

## Cluster policies, cluster evolution, and the transformation of old industrial regions\*

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### 산업집적지의 구조변화와 클러스터 발전방향

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**Abstract** : Despite growing recognition of the significance of industrial clusters to regional economic success, there has been only limited attention paid to the effectiveness of cluster policies in old industrial regions. Many of these regions still retain functioning industrial clusters, or have clusters which are adopting new strategies as part of a process of regeneration. This paper argues that the effectiveness of cluster policies in old industrial regions depends upon the extent to which they recognise the evolutionary nature of industrial clusters. It reviews the literature on the transformation of old industrial regions in Europe, and examines how cluster policies have risen to prominence as a policy tool. These strands are brought together in an exploration of cluster policies in old industrial regions. A brief case study is presented of the evolution of the steel industry supply chain in north east England. The conclusions focus upon the data requirements that form a starting point for informed policy intervention into processes of cluster evolution

**Keywords** : Industrial clusters, old industrial regions, cluster policies, cluster evolution, steel industry, north east England

**요약** : 지역경제의 성공에 있어 산업클러스터의 중요성에 대한 증대된 인식에도 불구하고, 구산업지구에 대한 클러스터 정책의 효과성에 대해서는 그다지 많은 관심이 모이지 못했다. 이들 지역 중 상당수에서는 아직 산업클러스터가 작동하고 있거나 재도약을 위한 새로운 전략이 모색되고 있다. 본 연구는 구산업지구에서 대한 산업클러스터 정책의 효과성을 산업클러스터의 진화적 성격에 대한 이해로부터 찾으려 한다. 이를 위하여 유럽 구산업지구의 변환에 대한 선행연구들을 고찰하고, 어떻게 클러스터 정책이 주요한 정책수단으로 등장하게 되었는지 살펴본다. 본 연구는 또한 영국의 북동지역에서 어떻게 철강산업의 공급체인이 형성되었는지 사례연구를 통해 살펴본다. 마지막으로 본 연구의 결론은 클러스터 형성 과정에서의 정책적 개입의 타이밍을 어떻게 잡을 것인지를 보여주는 자료에 초점을 맞추고 있다.

**주제어** : 산업클러스터, 구산업지구, 클러스터 정책, 클러스터 형성, 철강산업, 영국 북동지역

\* 이 논문은 산업단지 클러스터의 날 국제컨퍼런스 "산업집적지의 글로벌경쟁력 강화와 재창조 전략" (2008.11.12. 서울) 발표논문임(This is a paper presented to the conference "Recreating competitive global innovation clusters", Seoul, 12th November 2008)

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## 1. Introduction

In recent years there has been widespread political acceptance that one route to regional economic success is the identification of, and support for, clusters of linked activities. There have been at least two distinct routes to this conclusion. One takes explicit reference from the work of a small number of economists (see for instance Krugman 1991), stressing the benefits of agglomeration economies and endogenous growth (see also Martin and Sunley 1996). Much of this work was originally based on examination of the bases for competitive success of particular national economies. A second argues that clusters benefit from the creation of a pool of specialised knowledge and labour force skills, the sharing of innovative capacities, and an institutional fabric conducive to constant renewal and evolutionary change - often described as a set of "untraded interdependencies" (Storper 1995). Successful examples frequently cited in support of the vitality of such clusters include the motor sports industry in southern England (Pinch and Henry 1999), and the wooden furniture industry in Denmark (Maskell 1998). There are significant antecedents in this strand of the cluster discourse with debates over new industrial spaces, industrial districts, industrial milieux, and learning regions.

There have been several different typologies of clusters. Held (1996) for instance distinguished between the "classic" vertically-integrated supply chain; horizontally-integrated groupings of industries with a common resource base; and emerging clusters whose linkages were not yet fully established. This classification was used to inform the development of cluster policies in New York State. Others have stressed that the most dynamic and/or powerful clusters are those dominated by one or several lead firms, in what has been described as a hub-and-spoke

arrangement (Markusen 1996; see also Harrison 1994).

As yet however, there has been relatively limited attention paid to the effectiveness of cluster policies in one group of regions which share characteristic problems arising from early industrialisation. These old industrial regions have much in common: a concentration of economic activity in extractive sectors such as coal mining, or capital-intensive industries such as steel production, ship building and bulk chemicals production; often high and persistent levels of unemployment; low levels of new business creation; and acute infrastructural problems. Many of them have already been through decades of adjustment to new forms of global competition, whilst some (particularly in central and eastern Europe) are only beginning to adapt. Nonetheless, old industrial regions still often retain functioning industrial clusters, or at the least clusters which are (to some extent) adopting new strategies as part of a process of regeneration.

