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The ‘death of distance’ fifteen years on. Information technology and knowledge-based service firms in rural areas.

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Abstract

Since the seminal paper by Beyers and Lindhal on ‘lone eagles and high fliers’ (1996), rural knowledge-based services have received little attention, although the landscape of the information economy has dramatically changed. This paper embraces a comparative approach which endeavours to explore the existence of a possible digital divide between rural and urban firms, all other things being equal. The need to capture a locational effect requires a strict control of sector and size. Through a telephone survey implemented in early 2011, 400 business service firms located in rural areas in the South-East of France were asked about their use of telecommunication-based applications. Then, a sample of 300 similar firms based in the metropolitan area of Lyon was given the same questionnaire. The empirical analysis found that rural firms are less versatile users of information technology than their urban equivalents. However, the gap is thin and is not the result of a lack of telecommunication infrastructures. These findings suggest that, in the French context, local economic development policies must not solely rely on the provision of broadband infrastructure and services, but also on the stimulation of entrepreneurship, the rise of entrepreneurial skills, and the global enhancement of the community's attractiveness.

Keywords

Rural economy, information technology, business service firms, telecommunications, digital divide, local development

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1. Introduction

Since the beginning of the Internet era, the relation between information technology (IT) and the economic development of peripheral regions in developed countries has increasingly drawn interest from policy makers and planners. A powerful rhetoric has arisen in political circles that an ‘end of distance’ effect (Cairncross 1997) could emerge from the implementation of IT and give rural regions a golden opportunity in terms of development and embeddedness in a globalized economy. Although most optimistic expectations have not yet materialized, we have witnessed the emergence of rural knowledge-based service firms and entrepreneurs, who rely on telecommunications to trade with a wide market. In their seminal paper, Beyers and Lindhal (1996) call them ‘lone eagles and high fliers’. The present paper uses the expression ITES firms (for IT-enabled services), which is widely used throughout business milieus.

The second section of the paper presents the main term of debate. For nearly two decades, scholars have scrutinized the ability of rural firms to implement IT and take advantage of the digitization of information processing and exchange. The ability of rural service firms to fit into the digital economy may prove crucial for their very existence as well as for the diversification and widening of local communities’ economic bases. In Section three, we argue for more detailed and up-to-date research. Justifiably, this issue has been the subject of an important academic literature. However, empirical data that underlie much of the available studies are to some extent outdated, given the pace of technological change and the nonlinear character of its effects upon firms competitiveness and territorial economic development. Besides, the main of the existing literature focuses on manufacturing rather than services. We concur with Bryson (2008, 58) who asserts that ‘the activities of lone eagles and high fliers have been partially identified by previous studies but some of this work is based on anecdotal evidence that needs to be supported by detailed research.’

As sketched in Section four, this paper embraces a comparative approach. Through the comparison with urban firms of similar nature, the main purpose of the study is to assess rural firms’ behaviour in terms of IT adoption. The empirical research is based on a telephone survey of 700 ITES firms, 400 of them located in rural areas in the South-East of France, 300 based in the metropolitan area of Lyon - France (2.1 million people). Section five and six presents the main results and findings. Section seven elaborates on these results, suggests further research, and presents policy implications.

2. IT-enabled services (ITES) firms and the economic development of rural regions: the main terms of debate

The digital economy and the emergence of ITES

Digital technology and the Internet have permeated most business sectors (Porter 2001), driving frequent processes of vertical disintegration. Some firms have specialized in information processing and exchange. Hence the expression 'IT-enabled services' (ITES). For the main, ITES firms are largely overlapping with 'information professionals' (IP) (Sopuck 2003), 'knowledge-intensive business services' (KIBS) (Shearmur and Doloreux 2009; Shearmur forthcoming; Doloreux and Shearmur 2012), and 'business and professional services' (BPS) (Bryson 2008). Like BPS, ITES cover a 'complex heterogeneous collection of firms and professionals' (Bryson 2008, 44), acting in content producing (web design, book editing, software, photo, and video), consultancy, accountancy and legal advice, customer support, distance monitoring and technical support, telemarketing, electronic commerce, finance and insurance, architecture, engineering, medical services, and e-learning.¹

Because a great deal of these tasks is suitable to remote exchanges and processing, the key geographic issue within ITES is the potential for a wide locational split between vendors and buyers. For example, India has seen the emergence of a multi-billion dollar industry in computer services and business process outsourcing (Malecki and Moriset 2008). The geographic splintering of digitized value chains is also highlighted by the rise of telework. In the USA alone, more than 17 millions employees were telecommuting at least one day per month in 2008 (WorldatWork 2009, 6). To this figure must be added millions of small companies and self-employed persons.

However, the IT revolution has not so far produced the spatial effects expected by 'the end of geography' thinkers (O'Brien 1992; Cairncross 1997) and cyber-utopists (Negroponte 1995). The enormous literature on clusters (Porter 1998; Breschi and Malerba 2005; Asheim, Cooke, and Martin 2006; Karlsson 2008) reports that economic agglomeration still reigns supreme. Transactions that trade tacit content or require a high level of trust still give the premium to face-to-face contacts over tele-mediated relations (Bathelt, Malmberg, and Maskell 2004; Leamer and Storper 2001; Storper and Venables 2004). Therefore, since the beginning of the Internet era, IT implementation has done little to lessen the process of concentration of the knowledge-based economy in an archipelago of well-connected cities (Sassen 2001; Veltz 1996). After all, the rise of Indian ITES industry has been concentrated around a few dense cities.

'Lone eagles and high fliers' and the rhetoric of rural IT-driven development

Although metropolitan areas have attracted the lion's share of knowledge-based activities, the past two decades have seen the flourishing of a powerful and persistent rhetoric about the role that information technology could (or should) play in the development of rural regions. The issue has attracted a great deal of interest from

¹ A detailed list of ITES may be found on the site of Outsource2India, a business process outsourcing firm headquartered in Bangalore, India (www.outsource2india.com).

policy makers, planners, and scholars (Glasmeier and Howland 1995; Richardson and Gillespie 2000; Grimes 1992, 2000, 2003; Malecki 2003; Rusten and Skerratt 2008).

