The geography of transaction linkages in twelve European case study regions.

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Abstract

The paper begins with a discussion of the role of business linkages in regional economic performance. Business linkages are the "nervous system" of the local economy, and provide an important means for local businesses to access knowledge and information of various kinds, and hence the innovation which largely determines economic performance.

The second section presents some results of survey work, carried out in twelve regions across the EU, which focuses upon the geography of transaction linkages. Perhaps not surprisingly, the scale of both upstream and downstream linkages is very much determined by the sectoral characteristics of the business. More interestingly, they are also affected by to some extent by the characteristics of the region (in core-periphery terms), the size of the firm, its locational "history", and the level of human and social capital associated with the entrepreneur.

The paper concludes with a summary of the findings and some observations about policy implications and potential future work.

The research on which this paper is based forms part of the AsPIRE (Aspatial Peripherality Innovation and the Rural Economy) project, which is funded by the EU Fifth Framework (LIFE) Programme (Contract No QLK5-2000-00783). The research partnership comprises the Scottish Agricultural College, TEAGASC (Dublin), National University of Ireland, Galway, University of Valencia, University of Patras, University of Dortmund, and the University of Helsinki.

INTRODUCTION

It has long been recognised that regional economic performance is closely related to levels of innovation among the business population Both Marshall (1930) and Schumpeter (1934) have been credited as early proponents of this view. More recently innovation has been reinterpreted as an incremental, endogenous, group activity (North and Smallbone 2000, Asheim 1999). Its success depends not solely on technology transfer arrangements, or the presence of "innovators", but upon the characteristics of the entire local economy; the various actors, the relationships between them, and the environment within which they operate. Business networks thus form a major source of the information upon which innovation depends. The importance of linkages and networks is implicit in the literature on clusters, industrial districts, and innovation systems (Piore and Sable 1984, EU Commission 1995, Belussi 1996, Maillat 1998), and more recently they have become a specific focus for research in their own right (Perry 1999, Huggins 2000, Lechner and Dowling 2002).

One aspect of business linkages which is probably very important, but about which we at present know very little is their geography. A better understanding of the spatial manifestations of business networks, and how they vary in different environments, across the spectrum of industrial activity, and according to the characteristics of firms and entrepreneurs may be one of the keys to understanding processes of differentiation between regions in terms of economic performance.

This paper presents findings, relating to the geography of business networks, of part of an EU Fifth Framework project entitled **As**patial **P**eripherality, **I**nnovation and the **R**ural **E**conomy, (AsPIRE). In terms of data collection methodology the authors acknowledge their debt to Paul Courtney and Andrew Errington (Errington and Courtney 2000).

THE ASPIRE PROJECT

(i) The basic hypothesis

The AsPIRE project involves researchers in Scotland, Greece, Germany, Spain, Ireland and Finland. Its main focus is upon the way in which soft factors, such as business network characteristics, social capital, human capital (especially in relation to the exploitation of information technology), and institutional thickness can ameliorate the disadvantages of peripheral location. These issues are increasingly pertinent in a world where regional policies seem to have yielded infrastructural improvements (particularly transport and communications) contributing to the reduction of absolute time/cost disadvantages of peripheral regions, without necessarily bringing equivalent benefits in relative competitiveness. The well established academic emphasis on endogenous development processes and the content of recent economic development strategies in peripheral regions is evidence that the need to address local "soft" factors is already widely recognised as a response to differential performance in the periphery. AsPIRE is exploring these issues through a set of comparative regional case studies, and in terms of four themes: business networks and innovation, social capital, governance, and the role of Information Society Technology (IST). Each of the regions is benchmarked against an indicator of

"conventional" (spatial) peripherality. Amongst the final outputs of the project will be a better and more systematic understanding of the way in which soft factors interact with conventional locational disadvantage. This should enable the project team to devise more appropriate indicators whereby "softer" aspects of a regional economic environment may be assessed, and appropriate policy responses devised.

This paper is based upon analysis of data collected for the Business Networks theme of AsPIRE.

(ii) Case Study Areas

Each AsPIRE project partner selected two case study regions, one of which was perceived to be relatively peripheral, yet presenting a relatively dynamic and prosperous economy, the other more accessible but with a lagging economy. These regions are shown in Figure 1.

