, and only when they perceive clearly that the innovation will bring a business opportunity (Gagnon and Toulouse, 1996). Therefore, present efforts of awareness-raising that emphasize only technical advantages of IT may not be successful. In the SMEs' case, it is not sufficient to promote new technologies: information on how these technologies can contribute to organizational improvement must also be provided (STAR, 1993).

4. Summary and conclusions

Although the recent literature on SMEs support the case for a specific IT diffusion policy for those firms, the implementation of this policy has been reaching a limited number of firms in Europe. The challenges to stimulate IT diffusion among those firms are manifold. First, SMEs are extremely heterogeneous, so there are several policy possibilities. Second, the definition of a diffusion policy requires not only an empirical study of SMEs and their IT necessities but also a constant interaction between SMEs, IT suppliers and policy-makers. Third, a successful IT diffusion policy must combine regional, national and European initiatives. Fourth, success in IT diffusion requires a standardization of the information infrastructure, to guarantee full access to information for all firms. Finally, policy-makers must monitor the effects on SMEs of previous efforts to implement IT and of changes in the macroeconomic environment. As observed by the OECD (1995), policy-makers should not view IT as a 'technological medicine' but as a means for SMEs to achieve greater competitiveness.

In view of the above a policy to support IT in SMEs must be flexible enough to cope with the diversity of situations but at the same time have standard procedures of implementation to ease the coordination among the different agencies of support. The policy must identify the weaknesses

of SMEs in IT adoption and accordingly provide advice not only technical, but also in the areas of management and finance.

Therefore a diffusion policy must not only focus on the supply of infrastructure and services but also on stimulating the demand for IT. A demand-focused policy must not only include measures that are important to stimulate demand, such as the constitution of information centers and consultant systems for SMEs, but also ensure that there is a link between IT adoption and usage. This supposes policies to support the organizational development of SMEs, the upgrade of management and human resources and the creation of a technical culture that leads the firm to search constant technological updating. Finally, policies to support IT diffusion must target not only the technological capabilities of SMEs but their competitive capabilities as well.

Note

¹ For a discussion of the main authors in the literature, see James and Bhalla (1993). A book by Bagnasco and Sabel (1995) has more recent contributions to this issue.

References

- Acs, Z. J., 1992, 'Small Business Economics: a Global Perspective', *Challenge*, November-December.
- Acs, Z. J. and D. B. Audretsch, 1993, 'Inovação e Mudança Tecnológica: a Nova Ciência', in J. P.R. Velloso and L. Martins (eds.), *A Nova Ordem Mundial em Questão*, Ed. Jose Olympio, Rio de Janeiro.
- Antonelli, C., 1993, 'The Diffusion of Technological Systems and Productivity Growth: The Case of Information and Communication Technologies', *Herausforderung für die Informationstechnik Internationale Konferenz*, Dresden, 15–17 June.
- Bagnasco, A. and C. Sabel (eds.), 1995, *Small and Medium-Sized Enterprises*, London: Pinter.
- Bianchi, A., J. Cornford, B. Dillon, A. Gillespie, S. O'Siochru and L. Qvortrup, 1995, 'Strategic Options for Information and Communication Technologies in Less Favoured Regions', *International Telecommunications Society European Regional Conference*, Juan les Pins, France, 1–3 September.
- Blili, S. and L. Raymond, 1993, 'Information Technology: Threats and Opportunities for Small and Medium-Sized Enterprises', *International Journal of Information Management* 13.
- Bundesministerium für Wirtschaft (BMWi), 1995, 'Die Informationsgesellschaft: Fakten, Analysen, Trends', November.
- Burgelman, J. C., 1995, 'Issues and Assumptions in Communications Policy and Research in Western Europe: A Critical Analysis', paper for the 1995 IAMCR Conference 'Communication beyond the Nation State', Potorez, Slovenia, June.
- Camagni, R. (ed.), 1991, *Innovation Networks: Spatial Perspectives*, London: Bellhaven Press.
- Commission of the European Communities (CEC), 1990, 'Enterprise Policy: A New Dimension for Small and Medium-Sized Enterprises', Documents Series 08, Com(90) 528 final.
- Community R&D Information Services (CORDIS), database. Computer Industry Report, 1994, v. 29 n. 22, 30 September.
- Correa, C., 1994, *Difusión y Políticas de Tecnologías de la Información para Pequeñas y Medianas Empresas en América Latina y el Caribe*, mimeo, Buenos Aires, March.
- Directorate General XIII (DG XIII), 1995, Task Force Multimedia Educational Software, 'Educational Multimedia: First elements of reflection', I'M Europe database.
- Ducatel, K. and J. Millard, 1996, 'Employment and Innovation in Advanced Communication Technologies', *Futures* 28(2).
- European Community Host Organization (ECHO), database.
- European Information Technology Observatory (EITO), 1995, *European Information Technology Observatory 95*, Mainz: Eggebrecht – Press KG.
- EUROSTAF – Collection Analyses de Secteurs, 1994, 'Le Multimedia: Convergences Stratégiques face aux Enjeux des Médias Interactifs', 3ème trimestre.
- Freeman, C., 1991, 'Networks of Innovators: A Synthesis of Research Issues', *Research Policy* 20.
- Gagnon, Y. C. and J. M. Toulouse, 1996, 'The Behavior of Business Managers When Adopting New Technologies', *Technological Forecasting and Social Change* 52.
- Garnham, N., 1994, 'Whatever Happened to the Information Society?', in R. Mansell (ed.), *The Management of Information and Communication Technologies: Emerging Patterns of Control*, ASLIB.
- Gibbons, M. and T. Weijers, 1992, 'Position Paper on User-Producer Relations', mimeo, Apeldoorn, the Netherlands, June.
- Gillespie, A. and H. Williams, 1989, 'A Small Firms' Perspective on the Liberalisation of Telecommunications', in N. Garnham and A. Aksoy (eds), *European Telecommunications Policy Research*, Proceedings of the Communications Policy Research Conference, 22–24 June.
- Gillespie, A., R. Richardson and J. Cornford, 1995, 'Information Infrastructures and Territorial Development', paper prepared for the OECD joint ICCP-TDS Workshop on Information Technologies and Territorial Development, Paris, November.
- Granger, J. R., 1995, 'Advanced Telecommunication Services and Competitiveness in Small and Medium-Sized Enterprises: the Spanish Case', Fundesco, Madrid.
- Grupp, H., 1993, 'Efficiency of Government Intervention in Technical Change in Telecommunications: Ten National Economies Compared', *Technovation* 13(4).
- Hassink, R., 1996, 'Technology Transfer Agencies and Regional Economic Development', *European Planning Studies* 4(2).
- Hana, N., K. Guy and E. Arnold, 1995, *The Diffusion of*