Rurality is a complex figure (Lowe et al. 2003), essentially characterized by a low density of both population and economic interaction. Rural enterprises in non-agricultural sectors are likely to suffer from a ‘rural penalty’ (Hite 1997; Malecki 2003) resulting from shallow local markets, the remoteness of external markets, higher costs of access to key inputs and services, and the scarcity of highly-skilled professionals. Said flatly, the rural penalty is ‘the deprivation of most agglomeration economies, traded or untraded externalities, which are the essential constituent of dense business milieus’ (Malecki and Moriset 2008, 201).

It was inevitable that the rise of ITES would be regarded as a promising opportunity for rural regions. In places where a suitable telecommunication infrastructure is available, the penalty of a rural location might be lessened, and the locational trade-off between urban and rural regions could be changed, at least in certain business segments.

In 1994, P. Burgess, a researcher at the Center for the New West, a Denver-based think-tank, coined the ‘lone eagle’ moniker to describe self-employed entrepreneurs using IT to conduct some knowledge-based business. In 1996, Beyers and Lindhal added ‘high fliers’ to describe small rural enterprises of the same kind performed by several people. Following Beyers and Lindhal's seminal work, rural ITES have kept on attracting the interest of scholars (Gillespie and Richardson 1996; Clark 2000; Bryson 2008), as well as policy-makers, experts, and medias. The ‘lone eagles and high fliers’ rhetoric is still used today in some rural places of the Western US, such as Pagosa Springs (Archuleta County, Colorado).

‘Lone eagles and high fliers’ are entrepreneurial small-business owners who think outside the box... They are independent thinkers. They are intelligent. They are daring. They have families. They would find Pagosa’s small town character, and its unspoiled beauty, attractive (Hudson 2010).

Lone eagles and high fliers offer economic and social perspectives that go well beyond their strict statistical significance. After decades of decline, many rural regions throughout Europe and America show a demographic recovery and attract new residents (Johnson 2006). Scholars often identify the combination of IT and amenities as a major factor to explain this ‘rural rebound’, especially in the US context (McGranahan 1999; Nelson 1999; 2006; Beyers and Nelson 2000). Kotkin (2000) suggests that IT was instrumental in the migration to rural America of some working people and entrepreneurs of the ‘creative class’ (Florida 2002).

Widening the economic base of rural regions

Since the 1990s, in the wake of the renewal of regional studies, the old theory of the economic base (North 1955) has been rejuvenated. Some authors argue that, in the context of an interconnected economy and the ageing demographics, the key source of growth and wealth in rural areas lies increasingly in the attraction of revenues and ‘non-earning income’ without regard to their origin (Nelson and Beyers 1998; Nelson 2005; Talandier 2007; Davezies 2008). In rural regions endowed with amenities, tourism and the attraction of retired people have become the cornerstone of a new residential economy which compensates, at first sight, for the decline of older basic activities such as farming, mining, and manufacturing. However, this scenario does not please local officials. Its outcome may be summarized as follows:

- shift from manufacturing jobs to low-skilled and low-paid jobs in the social-medical sector;
- rise of a seasonal, tourism-based sector;
- increase of secondary houses;
- exodus of college-educated young people who cannot find suitable jobs locally.

The last point is the most worrying. Rural regions are subjected to a permanent brain drain which further hampers local development (De Hoyos 2011). Officials fear that rural France would merely become one of the Europe's recreation and elderly care areas, high value-added activities remaining the exclusive feature of metropolitan areas. Many local elites do not want even more secondary houses and nursing homes. They are not much pleased by the creation of call centers, which offer low-skilled, short-tenured jobs and have little driving effects on local economies (Richardson and Gillespie 2003). They want to attract creative people and their families, 'who bring with them both financial and human capital' (Nelson 1999). They want their college-educated children to return in their birth region back from university-cities and create start-ups (Malecki 1988).

3. The use of technology by rural ITES firms: the need for a reassessment

The rhetoric of the digital economy in rural regions is based on the assumption that local firms use IT properly to overcome distance and improve their competitiveness. Elaborating on the literature, Galloway, Sanders, and Deakins (2011) report the theoretical benefits of IT use in a peripheral context: increased internal firm efficiency, enhanced relationships with customers and partners (network effect), improved supply chains, access to extended markets. The last point is crucial. A firm which merely serves the local demand belongs to the non-basic sector and has little growth potential. On the other side, a company which exports some services outside the region (nationwide or abroad) has a virtually unlimited growth potential, and widens the local basic sector in the same way than farming and manufacturing usually do. In their study on 'lone eagles and high fliers', Beyers and Lindhal (1996) consider only such outwardly oriented firms.

It is generally admitted that the advent of advanced telecommunications and the Internet has shifted the tradeoff frontier between 'reach' and 'richness' (Evans and Wurster 2000). 'Reach' means the capacity to trade within a large market, while 'richness' characterizes the value-added and the degree of sophistication of transactions. The essence of ITES is precisely the capability to offer complex services to remote clients. Therefore, one question arises which is crucial for the development of rural ITES firms: do rural ITES implement IT-based applications to a degree that could favourably affect their organization and their competitive situation? The present paper endeavors to evaluate the degree of sophistication of rural enterprises' IT uses, and its relation to the geographic scale of their markets.

The relation between IT use and productivity has been identified as an intricate issue (Solow 1987; David 1991). It is meaningless to say in absolute terms whether a given degree of IT-implementation is satisfactory or not. Therefore, we should embrace a comparative method and appreciate IT adoption by rural firms through a comparison with urban firms.