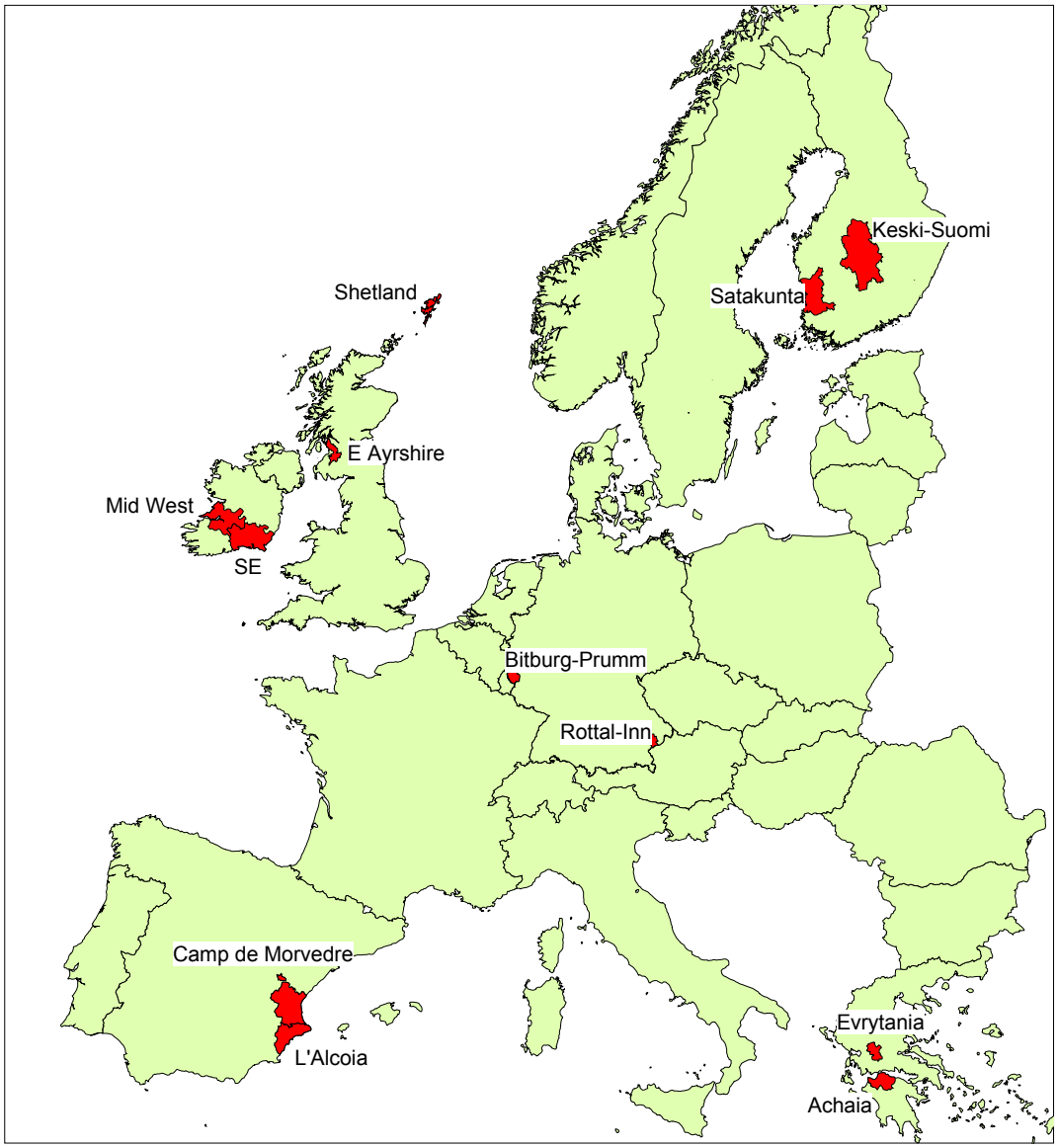

Figure 1: AsPIRE Case Study Areas

(iii) The Business linkages Dataset

As part of the Business Networks theme the AsPIRE team carried out a survey of 600 businesses, (50 in each case study region). Within each study area the sampling target was 25 manufacturing firms, and 25 service firms, with a distribution of firm sizes broadly reflecting the size distribution of the region. A sub-sample of 120 firms were asked further specific questions relating to the location of their ten most important suppliers and customers. This supplementary database has been linked to the main business survey database, allowing analysis according to various firm characteristics, such as business sector, age, size, the human capital of the entrepreneur and so on.

In the main business survey two questions formed the basis of the following analysis. These simply asked about the percentage of material inputs and sales which derived from or went to: (a) the same (NUTS 3) region, (b) the same member state, (c) other EU member states, and (d) outside the EU. The supplementary questionnaire asked for information about up to ten of the firm's suppliers and up to ten of its customers. For each of these a precise location (in terms of post code or settlement name) and the percentage of total inputs or sales value, were requested.

RESULTS

(i) Comparison of Member States

(a) Sources of Material Inputs

On average the firms interviewed derived a little over 40% of their material inputs from within the same (NUTS 3) region (Table 1), roughly the same proportion from other regions within the same member state, 10% from other EU member states, and 5% from outside the EU[1].

Table 1 : Sources of Material Inputs by Member State

	UK	IR	DE	FI	ES	GR	Total
	Average % of Material Inputs						
Within Region	34.4	40.5	38.7	**29.9**	**61.3**	47.2	42.0
Within Same Member State	**56.5**	34.0	38.9	**31.2**	**28.3**	**48.2**	39.5
Within EU	**4.4**	**18.0**	11.2	**16.0**	**5.2**	**2.9**	9.6
Outside EU	4.5	6.2	7.4	4.1	4.4	**1.8**	4.7
Outside Region	**62.9**	54.9	57.5	51.3	**37.9**	52.9	52.9

Note: Figures in bold are significantly different from the average across all regions at the 95% significance level

The level of intra-regional sourcing was lowest in Finland, at less than 30%. The UK firms had a similarly low level of local linkages. At the other extreme, the Greek interviewees purchased over 60% of their material inputs within the region, and the Spanish firms 47%.

[1] These figures do not sum to 100 because they are averages of percentages given by each interviewee, and in a significant proportion of these the sum was less than 100.

The pattern of extra-regional purchasing is not easy to interpret. The Greek and UK firms bought roughly half their inputs from other regions within the same member state, whilst in Ireland and Finland trade within the EU was relatively important. Extra EU sources were relatively important in the Irish and German samples.