I argue here that the limited attention paid to cluster policies in old industrial regions is unfortunate, for it is in just such regions that productive and challenging questions can be raised about the cluster concept. I draw upon an earlier study reporting the results of research commissioned by the UK Department of Trade and Industry (Sadler 2004). This explored changing strategies and location processes within the steel industry supply chain in north east England. It argued that a product-based cluster strategy was inappropriate in a context where industrial process knowledge was more significant as a competitive asset; and that despite acute contraction in its core local market, parts of the supplier industry continued to evolve and adapt. Here, I seek to develop more fully some of the theoretical and policy implications of this evidence, and to generalise the discussion to incorporate principles of cluster policy formulation for

a wider range of old industrial regions. In particular, I emphasise a need to evidence and incorporate ongoing processes of change even within established, 'old' industrial clusters.

This paper therefore seeks to demonstrate and consider the implications of a proposition: that the effectiveness of cluster-based policies in assisting the transformation of old industrial regions depends fundamentally upon the extent to which such policies recognise the evolutionary (rather than static) nature of industrial clusters. The argument proceeds as follows. The next section explores some of the literature on the transformation of old industrial regions in Europe, so as to establish the context. Then I examine how cluster policies have risen to prominence as a policy tool, and consider some of the debates around the effectiveness of cluster policies. These two strands are brought together in the subsequent section, which explores cluster policies in old industrial regions. The conclusions set out what might be needed to develop the preconditions for an effective cluster policy in such regions. Here I focus upon the data requirements that form a starting point for informed policy intervention into processes of cluster evolution.

## **2. The transformation of old industrial regions in Europe**

The impacts of global competition were felt particularly severely during the 1970s and 1980s in western Europe's old industrial regions. These experienced a period of almost continuous decline in the employment bases around which they had been physically and socially constructed almost a century previously. One consequence was that processes of social and economic transformation were initiated, encouraged by government policies of re-

industrialisation. This frequently involved substantial state intervention, in the form of infrastructure renewal, reorganisation of declining industries (particularly through state ownership), incentives to new business formation or relocation, and benefit payments to the unemployed. Governments became deeply involved in the transformation of these old industrial regions (Sadler 1995). During the 1980s in particular, re-industrialisation policies focused on two aspects. These involved support for the creation of a new generation (in many cases the first for a long time) of small businesses, and the attraction of inward investment. Whilst over-dependence upon inward investment risked re-creating the dependence upon external ownership and control which some saw as a problematic outcome of past developmental trajectories, support for entrepreneurship sought to tackle historically low levels of new business creation.

Some areas did make a partial economic recovery, but many more struggled to escape the problems of declining economic activity and high unemployment. In part, and with the benefit of hindsight, this was probably only to be expected, given the sheer size of the problems faced. In north east England for example, the three once-linked sectors of coal mining, steel production and shipbuilding still employed 150,000 people, one-third of the region's industrial workforce, in the mid 1970s. Twenty years later, with the closure of the last coal mine and shipyard, that total had fallen to below 5,000. Faced with such a challenge, government policies shifted further and further away from direct intervention. In the UK in particular, this was part of a wider vision of the politics of transformation, one which encouraged abandonment (forced if necessary) of older collectivist values, and commitment instead to privatisation in a variety of spheres (see also Sadler 1992). Moments of resistance, such as the year-long national coal miners' strike in

1984/85, were almost all unsuccessful. The power of the state, the promise of new job creation, and divisions between groups of workers and between places, proved a powerful combination.

During the 1990s too, a further element was added to the equation, with the onset of political and economic liberalisation in central and eastern Europe. Decades of central planning had left many regions there with even larger-scale problems of over-dependence upon basic industries, rapidly rising unemployment, and acute environmental and infrastructural legacies. Just as it was becoming more and more apparent that re-industrialisation built around inward investment and new business creation could only partially and slowly tackle the problems of western Europe's old industrial regions, a whole new generation of problem regions emerged (see for instance Bathelt 2009).