The 'rural *versus* urban' IT adoption debate is well-addressed by Galloway, Sanders, and Deakins (2011, 255): 'until recently rural businesses have been

observed to be slower in terms of ICT adoption than their urban counterparts... These observations have been identified as surprising by those who have theorised that since rural firms have more to gain from the benefits of the internet in terms of extending reach particularly, they would be more, not less, likely to engage in internet-based business activities than urban firms'. We will examine the two following hypotheses: have rural firms taken an edge over urban firms in the implementation of 'distance-killing' applications? Or should rural firms be actually considered as laggards, the 'rural penalty' being a hindrance to the adoption of IT as well as of any kind of technological innovation? Perhaps a third hypothesis should finally be examined: that in most developed countries, the rural/urban locational tradeoff has become largely irrelevant to the debate on IT adoption.

Although a few papers report the opposite thesis (Forman, Goldfarb, and Greenstein 2005), the dominant thesis is that rural firms are slower in adopting technological innovation (Karlsson 1995), and that 'being located in a metropolitan area is more favourable to ICT adoption' (Galliano and Roux 2008, 11). The 'main argument against rural areas is the lack of proximity to ICT suppliers and the poor accessibility to a qualified labour force for their implementation' (Galliano, Roux, and Filippi 2001, 1651). Indeed, it is a sound argument that the low density of IT-intensive firms in a given region prevents the production of external economies such as knowledge spillovers, which play a major role in epidemic diffusion processes.

According to Shearmur and Doloreux (2009, 80), 'most work on innovation has focused upon manufacturing sectors.' Indeed, if IT adoption by manufacturing firms has been well-documented we know less about service firms. More precisely, Bryson (2008, 58) has identified as an important research lacuna 'the working practices and lifestyle of lone eagles and high fliers in the European context.' The existing literature on manufacturing brings results that cannot be easily duplicated in the field of ITES. For example, Galliano's aforementioned econometric studies rely on surveys of firms with 20 people and more, while the rural ITES industry shows an overwhelming proportion of firms with less than 5 employees. Finally, we concur with Bryson (2008, 58) that 'the relationship between BPS and ICT appears to be ambiguous and requires further detailed research.'

The fast evolution of the technological landscape during the past decade is an additional motive for a reassessment. The existing literature surveys IT applications which for the main have become mundane for every company, such as Internet access and e-mail. There is therefore a need of getting some up-to-date knowledge about emerging applications and services such as videoconferencing and social networks.

In the same vein, we must take into account the recent changes in broadband access in developed countries' rural regions. The existence of a rural broadband divide has been well-studied (Strover 2001; Grubestic 2003; Tookey, Whalley, and Howick 2006; LaRose et al. 2007). These authors point out that rural areas are often lagging behind metropolitan areas in terms of broadband availability, as a result of the low density of demand which prevents a full and profitable coverage of these areas by infrastructures and related services. In the early 2000s, rural firms had to face the scarcity of broadband coverage. France, for example, had by 2004 about 11 million of Internet subscriptions, of which 6.5 million (60 percent) were low-speed, dial-up connections, by then dominant in rural regions. By the end of 2010, the country had 21.5 million of Internet subscriptions, including 480,000 (2.3 percent)

residual, low-speed subscriptions (ARCEP² 2011). Therefore, the context and stakes of IT adoption have dramatically changed since the early 2000, making obsolete data that most existing studies rely on. The context of France in the early 2010s offers a rare window of opportunity to refresh data and suggest new interpretations of possible differences in IT adoption between rural and urban firms.

4. Methodology

The area

The primary goal of the research was the comparison of IT uses between rural and urban firms, located in the Southeastern part of France (Figure 1). The rural field was delimited through the elimination of metropolitan areas over 100,000 inhabitants and densely populated corridors linking large cities. For example, the Rhône Valley corridor between Lyon and Marseille, a major transportation axis in Europe, was excluded. The delimited area has a surface of 48,843 km² and a population density of 32.5 people per km² (France's mainland overall density is 114)

The urban sample was chosen in the metropolitan area of Lyon, a major business city (1.7 million people), central to the peripheral areas surveyed, with abundance of knowledge-based service firms of all sizes.