Overall, there seem to be two subgroups within the six countries involved in the survey (Table 2). Within the Northern group (UK, IE, DE and FI) sourcing within the member state dominated the pattern, with intra-regional sourcing apparently less important. In the Southern group (ES GR) this pattern was reversed. The Northern group also seem to bring in more inputs from other member states, and from outside the EU, than the Southern group.

Table 2: Sources of Material Inputs, Northern and Southern Member States

	Northern Member States	Southern Member States	Total
	Average % of Material Inputs		
Within Region	**35.8**	**54.1**	42.0
Within Same Member State	40.1	38.3	39.5
Within EU	12.4	**4.0**	9.6
Outside EU	5.5	3.1	4.7
Outside Region	56.6	**45.4**	52.9

Note: Figures in bold are significantly different from the average across all regions at the 95% significance level

From the smaller (sub-sample) survey results (Table 3) it can be seen that the average distance to suppliers was about 640 kilometres, and the average distance to the most important supplier was a little greater at about 740 km. The greatest mean distance (over 1,200km) was found in the Irish sample, and reflects the strong transatlantic links of the case study areas there. Longer linkages are also characteristic of the other case study areas within the "Northern Periphery", (UK and FI). The Spanish and Greek samples are by way of contrast characterised by relatively short supplier linkages. The German study areas, being relatively close to major industrial areas, also displayed short input linkages.

Table 3: Supply Linkage Lengths by Member State

	Mean Distance to Supplier (Km)	Mean Distance to Most Important Supplier (Km)
UK	633	803
IE	1,228	1,662
DE	527	744
FI	822	712
ES	520	602
GR	316	38
All	637	740

(b) Destination of Sales

The overall average percentage of sales within the case study regions was found to be 44%, whilst 39% went to other regions within the same member state (Table 4). Other member states and countries outside the EU received 10% and 5% of sales

respectively. Thus the overall pattern of sales linkages is quite similar to that for inputs.

Table 4: Sales destinations, by member state

	UK	IR	DE	FI	ES	GR	Total
	Average % of Sales						
Within Region	38.8	**25.5**	**35.4**	36.9	**52.2**	**73.7**	43.8
Within Same Member State	43.2	42.3	46.2	**48.5**	**32.4**	**24.0**	39.4
Within EU	7.7	**23.9**	13.8	**4.4**	12.9	**1.3**	10.6
Outside EU	**10.4**	**9.7**	3.6	**2.2**	**1.6**	**0.4**	4.6
Outside Region	60.7	**75.9**	**63.5**	55.0	46.6	**25.7**	54.5

Note: Figures in bold are significantly different from the average across all regions at the 95% significance level

Again the Southern member state study regions seem to be more "self contained" than those in the North. The firms interviewed in Greece and Spain sold over 60% of their products within the same region, and only 36% outside the region (Table 5). In the Northern study areas roughly one-third of sales went to the local region, whilst, 45% went to other regions within the same member state, and about 20% to other countries. The Irish firms were notable for their low level of intra-regional sales, and their high level of exporting (Table 4).

Table 5: Destinations of sales, Northern and Southern member states

	Northern Member States	Southern Member States	Total
	Average % of Sales		
Within Region	**34.1**	**63.1**	43.8
Within Same Member State	**45.1**	**28.2**	39.4
Within EU	12.4	**7.1**	10.6
Outside EU	6.4	**1.0**	4.6
Outside Region	**63.8**	**36.1**	54.5

Note: Figures in bold are significantly different from the average across all regions at the 95% significance level

The pattern of sales linkage length was similar to that of input linkages, although the distances were relatively longer. The mean distance to all customers was 700km. That to the most important customer was shorter, at about 470km. The Greek firms seem especially localised in their reach, whilst the Spanish average occupies an intermediate position. By contrast the Northern Periphery countries displayed the longest linkages (the averages for the UK and Ireland being boosted by a few firms with global interests).

Table 6: Sales linkage length by Member State

	Mean Distance to Customer (Km)	Mean Distance to Most Important Customer (Km)
UK	1,655	874
IE	1,246	1,000
DE	750	220
FI	301	174
ES	522	524
GR	67	5
All	700	468

(ii) The geography of Linkages and Innovation

The AsPIRE Business Survey asked the sampled firms about innovations they had carried out during the past year. It was explained that these could be product, process or market innovations, and could range in "originality" from something which was simply "new to the firm", through "new to the region" to "totally original". It was thus possible to investigate the different patterns of linkages for innovative and non-innovative firms, in order to shed light on possible associations between linkage patterns and innovation.

(a) Sources of Material Inputs

Innovative firms seem to draw a slightly higher proportion of their material inputs from outside the local region than non-innovative firms (Table 7). The greatest contrast is between those who claimed totally original innovations, (which sourced an average of 32% of their inputs from within their region) and the non-innovators, (which relied on local sources for an average of 42%).

Table 7: Sources of Material Inputs by Level of Innovation

	None	New to Firm	New to Region	Original	Total
	Average % of Material Inputs				
Within Region	42.2	50.2	36.6	**31.5**	42.2
Within Same Member State	44.3	**32.6**	41.6	43.2	39.8
Within EU	7.2	10.1	11.4	**12.5**	9.7
Outside EU	4.6	2.7	5.0	9.1	4.7
Outside Region	55.4	**44.7**	57.1	63.0	53.3

Note: Figures in bold are significantly different from the average for non-innovating firms at the 95% significance level

(b) Destination of Sales

The association is stronger on the downstream side (Table 8). More innovative firms sold less than 30% of their products within the local region, whilst non-innovators sold almost 55% locally.