It was in this context that policy turned to explore the bases for competitive success of growth regions and industries, to seek new ways of transplanting lessons into older industrial contexts, and to find explanations for the decline of old industrial regions in the absence of those features which were held to account for the dynamism of more successful regions. In particular, it was argued that whilst industrial clustering might lead to enhanced potential for innovation in some regions, in other cases it might instead be part of the cause of the failure to adapt. Unsuccessful clusters might become inward-looking systems, characterised by functional lock-in (hierarchical inter-firm relationships), cognitive lock-in (an inability to recognise and interpret external trends), or political lock-in (possessing institutional structures over-dependent upon old industries and thereby hindering indigenous potential for change) (see Grabher 1993). These concepts became increasingly utilised to explain the failure of old industrial regions to adapt. As Hassink and Shin (2005) pointed out,

however, little research explored how such 'lock-ins' emerged, and what differentiated clusters possessing such unfavourable characteristics from those which saw positive consequences from very similar processes of institutional representation. As they argued, the 'lock-in' concept was mostly based on observations in a few industries and regions, the 'classic' case being coal mining and steel production in the Ruhr Valley in west Germany.

In theory then, old industrial regions offer an environment in which growth clusters might be encouraged or enabled to prosper. There is the possible scenario that one reason for their limited capacity to adapt to changing external circumstances is a process of institutional lock-in, although this is as yet not fully evidenced. Before exploring in more depth the extent to which the cluster discourse helps in understanding the processes of change in old industrial regions, the following section goes on to explore some of the debates concerning the cluster concept as a policy tool, and explores the evidence base on the effectiveness of cluster policies.

### **3. Cluster policies**

Cluster policies became of major significance in the UK in the late 1990s (see for instance DTI 1998). In 1999 a Cluster Policy Steering Group was created, reporting to the Cabinet. Two years later a multi-volume study commissioned by the Department of Trade and Industry (TBR 2001) was published. This explicitly set out to find clusters. Defining an industry as a group of companies supplying the same product, and using enterprise-level five-digit SIC employment data, regional 'high-points' were identified with a location quotient of 1.25 or above (and accounting for at least 0.2 per cent of the regional workforce). These

high-points were then grouped on the grounds of product similarity to form the basis of a regional cluster. In this way, 154 clusters were identified within the UK.

The TBR (2001) report stressed that its findings were preliminary in nature, a necessary precursor to more detailed intensive research on the precise workings of particular clusters. It acknowledged that product similarity was not the only, nor even the most logical, basis for seeking commonality. Others, including technology and market, could have been more appropriate but were not incorporated. It accepted that it stopped short of a key issue, the precise nature of the linkages between firms within particular clusters. It cautioned against expectations that clusters would be powerful sources of employment growth in the future, commenting that for most of the regions of the UK, cluster job creation performance was no better than the regional average, and in some cases significantly worse. Nonetheless, the study was a significant guide to policy formulation, and subsequent regional strategies incorporated specific cluster-based industrial policies.

McDonald et al., (2007) tested some of the assumptions of this DTI study of UK clusters. They classified clusters within the DTI study into three categories: manufacturing; services; and media, computer-related and biotechnology industries (MCRB), the latter grouped on the grounds that previous case studies had indicated high performance within these activities. These sectors comprised respectively 21 per cent, 64 per cent, and 15 per cent of the 154 clusters identified in the DTI study. Utilising data and variables from the DTI study, they sought to explain employment change (declining/static, or growing) and whether or not a cluster was of international significance, in terms of stage of

development (established or otherwise), cluster depth (shallow or deep), and industrial sector (manufacturing/non-manufacturing). Acknowledged data limitations in this re-working of the DTI study included the lack of evidence on sub-national trade flows, the extent of information and knowledge sharing within clusters, and on the evolution of clusters over time. Results indicated that cluster depth was not significant in explaining employment growth or international significance. Established clusters were more likely to be associated with employment growth, but they were not more likely to be internationally significant. Non-manufacturing clusters were more likely to be associated with employment growth and to be internationally significant. Interpreting these findings, they cautioned that the limited effect of cluster depth on international significance might mean that there was an over-reliance on local sourcing in some clusters. In other words their conclusion was that the absence of one relationship might indicate a different relationship, in that over-dependence upon local firms was generating employment but hindering international competitiveness. Finally, they suggested that since clusters in the MCRB sector had the highest potential to be internationally significant, the promotion of deep clusters might be of less significance than policies to promote clusters in sectors which had the most scope for good performance. In other words, "cluster policies that focus on developing local supply chains and locally based collaborative networks are unlikely to be sufficient, and in some cases may not be necessary, to create and develop clusters that promote regional development objectives" (p. 47).