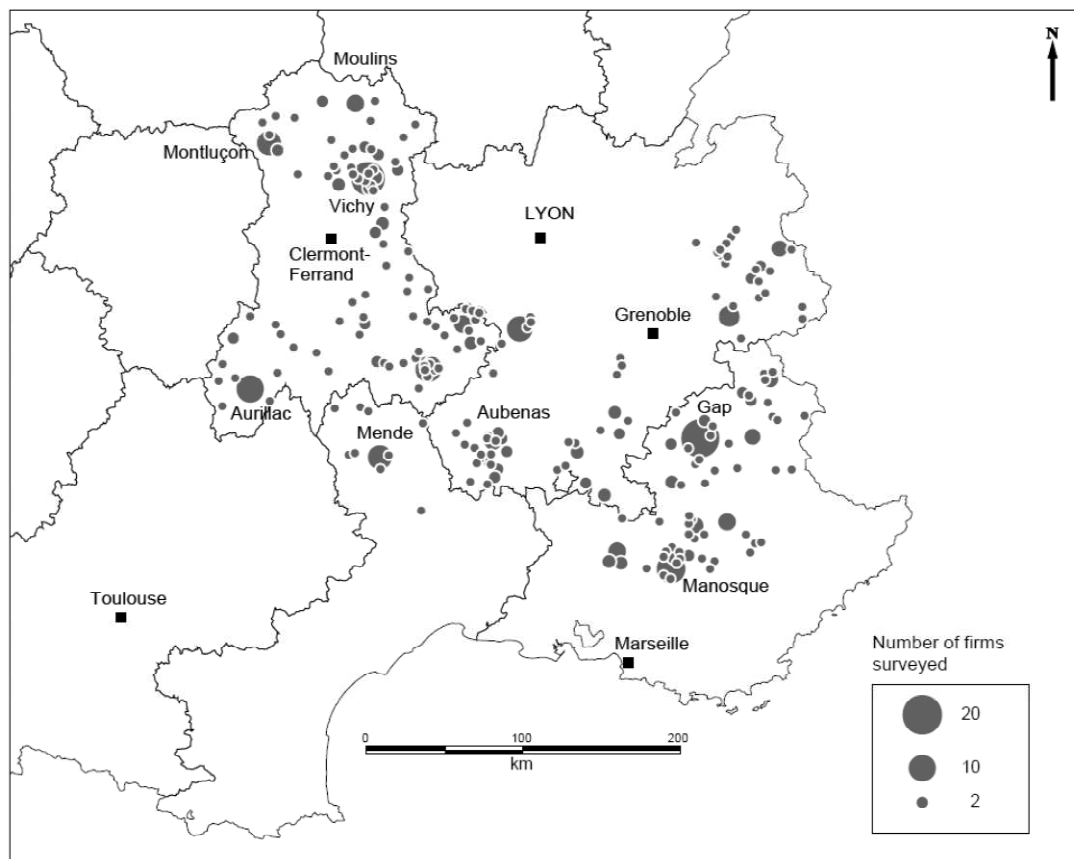


Figure 1. Location of rural firms surveyed

² ARCEP is the French Telecommunications Regulation Authority.

The business sectors

The topic of the study requires to survey firms which trade mainly intellectual goods and services, liable, to some extent, to telecom-based distant delivery. The sample was built on the basis of NAF codes (the French equivalent of US NAICS). 26 sectors were selected at the four-digit level, later consolidated in seven main sectors (Table 1 and 2).

In search of a geographic effect: building mirror samples

The ultimate goal of the study is to examine the possible effect of a rural location on ICT uses. Without control of size, the comparison of rural and urban ITES industries would provide non-conclusive results. Urban firms are likely to be much more versatile IT adopters because they are much bigger. Most rural firms have a very small number of employees. The majority (70% in the sectors studied) has no employee at all. On the other hand, major business service firms present in Lyon, such as IBM, Cap Gemini, ATOS, and Deloitte have hundreds of employees each. The comparison of these firms' practices with their rural fellows would have been misleading.

Table 1. Service sectors comprized in the study

Survey group	NAF sectors (NAICS equivalent)
A - Edition, publishing	Book publishers
	Other publishers
	Game software publishers
	Software publishers
	Motion picture and video production
	Motion picture and video postproduction
	Sound recording industries
B - Computer services	Software programming
	Computer systems design and related services
	Data processing, hosting, and related services
	Internet publishing and broadcasting and web search portals
C - Design, Graphics	Prepress services
	Advertising, public relations, and related services
	Specialized design services
D - Translation	Translation and Interpretation Services
E - Architecture	Architecture
	Marketing research and public opinion polling
F - Office administration and clerical services	Office administration and clerical services
	Copying and other services
	Call centers
	Billing services and misc.
	Other business support services
G - Engineering, R&D, and testing	Engineering services
	Testing laboratories
	Scientific research and development services
	Diverse technical and scientific activities

Therefore, the capture of a possible rural penalty in IT implementation requires a strict control of sectors and sizes. The building of two ‘mirror samples’, one chosen in peripheral areas, one chosen in a large city, is the methodological nexus of this paper. The rural sample was built first, and 400 questionnaires filled. Firms with several employees were deliberately over-represented in the sample, to catch ‘high fliers’ – the two samples do not endeavour to reflect faithfully the actual size breakdown of the industries surveyed. Then, the sample of Lyon’s firms was built in order to mirror the rural sample. As showed in Table 2, the final samples have very similar structures in terms of sector and size.³

Table 2. The sector breakdown of rural and urban firms surveyed

Consolidated business sectors	Available sample (rural)	Effective answers			
		Rural		Lyon	
A – Edition, publishing	318	27	6.75%	20	6.67%
B – Computer services	927	78	19.50%	58	19.33%
C – Design, Graphics	694	60	15.00%	45	15.00%
D - Translation	210	17	4.25%	13	4.33%
E - Architecture	778	64	16.00%	48	16.00%
F – Office adm. and clerical services	788	57	14.25%	43	14.33%
G – Engineering, R&D, and testing	1173	97	24.25%	73	24.33%
Total	4888	400	100.00%	300	100.00%

The questionnaire

The questionnaire comprises 69 questions (mostly multiple choice, closed-ended questions) organized in four sections:

- 1) general features of the company;
- 2) Internet connection and use of telecommunications;
- 3) use of telecom-based applications which allow distant-working;
- 4) spatial organization and embeddedness of the firm in the region

The IT variables and the IT index⁴

The questionnaire examines telecommunication-based and Internet-based practices which make it possible to work at distance with colleagues, partners, and/or customers, and, in some way, to relieve the enterprise from locational constraints. The questionnaire does not address the intensity of use, which is difficult to measure precisely through a telephone survey, but evaluates adoption of various applications

³ There are less urban questionnaires (300) than rural ones (400), for practical reasons: given that the overall research project is focused on the study of peripheral areas, several questions, not exploited in the present paper, were of rural interest only. Therefore, statistical significance required that, for a given budget, some priority be given to the survey of firms with a peripheral location.

⁴ The study mainly focuses on Internet-based and telecommunications-based applications. For example, the use of professional softwares was not assessed in the survey..

through a binary variable ('does' or 'does not use'). Nine main variables are evaluated:

- implementation of a web site;
- practice of online sales;
- use of telephone conferencing;
- use of web or videoconferencing;
- recourse to specialized web browsers;
- subscription to RSS flows;
- use of collaborative software (groupware);
- presence on social networks for business purpose;
- practice of electronic or telephone marketing.

These nine variables are consolidated in a simple IT-index, which reports the scope of IT implementation within the firm. The maximum theoretical score is nine (the company uses all applications). The minimum is zero (it uses none).

The geography of sales

With regard to the main topic of the research, the geography of sales is an important variable, because it has an impact on the contribution of the firm to the economic base of the region. Firms were asked if they serve clients on local, regional, national, or international scales (several answers were possible). The analysis is based on a free appreciation of words by respondents. It looked unreliable to ask the share of these markets in the turnover of each firm. Therefore, we resort to build four categories exclusive to each other which measure, in some way, the 'reach' of the company:

- has local customers only;
- acknowledges regional sales at best (may have some local sales);
- has some nationwide sales (but does not trade internationally);
- has a proportion of international sales.