Table 8: Destination of sales, by level of innovation

	None	New to Firm	New to Region	Original	Total
	Average % of Sales				
Within Region	54.8	**41.6**	**40.8**	**29.2**	44.1
Within Same Member State	33.1	**40.9**	**43.7**	**46.9**	39.6
Within EU	6.8	**12.7**	10.7	**15.4**	10.7
Outside EU	4.6	2.9	3.3	**10.1**	4.7
Outside Region	44.3	**56.3**	**57.7**	**72.3**	54.9

Note: Figures in bold are significantly different from the average for non-innovating firms at the 95% significance level

Clearly the above analysis does no more than show an association between (self-defined) innovativeness and the length of linkages. There may or may not be any

causal relationship. Two possibilities suggest themselves: (a) It is possible that longer linkages provide contacts which act as channels for "exotic" market or technical information which stimulates local innovation. (b) Alternatively the causal relationship could be the other way around, innovation being associated with specialised products for which the local demand is limited.

(iii) Comparison of Peripheral and Accessible Regions

The AsPIRE study regions were selected by each research partner on the basis of two criteria; peripherality and economic performance. The intention was to draw comparisons (within each member state) between a region which was relatively peripheral, but which had a dynamic economy (Type A), and a region which although relatively accessible, had a lagging economy (Type B). The selection of the regions was carried out by the research partner on the basis of a review of statistical and anecdotal evidence.

(a) Sources of Material Inputs

In the northern member state case study areas the dynamic peripheral case study areas seem to have been more "regionally sufficient" in terms of material inputs, whereas the lagging accessible regions derived slightly higher proportion of inputs from outside their borders (Table 9). However the difference is not statistically significant at 95%. In the two southern member states the lagging accessible regions are more dependant on local material inputs, but again the difference is not statistically significant.

Table 9: Sources of material inputs by case study area type

	Northern Member States			Southern Member States		
	Dynamic Peripheral	Lagging Accessible	Total	Dynamic Peripheral	Lagging Accessible	Total
	Average % of Material Inputs			Average % of Material Inputs		
Within Region	38.1	33.4	35.8	48.4	59.8	54.1
Within Same Member State	39.5	40.7	40.1	41.5	35.0	38.3
Within EU	11.8	13.1	12.4	5.4	2.7	4.0
Outside EU	4.5	6.6	5.5	3.4	2.7	3.1
Outside Region	55.1	58.2	56.6	50.4	40.4	45.4

Note: Figures in bold are significantly different from the average for the N or S groups at the 95% significance level

The supplementary (sub-sample) survey of firms allows us to create a "profile" of material input supply for each type of study region (Figure 2). The curve representing the average for all firms (in both types of study area) owes its concave shape to the increasing radius of the zones with increasing distance from the firm's location (equal radius zones would show a classic distance decay gradient with increasing distance). The graph still clearly illustrates the differences in the profile for each type of case study area. Thus firms in both types of study area derived approximately 22% of their material inputs from within a 50km radius of their location. In the 50-100km zone firms in the lagging accessible case study areas acquire about 18% of their inputs, whilst those in the dynamic peripheral case study areas derive only about 8%. Firms in the peripheral study areas tended to derive a higher proportion of their inputs from

more than 100 kilometres away. This is a reasonable finding, given the relative sparsity of economic activity further way from the main centres of population.

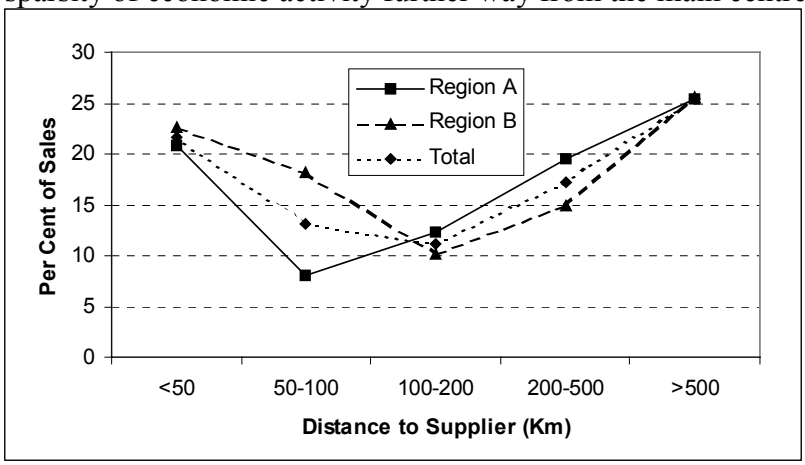

Figure 2: Profile of material input supply, by type of study region

(b) Destination of Sales

On the downstream side the business survey results (Table 10) indicate no significant difference between the peripheral dynamic and accessible lagging areas in terms of the regional pattern of sales.