Relatively few studies have approached the effectiveness of cluster policies in an international comparative fashion. Reporting on a study of 43 European industrial clusters, McDonald et al., (2006) concluded that government policies had no significant

impact on the growth of clusters, or on the development of co-operation between firms within clusters. The data collected was however limited to the number of government agencies involved with cluster policies, and the number and nature of government policies applied to the industrial cluster, on a binary basis (for instance more than three policies scored one, less than or equal to three policies scored zero). The regression analysis utilised growth in numbers of firms as a proxy for the development of clusters, again on an either/or basis (increasing/not increasing). Whilst recognising the extent of data limitations, the study concluded that there may be no clearly identifiable generic factors behind the development of clusters. Policy, it was argued, should be more tailored to the needs of particular circumstances.

In a wider ranging critique, Martin and Sunley (2003) challenged much of the cluster discourse, and in particular its antecedents in the work of Porter's discussion of the determinants of competitiveness (see for instance Porter 1990). They argued that the association between spatial concentration and growth was not necessarily proven; that the extensive methodology of top-down mapping exercises based on product similarity was at best only suggestive of the existence of possible clusters; and that much of the power of the cluster discourse rested in its neatness of fit with policy priorities of raising productivity and innovation. They noted further that sub-national trade data was only rarely available, and that all too little attention had been paid to the evolution of clusters as dynamic, changing constellations.

There is then a growing literature on the cluster policy concept, and an emergent consensus that data limitations in particular make it difficult to be definitive about the effectiveness of the policy in practice. The following section goes on to consider cluster policies in

the specific context of old industrial regions.

#### **4. Cluster renewal and the transformation of old industrial regions**

Whilst considerable attention has focused on growth regions and the early stages of cluster development, only limited research has explored the renewal of clusters in old industrial regions. This section first introduces one of the few studies to have done just that, before going on to summarise case study evidence on the process of change in the steel industry supplier cluster in north east England.

Utilising a 'regional innovation system' approach, Tödtling and Trippel (2004) argued that local specialisation in mature industries does not necessarily lead to a loss of entrepreneurship and innovation. Taking issue with the view that old industrial regions need diversification and suffer from the over-powerful role of historically dominant companies, they proposed instead that such regions do often have a high density of institutions of education, innovation and R&D. The challenge is "to bring in new technological orientations as well as new and more interactive forms of innovation" (p. 1177). Their research contrasted the fortunes of two clusters in Styria, Austria, in the automotive and metal sectors. The former had grown and adapted, whilst the latter had struggled to adjust. They explained the difference in terms of the concept of 'systemness'. The automotive cluster had benefited from a range of cluster-focused policy initiatives, including collaboration with local universities, which had the collective effect of enhancing the potential for trust and knowledge transfer within the sector. The metal cluster, by contrast, had struggled to escape from a previous emphasis upon external control, was not

seen as a priority (nor even welcoming of intervention) by regional policy actors, and had failed to generate a new process of innovation system building. Thus in the metal sector, “selective communication, self-thematisation, the shaping of a common identity as essential operations of system building” (p. 1191) were only weakly developed.

*The steel industry supplier cluster in north east England: key characteristics*

Based on Teesside, a sub-region that epitomises many of the characteristics of a classic old industrial region, with a heavy dependence upon steel and chemicals (Beynon et al., 1994), the steel industry in north east England has been through decades of contraction. In the 1960s 30,000 people worked in the industry in Teesside alone; now less than one-tenth that number are directly employed in steel production. The

research reported here was initially commissioned at a moment of further cutback in steel production and employment in 2001. This sub-section concentrates in particular upon the capacities of the steel industry supplier sector rather than the steel industry itself.

In the year 2000 the Teesside steel industry purchased goods and services worth £500m, excluding basic raw materials and services such as iron ore, alloys, coal, scrap and refractories, and transport costs. It was supplied by 586 establishments based in north east England with £50m worth of purchases, of which around four-fifths came from within Teesside (Figure 1). Within Teesside the supplier establishments were clustered towards the coast, particularly on the south bank of the River Tees where steel production was now concentrated (Figure 2). Total employment within the supply chain amounted to 16,700 and total turnover