When necessary, local and regional sales on the one hand, national and international sales on the other hand, were consolidated in two categories: 'local' and 'global'. The difference between local and regional may be fuzzy for many respondents. On the contrary, we expect little confusion between regional and national, which are very different scales of operations in a country of about 1,000 km of length and width, with 21 regions (mainland). The 'global' category well embraces those firms which may be regarded as net contributors to the local economic base.

5. Results: A moderate rural-urban gap in IT adoption and practice

We found some evidence that firms located in the periphery have on average lower rates of IT adoption (Table 3). This finding is consistent with the main of the literature mentioned above. Rural firms have a lower average IT index (1.71) than urban firms (2.11). Admittedly, the differences found are statistically robust (p. of error < 0.5%) for only three applications: *Social networks*, *RSS flows*, *Groupware* (Table 4). However, what makes the analysis much conclusive is that a rural-urban divide is found for all but one application surveyed. It is worth noting that rural firms are less present on social networks by a wide margin (14.3 percent against 25 percent). Although the presence on *Facebook* is almost similar, a clear gap is found

when we examine the presence on major professional networks such as *Viadeo* and *Linkedin*, or the use of *Twitter* (Table 5).

However, if mean IT indexes and use rates show a significant difference between rural and urban firms, the share of variance explained by geography is small: 1.1%. This is unsurprising, given the high standard deviations found within the firms surveyed. Indeed, firms in both rural and urban samples have very contrasted behavior in terms of IT solution implementation. This is a first evidence that geography *per se* has a small effect on IT adoption, with the probable exception of particular applications such as social networks.

Table 3. IT indexes of surveyed firms

	Rural	Lyon	All
Sample	400	300	700
Mean IT Index	1.73	2.11	1.89
Std-dev	1.621	1.818	1.717

Share of variance explained by location (Rural / Lyon): 1.1%

F test value: 8.863234

Probability of error: 0.00301

Table 4. Percentage of IT adoption rates across various applications: a rural / urban comparison

	Rural (400)		Lyon (300)		X^2
	Nb.	Adoption rate	Nb.	Adoption rate	
Web site	216	54.0%	180	60.0%	2.51
Tel. / E-marketing	90	22.5%	80	26.7%	1.62
Web browsers	82	20.5%	69	23.0%	0.63
Tel. conferencing	67	16.8%	64	21.3%	2.37
Social Networks	57	14.3%	75	25.0%	12.95***
Videoconferencing	54	13.5%	53	17.7%	2.30
RSS flows	45	11.3%	48	16.0%	3.36*
Groupware	43	10.8%	45	15.0%	2.82*
Online sales	36	9.0%	20	6.7%	1.27

*** $p > 0.01$; ** $p > 0.05$; * $p > 0.1$

Table 5. Percentage of use of social networks (multiple answers)

	Rural (400)		Lyon (300)		X^2
	<i>Nb.</i>	<i>Adoption rate</i>	<i>Nb.</i>	<i>Adoption rate</i>	
Use of any social network	57	14.25%	75	25.00%	12.95***
<i>Including:</i>					
Facebook	45	11.25%	38	12.67%	0.33
Viadeo	23	5.75%	48	16.00%	19.76***
Linkedin	8	2.00%	21	7.00%	10.79***
Twitter	14	3.50%	23	7.67%	5.95**
MySpace	3	0.75%	3	1.00%	0.13

*** $p > 0.01$; ** $p > 0.05$; * $p > 0.1$

Cross analysis: size, sector, and market

The cross analysis of several variables allows to identify three interesting correlations to IT implementation rates: the business sector of the firm, the size of the firm, and the geographic span of its operations. Some other variables give no result. For example, no link was found between IT implementation and the location of the firm at the regional scale: 158 firms located in medium-sized towns⁵ have an average index of 1.71, against 1.74 for 242 enterprises located in small towns or small isolated settlements (which constitute the countryside strictly speaking).

A strong evidence lies in the high degree of consistency of results among categories, summarized in Tables 5, 6, and 8, which amount to 14 subgroups for each kind of areas. Although the degrees of statistical significance are diverse, urban firms have higher indexes (which measure the average implementation rate of nine applications) in all but one category (firms of 3-4 people).⁶

The size factor

Results presented in Table 6 confirm the well-established idea that the use of IT is positively related to the size of businesses (Palvia, Means, and Jackson 1994; Premkumar and Roberts 1999). The larger the firm is, the more versatile IT user it is likely to be. A more important staff means higher scale economies in the use of equipment and software, a more diverse amount of skills within the company, and more opportunities for external and internal interaction. However, it is worth noting that rural firms have lower index for each category of size, sometimes by a wide margin. Again, the variability within each sample is important, and size does explain a little share of the variability of the IT index.

⁵ This result refers to the official distinction between 'rural space' and 'urban centers', which offer at least 5,000 jobs.

⁶ This exception is partly a consequence of the unequal distribution of sizes within sectorial groups. A more detailed analysis shows that firms of three-four people are over-represented in the Lyon group of architects, a fact that significantly lessens the global index of the category.

Table 6. IT index and the distribution of firms, by size

<i>Workforce</i>	Rural			Lyon		
	<i>Nb.</i>	<i>IT Index</i>	<i>Std-dev</i>	<i>Nb.</i>	<i>IT Index</i>	<i>Std-dev</i>
1	167	1.51	1.563	125	1.92	1.776
2	77	1.52	1.438	46	2.50	2.188
3-4	72	1.71	1.587	55	1.85	1.458
5-9	65	2.25	1.613	54	2.13	1.904
10 +	29	2.55	2.063	20	3.10	1.447
<i>All</i>	400	1.71	1.621	300	2.11	1.818
Share of variance explained	3.45%			2.21%		
F test value	4.566425			2.685498		
Probability of error	0.00129			0.031624		

The business factor

Table 7 presents the average indexes of firms distributed by business sectors. It is unsurprising to find that computer service firms (*B*) are the most sophisticated users of information technology (average index = 2.81). The sector effect may be compounded by a size effect. For example, architecture firms (index 0.72) are usually small; only 9.4 percent in the rural sample have 5 people or more, against 20.5 percent for computer service firms. Again, the rural-urban divide is found for every category, admittedly with diverse significance margins.