Table 10: Destination of sales by study area type

	Northern Member States			Southern Member States		
	Dynamic Peripheral	Lagging Accessible	Total	Dynamic Peripheral	Lagging Accessible	Total
	Average % of Sales			Average % of Sales		
Within Region	33.9	34.3	34.1	60.0	66.1	63.1
Within Same Member State	43.2	46.9	45.1	30.7	25.6	28.2
Within EU	12.4	12.5	12.4	6.7	7.5	7.1
Outside EU	8.7	4.2	6.4	1.7	0.3	1.0
Outside Region	64.0	63.6	63.8	39.1	33.1	36.1

Note: Figures in bold are significantly different from the average for the N or S groups at the 95% significance level

However the profile based upon the supplementary survey suggests that a higher proportion of sales from firms in the dynamic peripheral regions are to customers within 50 kilometres of the business location and a lower proportion are in the 50-100 and over 200 kilometre zones.

Thus by combining the information on material input and sales linkages a (tentative) picture emerges of peripheral regions which are dependent upon both local and distant inputs, but which serve predominantly regional markets. Firms in the more accessible areas are more likely to have shorter upstream linkages and longer downstream linkages.

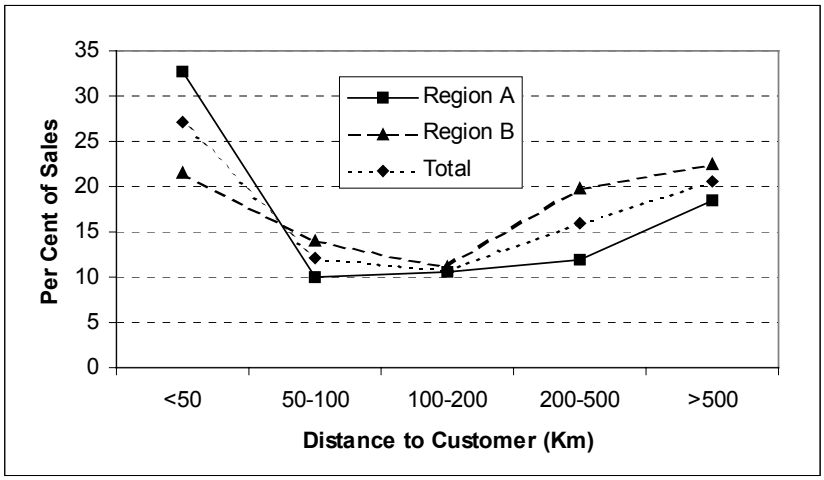

Figure 3: Sales linkage profile by type of case study region

(iv) Sectoral Effects

Previous work (MLURI *et al* 2002, Copus 2001) has suggested that the geography of business linkages is very much affected by the sectoral specialisation of firms. It is therefore important to explore the AsPIRE business survey data in terms of broad categories of economic activity. The sampling frame excluded primary industries, but ensured that manufacturing (including food processing) and services were represented within each study area. A preliminary analysis suggested that a tripartition of the data, into food processing, other manufacturing, and services, was appropriate.

(a) Sources of Material Inputs

For fairly obvious reasons, food manufacturing companies are significantly more dependent upon supplies of material inputs from within the same region than the rest of manufacturing industry (Table 11). Perhaps less obvious is the explanation of the service sector's localised pattern of input linkages. However it should be kept in mind that the service sector, by definition uses relatively few material inputs.

Table 11: Sources of material inputs, by broad sector

	Food Man.	Other Man.	Services	Total
	Average % of Material Inputs			
Within Region	**48.0**	27.6	**49.5**	41.9
Within Same Member State	43.4	45.5	**36.5**	40.1
Within EU	**5.6**	18.1	**5.5**	9.7
Outside EU	**1.8**	7.2	**3.6**	4.7
Outside Region	**50.8**	70.6	**44.3**	53.6

Note: Figures in bold are significantly different from the average for "other manufacturing" at the 95% significance level

The same patterns are clearly revealed by the supplementary survey data (Figure 4), which shows that food manufacturing firms obtained, on average, 70% of inputs from the zones within 100 kilometres, whilst other manufacturing obtained a average of a little over 20%, and services a little under 40% from the same area. At the other extreme, other manufacturing acquired an average of more than 30% from over 500

kilometres, whilst both food manufacturing and services received only about 20% from this distance.

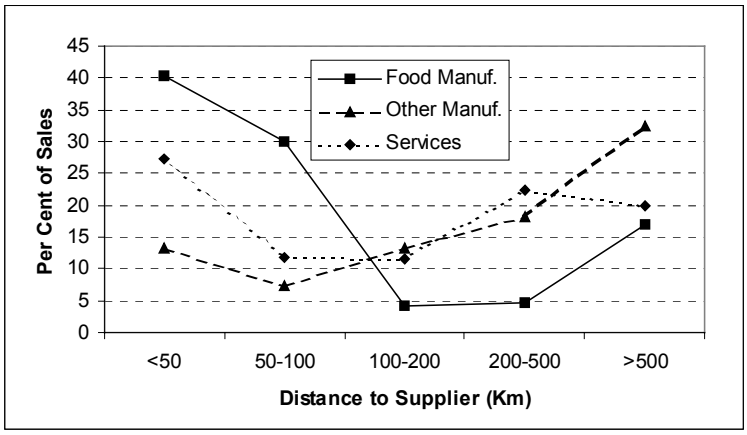

Figure 4: Material input profile, by broad sector

(b) Destination of Sales

The main feature of the regional pattern of sales is the relatively localised marketing of services, which is not surprising given the ubiquitous, market orientated nature of the sector.