- Information Technology: Experience of Industrial Countries and Lessons for Developing Countries*, World Bank Discussion Papers 281.
- James, J. and A. Bhalla, 1994, 'Flexible Specialization, New Technologies and Future Industrialization in Developing Countries', *Futures*, July/August.
- Mansell, R., 1993, *The New Telecommunications: A Political Economy of Network Evolution*, Sage.
- Mansell, R., 1994, 'Negotiating the Management of ICTs – Emerging Patterns of Control', in Mansell, op. cit.
- Melody, W., 1995, 'Future Telecom Services: New Directions', paper presented at the Annual COST 248 Workshop, 'The Future European Telecommunications User', Bad Honneff, Germany.
- OECD, 1993, *Les Petites et Moyennes Entreprises: Technologie et Compétitivité*.
- OECD, 1995, *Information Technology (IT) Diffusion Policies for Small and Medium-Sized Enterprises*.
- Pratten, C., 1991, *The Competitiveness of Small Firms*, Cambridge University Press.
- Pyke, A. and D. Charles, 1995, 'The Impact of International Collaboration in U.K. University-Industry Links', *Industry and Higher Education*, October.
- Rothwell, R. and M. Dodgson, 1993, 'Technology-based SMEs: Their Role in Industrial and Economic Change', *Inderscience Enterprises*.
- Schmitz, H., 1995, 'Collective Efficiency: Growth Path for Small-Scale Industry', *Journal of Development Studies* 31(4), April.
- Soete, L., 1993, 'Information Technology Promoting Structural Change', Herausforderung für die Informationstechnik Internationale Konferenz, Dresden, 15–17 June.
- Souza, M. C. A. F., 1993, *Pequenas e Médias Empresas na Reestruturação Industrial*, Ph.D dissertation, UNICAMP, Campinas.
- Special Telecommunications Action for Regional Development (STAR), 1993, Community-level Evaluation, Executive Summary, Eubank Press Ltd.
- Storey, D. J., 1994, *Understanding the Small Business Sector*, London: Routledge.
- Thwaites, A. and P. Wynarckzyk, 1993, 'Innovation and Financial Performance in Small Firms', Centre for Urban and Regional Development Studies (CURDS), Newcastle.
- Utterback, J. and F. Suarez, 1993, 'Innovation, Competition and Industry Structure', *Research Policy* 22, 1–21.
- van Dijk, M. P., 1995, 'Flexible Specialisation, the New Competition and Industrial Districts', *Small Business Economics* 7, 15–27.
- Wynarckzyk, P., I. Hardill and J. Turner, 1995, 'Technology and Company Performance: Survey of the British Textile and Clothing Filere', CURDS Working Paper, Newcastle.

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