It is worth noting that the business sector is a better predictor of IT implementation levels than size and geography, with almost the same share of variance explained in the two samples: 14.7 and 15.5 percent.

Table 7. IT index and the distribution of firms, by business sectors

<i>Business sectors</i>	Rural			Lyon		
	<i>Nb.</i>	<i>IT Index</i>	<i>Std-dev</i>	<i>Nb.</i>	<i>IT Index</i>	<i>Std-dev</i>
B - Computer services	78	2.81	2.071	58	3.29	2.128
A - Edition, publishing	27	2.19	1.545	20	2.60	1.536
D - Translation	17	1.65	1.498	13	1.85	1.463
G - Engineering, R&D, and testing	97	1.65	1.362	73	1.92	1.754
C - Design, Graphics	60	1.60	1.238	45	2.33	1.651
F - Office adm. services	57	1.44	1.536	43	1.77	1.461
E - Architecture	64	0.72	0.899	48	0.96	1.202
<i>All</i>	400	1.71	1.621	300	2.11	1.818
Share of variance explained	14.77%			14.53%		
F test value	12.527889			9.472683		
Probability of error	0			0		

The use of Information Technology is correlated with the geography of sales, notably in rural areas

There is a relation between the versatility of IT uses and the geographic scale of the market: the more globally the company trades, the more it is likely to use a large panel of ‘distance-killing’ applications (Table 8). It is interesting to find that the geography of sales is a better predictor of IT-related behaviours in a rural context, with 8.17 percent of the variance explained, compared with 3.66 percent for firms located in Lyon.

Table 8. IT index and the geography of sales

<i>Geography of clients</i>	Rural			Lyon		
	<i>Nb.</i>	<i>IT Index</i>	<i>Std-dev</i>	<i>Nb.</i>	<i>IT Index</i>	<i>Std-dev</i>
Local / Regional	175	1.19	1.226	108	1.64	1.640
National / International	220	2.16	1.768	187	2.40	1.873
nr	5	1.40	1.673	5	2.40	1.140
<i>All</i>	400	1.71	1.621	300	2.11	1.818
Share of variance explained	8.17%			3.66%		
F test value	18.74615			6.684412		
Probability of error	0			0.001447		

A convergence of ‘global’ rural firms toward the urban model of business?

One of the main findings of the present study is the tendency of rural firms with a large span of operations to adopt a behaviour in IT use similar to their urban equivalents. Table 9 and Figure 2 show use rates for the nine applications surveyed within three groups:

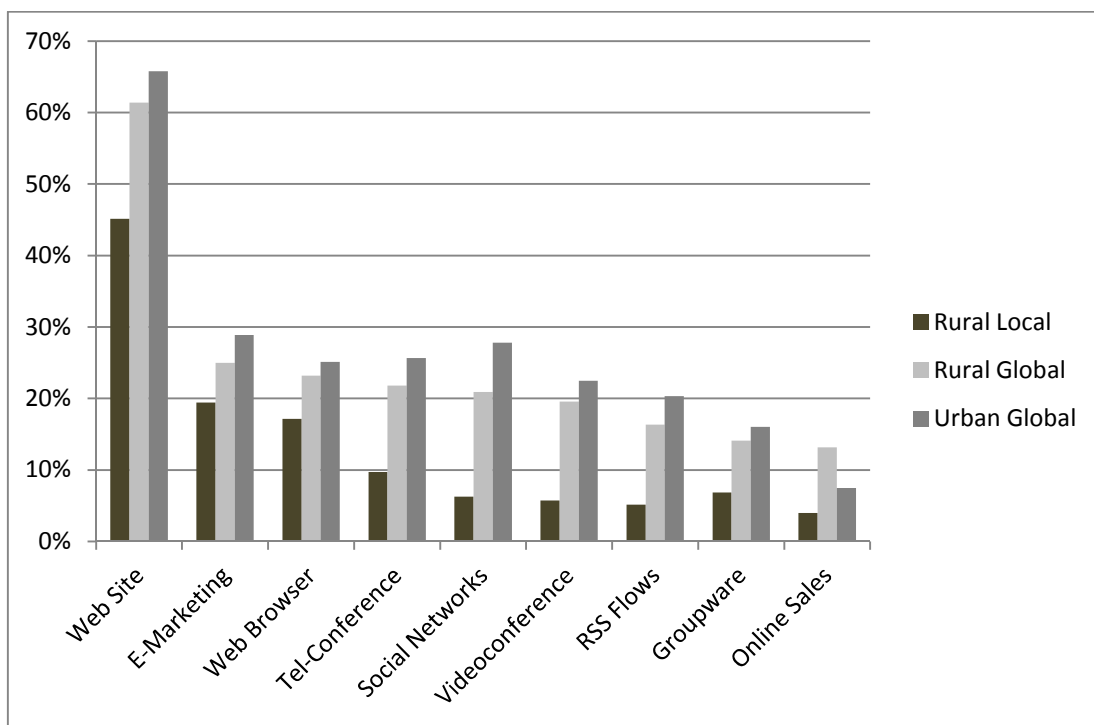
- rural firms that have local or regional sales only (‘local’ rural);
- rural firms which sell on national or international scales (‘global’ rural);
- and urban firms with national or international reach (‘global’ urban).

There is evidence of a clear gap between ‘local’ and ‘global’ rural ITES firms, by a very significant statistical margin for seven out of nine applications. On the contrary, ‘global’ rural businesses and their urban equivalents show much closer figures, with only one difference significant at the $p = 90\%$ level, which is in favour of rural firms (online sales). The graphical representation of the same data (Figure 2) speaks for itself.