Table 12: Destination of sales by broad sector

	Food Man.	Other Man.	Services	Total
	Average % of Sales			
Within Region	44.3	32.0	**50.7**	43.9
Within Same Member State	43.0	49.0	**34.4**	39.9
Within EU	10.5	11.4	10.1	10.5
Outside EU	**2.5**	7.0	**3.3**	4.5
Outside Region	55.9	67.1	**47.7**	54.8

Note: Figures in bold are significantly different from the average for "other manufacturing" at the 95% significance level

The profile of sales linkages revealed by the supplementary survey reveals a local focus for the food processing sector, over 55% of sales being from within 50 kilometres. Other manufacturing firms had much broader horizons, sending over 20% of sales to customers over 500 kilometres away.

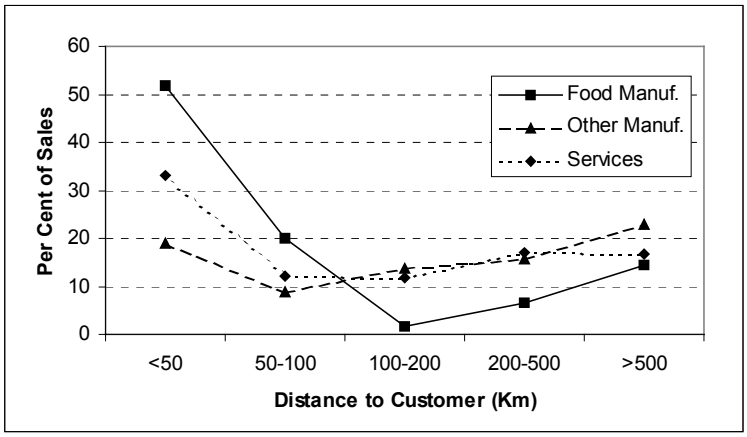

Figure 5: Sales linkage profile, by broad sector

(v) The Role of Business Size

(a) Sources of Material Inputs

Larger firms (those which employed more than 50 people), tended to derive a smaller proportion of their inputs from within the same region (under 29% compared with 44% for the smallest firms). They also purchased over 17% of their inputs from outside their own member state (Table 13).

Table 13: Sources of material inputs by firm size

	Employees			
	<20	**20-49**	**50+**	**Total**
	Average % of Material Inputs			
Within Region	44.6	38.6	**28.7**	41.9
Within Same Member State	38.6	42.4	43.4	39.6
Within EU	7.9	13.2	**17.5**	9.6
Outside EU	4.5	4.5	6.0	4.7
Outside Region	50.0	59.4	**66.3**	53.1

Note: Figures in bold are significantly different from the average for the <20 size group at the 95% significance level

The other side of the coin; the relative importance of local sources of inputs is clearly shown by Figure 6. On average over 25% of small firm's inputs were purchased from suppliers within 50 kilometres of the firm's location.

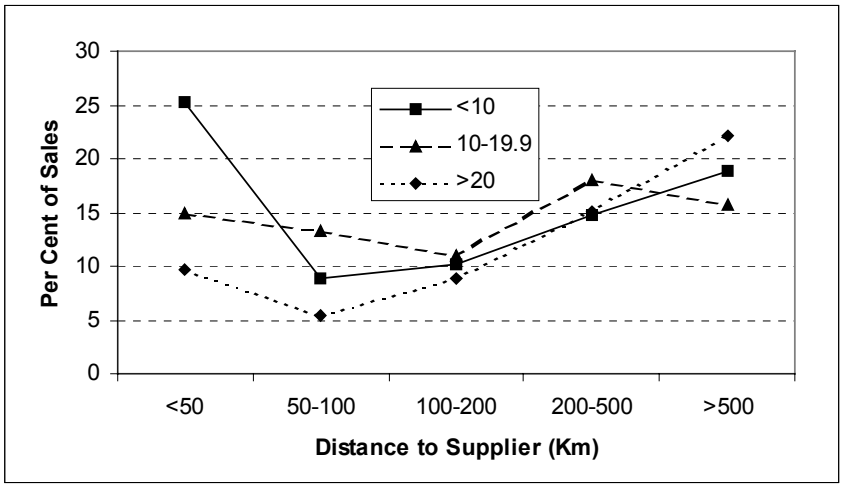

Figure 6: Profile of input linkages, by firm size

(b) Destination of Sales

The pattern of sales linkages by firm size (Table 14, Figure 7) closely resembles that for material inputs, with smaller firms selling a higher proportion of their products locally, and very little outside their member state or over distances of more than 500 kilometres.

Table 14: Destinations of sales by size of firm

	Employees			
	<20	**20-49**	**50+**	**Total**
	Average % of Sales			
Within Region	48.7	**35.0**	**20.9**	43.7
Within Same Member State	36.8	**48.1**	**48.4**	39.5
Within EU	8.8	10.2	**22.0**	10.7
Outside EU	3.8	5.6	**9.0**	4.6
Outside Region	49.3	**63.9**	**79.4**	54.6

Note: Figures in bold are significantly different from the average for the <20 size group at the 95% significance level