Table 9. Implementation rates of IT applications and the geography of sales

	Rural Local (1)		Rural Global (2)		X^2 (1-2)	Urban Global (3)		X^2 (2-3)
Sample	175		220			187		
Web Site	79	45%	135	61%	10.33***	123	66%	0.85
E-Marketing	34	19%	55	25%	1.73	54	29%	0.84
Web Browser	30	17%	51	23%	2.18	47	25%	0.21
Tel-Conference	17	10%	48	22%	10.39***	48	26%	0.83
Social Networks	11	6%	46	21%	16.88***	52	28%	2.63
Videoconference	10	6%	43	20%	16.05***	42	22%	0.52
RSS Flows	9	5%	36	16%	12.16***	38	20%	1.07
Groupware	12	7%	31	14%	5.26***	30	16%	0.30
Online Sales	7	4%	29	13%	9.92***	14	7%	3.47*

*** $p > 0.01$; ** $p > 0.05$; * $p > 0.1$

**Figure 2. Implementation rates of IT applications and the geography of sales**

The detailed analysis of social networks provides interesting findings (Table 10) if we consider the distinction between *Facebook* and business-oriented networks such as *Viadeo* and *LinkedIn*. *Facebook* is by far the preferred networks of rural firms, while *Viadeo* is dominant among urban firms. It is worth noting that *Twitter*, *Viadeo*, and *LinkedIn* are almost fully ignored by ‘local’ rural firms, but more frequently adopted by ‘global’ rural firms. This difference of behaviour is an additional evidence of the convergence of some rural ITES firms toward a ‘global’

model of business: rural firms that endeavor to serve a large market must get in touch with clients who are mainly located in cities and more frequent adopters of *Viadeo*, *Linkedin*, and *Twitter*.

Table 10. Professional use of social networks, and the geography of sales (multiple answers)

	Rural Local (175)		Rural Global (220)		X^2	Urban local (108)		Urban Global (187)	
Use of any social network	11	6.3%	46	20.9%	16.88***	23	21.3%	52	28.0%
<i>Including:</i>									
Facebook	10	5.7%	35	15.9%	10.04***	10	9.3%	26	13.9%
Viadeo	2	1.1%	21	9.5%	12.55***	16	14.8%	32	16.6%
Linkedin	1	0.6%	7	3.2%	3.35*	3	2.8%	17	9.1%
Twitter	1	0.6%	13	5.9%	8.12***	4	3.7%	19	10.2%

6. Explaining the rural-urban gap: the effect of a broadband divide?

Even if rural firms with a ‘global’ reach tend to converge with urban firms, we have found evidence of a rural-urban digital divide. Its depth is variable, but existent for every class of size and sector, and for all but one application. How can this gap be explained? The literature puts forward two main hypotheses, both linked to the intrinsic features of peripheral areas compared with large cities: the existence of a broadband divide, and a general backwardness in technology adoption, which mirrors a lesser degree of business sophistication.

The existence of a telecom infrastructure-based digital divide between rural and urban areas – often called the broadband divide – has been for long a popular theme in both academic and political circles. However, the present study shows some evidence that, in the French context, rural firms do not face specific difficulties to access telecommunications networks and services (whether in terms of availability or cost).

First, the old broadband divide has almost vanished (Table 11): 97 percent of the rural companies surveyed benefit from ADSL (asymmetrical) or SDSL (symmetrical) services. In 2011, broadband covers nearly one hundred percent of France (ARCEP 2011). Admittedly, a few isolated settlements remain out of touch from ADSL services. But in most rural regions, local governments have favored the deployment of WiMAX networks, or subsidy the acquisition of satellite reception gear⁷.

Second, it is true that fiber optics is emerging in large cities such as Lyon (19 subscribers out of 300 respondents), while rural fiber is nearly non-existent. However, there is no reason to think that the absence of fiber is by now a strong deterrent for implementing more advanced telecom-based practices in rural firms. Actually, a large majority of rural respondents say they are very or fairly happy with their Internet connection. Only ten percent regard their connection as not satisfactory, against 8.4 percent in Lyon, a very close figure.

⁷ KA-SAT, launched in December 2010 by Eutelsat, delivers the unprecedented speed of 50 Mbps. download, and 20 Mbps. upload (Eutelsat 2012).

Admittedly, the share of ‘fully satisfied’ users is higher in Lyon (42.7 percent) than in rural areas (29.8). However, the cross analysis of the IT index and the declared satisfaction rate of connection is inconclusive. Fairly satisfied rural firms have an IT index of 1.68, against 1.73 (the global average index) for highly satisfied respondents, a very small, insignificant margin. In the same vein, rural users point out telecommunications problems more frequently than urban users. But the difference is thin: 13.8 percent acknowledge a lack of speed, against 12 percent in Lyon; 15.5 percent complain about reliability, against 11 percent. The difference could be explained by the structural deficiency of ADSL in low density areas: the longer is the line between the subscriber and the provider's multiplexor, the slower is the connection. However, the perceived gap is modest and does not lead to a convincing explanation, given that most of the applications surveyed, with the exception of Web/video conferencing, are not much bandwidth-consuming.

The gap is markedly higher when comments focus on the quality of technical support (Table 12): 15.5 percent of rural firms mention a problem in this regard, against four percent in Lyon. However, it is unclear that this significant difference could be the outcome of location *per se*. Telecom service providers in rural areas are fewer, and the distance from clients is greater. But telecom maintenance is often a matter of remote helpdesk efficiency, that is independent from distance.

Table 11. Internet access and telecommunication services: Rural / Urban comparison

	Rural		Lyon		X^2
Main internet access					
ADSL / SDSL	387	96.8%	268	89.3%	15.68***
Optical fiber	2	0.5%	19	6.3%	20.05***
Other	7	1.75%	6	2.0%	
Nr.	4	1.0%	7	2.3%	
<i>Total</i>	400	100%	300	100%	
Internet providers					
Orange (France Telecom)	315	78.8%	160	53.3%	50.77***
SFR	32	8.0%	36	12.0%	
Free	30	7.5%	63	21.0%	27.12***
Bouygues	7	1.8%	6	2.0%	
Numéricable	0	0.0%	12	4.0%	12.28***
Other	11	2.8%	13	4.3%	
Nr.	5	1.3%	10	3.3%	
<i>Total</i>	400	100%	300	100%	
Satisfaction rate					
Very high	119	29.8%	128	42.7%	12.53***
Fair	239	59.8%	145	48.3%	9.02***
Under average	29	7.3%	17	5.7%	
Very low	11	2.8%	8	2.7%	
Nr.	2	0.5%	2	0.7%	
<i>Total</i>	400	100%	300	100%	

*** $p > 0.01$; ** $p > 0.05$; * $p > 0.1$

The analysis of cost is similarly inconclusive. On average, rural firms pay a 55.5 euros monthly fee for their Internet connection, while urban firms pay 44.7 euros. A part of this difference might be explained by the lack of competition between telecom providers, given Orange's (France Telecom) virtual monopoly in rural regions (Table 11). But this difference can by no means be regarded as a significant issue in terms of competitiveness. It is easily counterbalanced by lower labor costs, lower local taxes, and cheaper real estate. Finally there is a simpler way to reject the telecom cost argument: if a given firm is willing to pay more for its Internet connection, it is expected to implement a broader set of related applications, not a smaller one. Actually, if rural firms pay moderately more, they are less versatile users.

Table 12. Main perceived telecom problems (multiple answers)

<i>Sample</i>	Rural		Lyon		X^2
	<i>400</i>	<i>100%</i>	<i>300</i>	<i>100%</i>	
Lack of reliability	62	15.5%	34	11.3%	2.52
Lack of speed	55	13.8%	36	12.0%	0.46
Lack of technical support	35	8.8%	13	4.3%	5.24**
Exaggerated price	24	6.0%	13	4.3%	0.95

7. Discussion and policy implications

Throughout this empirical research, we have found that rural ITES firms are on average less sophisticated and less versatile users of information technology than their urban fellows. In this regard, the findings of this paper are in line with the dominant literature (Galliano and Roux 2008; Galloway, Sanders, and Deakins 2011). The idea that rural firms are likely to be more IT-intensive or IT-versatile than urban firms because of spatial isolation must be discarded once and for all.

We have found evidence that the access to telecom infrastructure and services, in the French context, is no longer a discriminant factor between rural and urban firms. The rural-urban 'broadband divide' has almost entirely vanished, even if a faster rise of fiber optics in cities may be perceived throughout rural regions as a threat in the medium term.

Technology adoption often spreads through a process of imitation. Admittedly, some rural entrepreneurs may lack touch with a 'techno-buzz' which is quintessentially urban. It is tantalizing to find recourse in the vast literature which emphasizes the role of geographical proximity and agglomeration in the production and diffusion of knowledge and innovation (Bathelt, Malmberg, and Maskell 2004; Boschma 2005; Storper and Venables 2004) to conclude that the technological gap found may be the inevitable result of remoteness. However, there is evidence that a share of rural ITES firms is able to get in touch with remote markets, nationwide or abroad, and therefore, enhances its growth potential and widens the local economic base. These rural firms with a large geographic reach present a behaviour in terms of IT implementation which is close to those of their urban equivalents. The more sophisticated the business, the more remote the client, the more versatile the IT solutions adopted. In this respect, our interpretation is consistent with the work on Quebec by Shearmur and Doloreux (2009) and the result of Bryson and Rusten

(2005) on Norway, who found very adaptive and dynamic KIBS outside metropolitan areas.

Therefore, this paper concurs with the idea that the spatial dynamics of innovation is not reducible to a question of agglomeration economies (Shearmur 2012). We have some reason to consider that geography *per se* is not a definitive hindrance to IT implementation and, therefore, that the relevancy of a rural-urban 'digital divide' must be seriously questioned. There is no proven evidence that rural ITES entrepreneurs do not use the IT applications they need in a given business context; or, more precisely, the applications they *consider* they need.

As shown in Table 3, IT adoption rates within both rural and urban samples are subjected to a great variability, compared to the modest, residual gap between average rural and urban behaviours. Here is an evidence of the limitations of quantitative methods based on official business classifications, which are unable to capture important differences in business operations and organizations within categories of firms. In this regard, we must plainly be aware of the limited significance of mean-based quantitative analyses. This method leads to conceptualize and analyze the behavior of an average individual firm, which does not exist in the real business sphere. This is an indication that a part of future research should embrace qualitative methods – notably in-depth interviews.

The present paper leaves open the way to methodological improvements in further research. In particular, it does not provide a macroeconomic measurement of rural ITES industry. Therefore, the actual economic impact of these activities on rural regions remains mostly unknown. However, our results may have some implications in the field of local development policy. The findings of this paper are in line with Grimes (2000) who states that 'a fundamental flaw in policy conceptualization of ICTs is to assume that they are a substitute for more basic requirements such as entrepreneurial skills'. Admittedly, the implementation of ultra-high-speed optical networks may be essential to prevent the advent of a 'digital divide 2.0' (Moriset 2010). However, the issue of accessibility remains secondary to the lack of entrepreneurship (Galloway 2007). In the same vein, Malecki (2003, 212) argues that the issue of rural development 'is far more than a relatively simple infrastructure supply issue... but part of a complicated process that goes beyond rural and urban.'

The improvement of the overall attractiveness of the place must therefore be present in the agenda of rural policy makers who want more 'lone eagles and high fliers' to rejuvenate their communities. The creation of local incubators and telecenters may favour this move. Housing, education, and health services are also capital. Decent shopping opportunities, cultural and recreational activities should be considered to complete the package. As a general purpose technology (Bresnahan and Trajtenberg 1995), Internet can drive many improvements in these fields. We concur with Galloway, Sanders, and Deakins (2011) to consider the importance of complementarities between local and global scales in rural business operations. In particular, the development of locally-oriented ITES firms may be critical to the competitiveness of more globally-oriented enterprises in basic sectors of rural economies such as manufacturing and tourism.

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