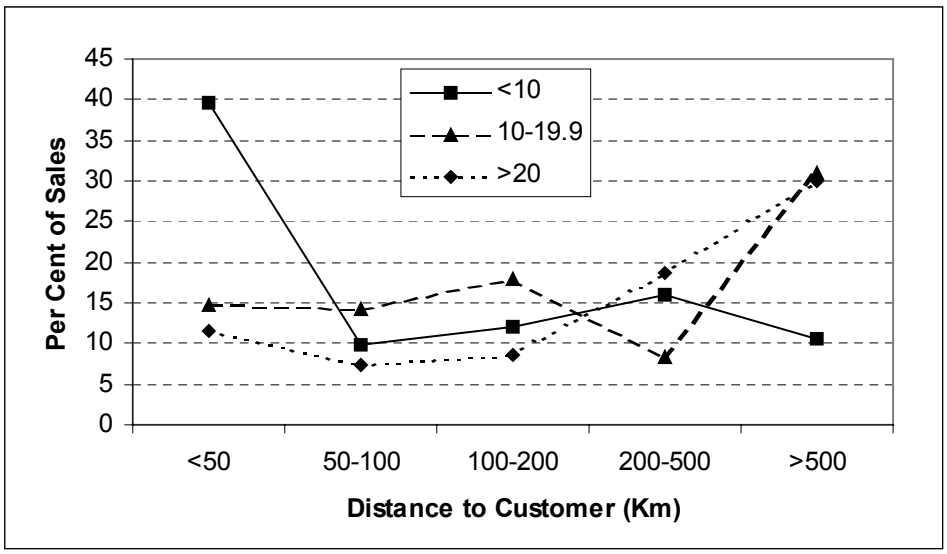

Figure 7: Sales linkage profile by size of firm

(vi) The Effect of Re-Location

(a) Sources of Material Inputs

Firms which had moved location tended to derive a slightly lower proportion of their inputs from local sources and a higher proportion from other member states, or from outside the EU (although most of these differences were not significant at the 95% level - Table 15). The survey results also suggested that this was most likely among firms which re-located between member states, although the numbers involved were relatively small.

Table 15: Sources of material input by migration status

	Non-migrant	Migrant	Total
	Average % of Material Inputs		
Within Region	43.4	37.1	42.3
Within Same Member State	39.8	39.4	39.8
Within EU	8.2	**16.4**	9.7
Outside EU	4.5	5.6	4.7
Outside Region	51.7	60.1	53.3

Note: Figures in bold are significantly different from the average for non-migrant firms at the 95% significance level

(b) Destination of Sales

Migration seems to have less impact on the geography of sales linkages, the regional distribution of sales being very similar in both migrant and non-migrant groups (Table 16).

Table 16: Destinations of sales by migration status

	Non-migrant	Migrant	Total
	Average % of Sales		
Within Region	44.1	43.5	44.0
Within Same Member State	39.5	41.0	39.8
Within EU	11.2	8.8	10.7
Outside EU	4.8	3.8	4.6
Outside Region	55.3	53.5	55.0

Note: Figures in bold are significantly different from the average for non-migrant firms at the 95% significance level

(vii) The Role of Human Capital

(a) Sources of Material Inputs

One of the most important elements of human capital in relation to the performance of SMEs is the level of education of the entrepreneur. The results of the AsPIRE business survey suggest that the level it also has an impact upon the geography of material input linkages (Table 17). Firms whose entrepreneurs had secondary or post-secondary education were much more likely to draw on inputs from outside their region.

Table 17: Material inputs by education level of the entrepreneur

	Primary	Secondary	Post-Secondary	Total
	Average % of Material Inputs			
Within Region	55.6	**43.3**	**38.6**	41.9
Within Same Member State	27.8	**43.1**	**41.9**	40.6
Within EU	6.5	8.0	11.1	9.7
Outside EU	2.6	3.5	5.1	4.3
Outside Region	36.8	**53.4**	**57.0**	53.7

Note: Figures in bold are significantly different from the average for firms whose manager had no post-primary education at the 95% significance level

Data from the supplementary survey shows that firms whose entrepreneurs had higher cumulative scores on a number of human capital attributes (previous entrepreneurial experience, involvement in representative bodies or local politics and so on), were on average much less reliant upon local sources of inputs.

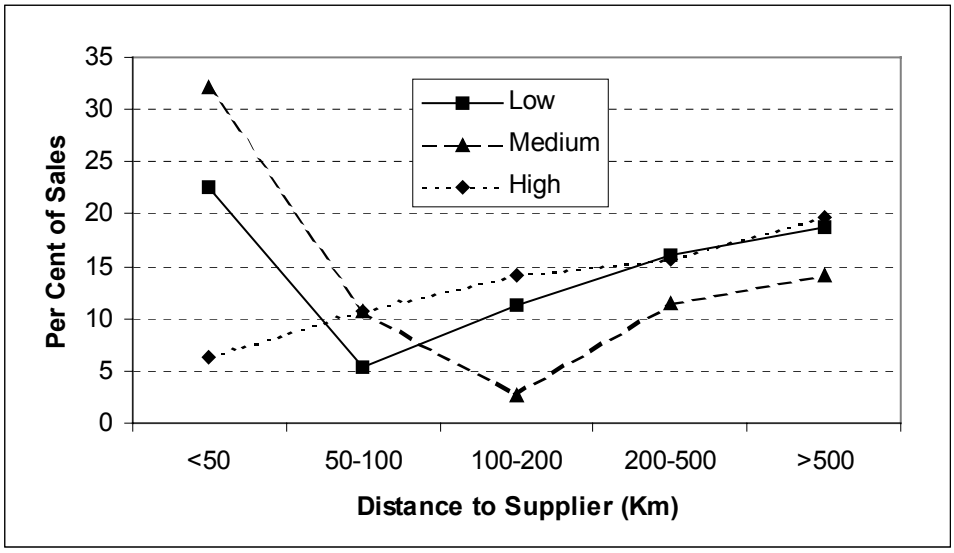

Figure 8: Profile of material input linkages by cumulative human capital score

(b) Destination of Sales

Strangely the relationship between education level and the geography of linkages does not seem to hold good with regard to sales (Table 18), and the relationship with cumulative human capital score is not as clear-cut (Figure 9).

Table 18: Destination of sales by educational level of entrepreneur

	Primary	Secondary	Post-Secondary	Total
	Average % of Sales			
Within Region	45.3	45.5	43.5	44.3
Within Same Member State	37.1	40.1	40.1	39.8
Within EU	12.0	9.2	10.5	10.3
Outside EU	4.1	4.5	5.0	4.8
Outside Region	53.2	53.5	55.6	54.7

Note: Figures in bold are significantly different from the average for firms whose manager had no post-primary education at the 95% significance level

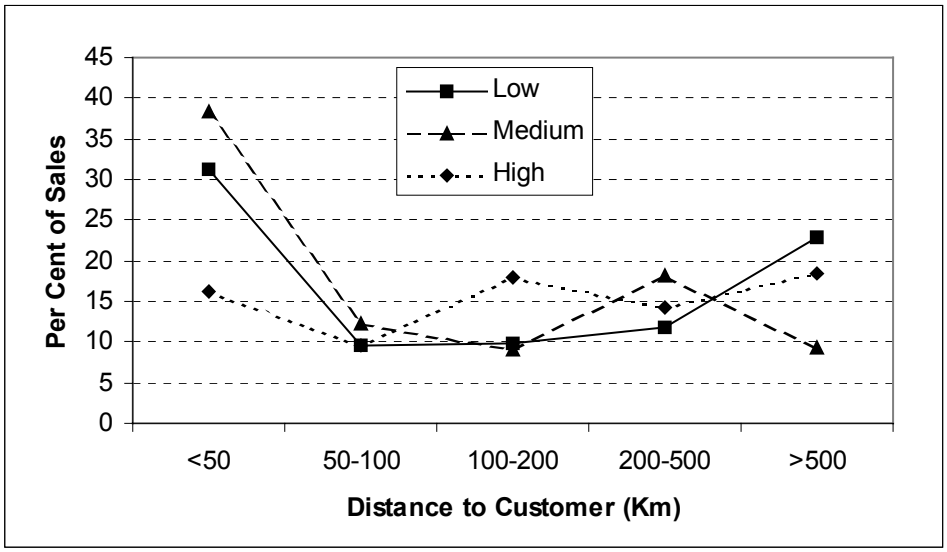

Figure 9: Profile of sales linkages by cumulative human capital score of entrepreneur

SOME TENTATIVE CONCLUSIONS

The results reported above provide some useful insights into the way in which upstream and downstream business linkages vary between different locational and environments, between different sectors, and according various other characteristics of the firm and the entrepreneur.

Considerable variations were found in the patterns of linkages between the participating member states, especially between the Northern member states and the two Southern countries, where a larger proportion of the linkages were intra-regional, and short distance, and fewer were with other member states or non-EU countries. However it is perhaps worth stressing that further survey work would be required to establish whether this difference relates particularly to the study regions or to the rural economy of the countries as a whole.

Despite the significant variations between the member states it was possibl to establish a relationship between patterns of business linkages and an indicator of innovativeness. It was found that businesses claiming to be innovative tended to have geographically more extensive linkages, especially on the downstream side. However further analysis will be needed to establish the direction of causality in the relationship.

An indication of a relationship between the type of study area and the length of linkages was suggested by the supplementary survey results. These suggested that the dynamic peripheral areas (Type A) derived more inputs from longer distances than the lagging accessible ones (Type B). On the downstream side the data suggests that the Type A areas tend to serve more local markets than Type B regions.

Other characteristics which the data suggests are influential over patterns of material input and sales linkages include business sector, business size, locational history, and the human capital of the entrepreneur. Thus service sector and manufacturing industries dependent upon perishable or bulky materials and producing perishable products (such as food processing) tend to have a smaller "footprint" than other manufacturing industries. Larger firms (in terms of employment) tend to have more extensive networks than smaller ones. Firms which have migrated are more likely to have linkages over longer distances than those which have not. Firms run by entrepreneurs with higher educational attainment and with greater levels of "human capital" tend to have wider profiles of linkages.

The surveys reported in this paper have collected information on physical, transaction linkages only. It is accepted that there are many indications in the literature that non-market or "soft" linkages are equally, if not more important, in terms of providing access to the information which fuels innovation and hence economic growth. However such soft linkages are very difficult to observe and quantify directly, and this study has followed the precedent of other research in assuming that physical linkages are a good proxy. The practical procedures for assessing the geography of physical linkages used within the AsPIRE project can therefore contribute to an explanation of differential regional economic performance. However the limitations of the sampling carried out, and the need for a larger survey, with more carefully controlled sampling before the conclusions drawn above can be anything more than tentative, is recognised.

In terms of policy implications the findings tend to confirm the validity of a shift away from investment in physical infrastructure towards policies which provide investment in human and social capital, and which nurture the development of stronger business networks (both non-market and transactional). More specifically this would imply provision of training and measures to raise "network awareness" among entrepreneurs. A greater understanding of the constraints relating to the characteristics of regions, firms and entrepreneurs will assist in the tailoring of local measures and their targeting.

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