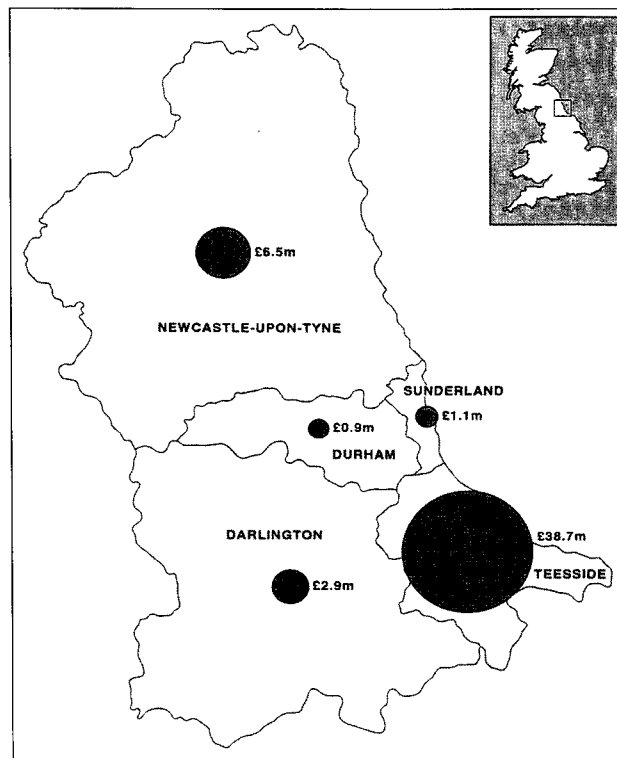
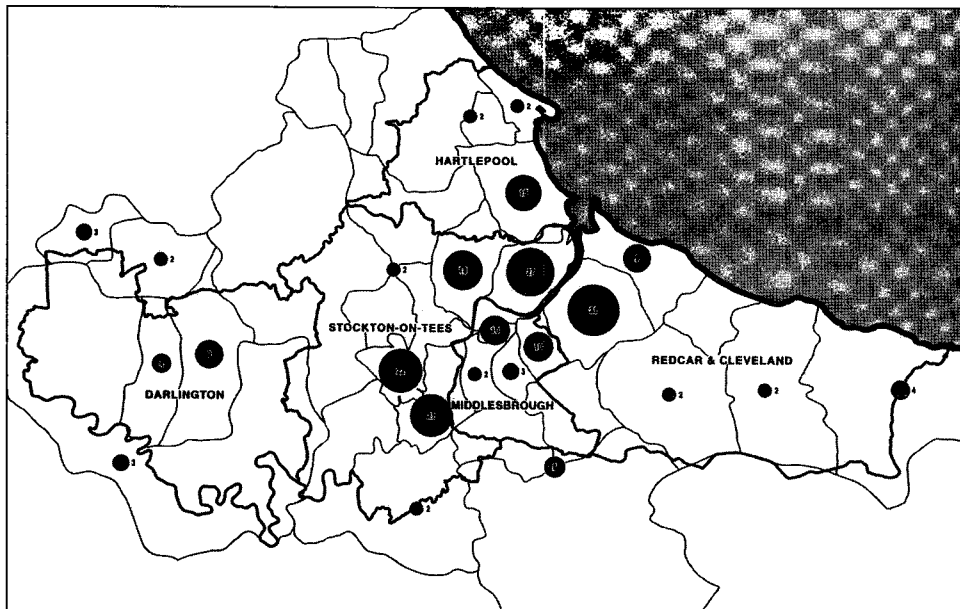


Figure 1. Value of purchases by the steel industry in Teesside within north east England, 2000.



**Figure 2. Number and location of establishments in Teesside supplying the steel industry in the region during 2000.**

was £1,250m annually, although by proportion of turnover only around 2,000 of these jobs rested upon relationships with the steel industry.<sup>1)</sup> Around 50 per cent of the establishments were involved in engineering, 20 per cent provided business services such as labour supply, design, and project management, and 10 per cent provided construction services.

Unusually, drawing on an earlier study and cross-referring with this, it was possible to identify a group of establishments that were still trading, had been suppliers to the steel industry nearly a decade previously, but were no longer supplying the steel industry. These 295 surviving ex-suppliers employed 9,800 people and had a combined turnover of £860m. Many of these were located alongside the concentrations of current suppliers, but there was also a notable clustering in areas where steel production no longer took place around Stockton-on-Tees (Figure 3).<sup>2)</sup> Additionally, a further 160 establishments were identified which had ceased trading since the earlier

study. These were even more heavily concentrated in the inland, Stockton-on-Tees area (Figure 4). Thus one aspect of the evolution within the steel industry supply cluster involved locational change and concentration towards the south bank of the Tees where the river met the sea.

#### *Process engineering knowledge within the supply chain*

This sub-section draws on in-depth interviews conducted with 25 of the engineering establishments, of which 17 were still supplying the steel industry, and 8 had supplied the steel industry in the past. The intention of the interviews was to explore in more depth the processes behind particular strategies within the supply chain, and to identify wherever possible the key policy issues. The interviews conducted suggested that establishments within these activities could be grouped into three categories, along a knowledge continuum: general engineering, specialised process service providers, and design-dependent. These



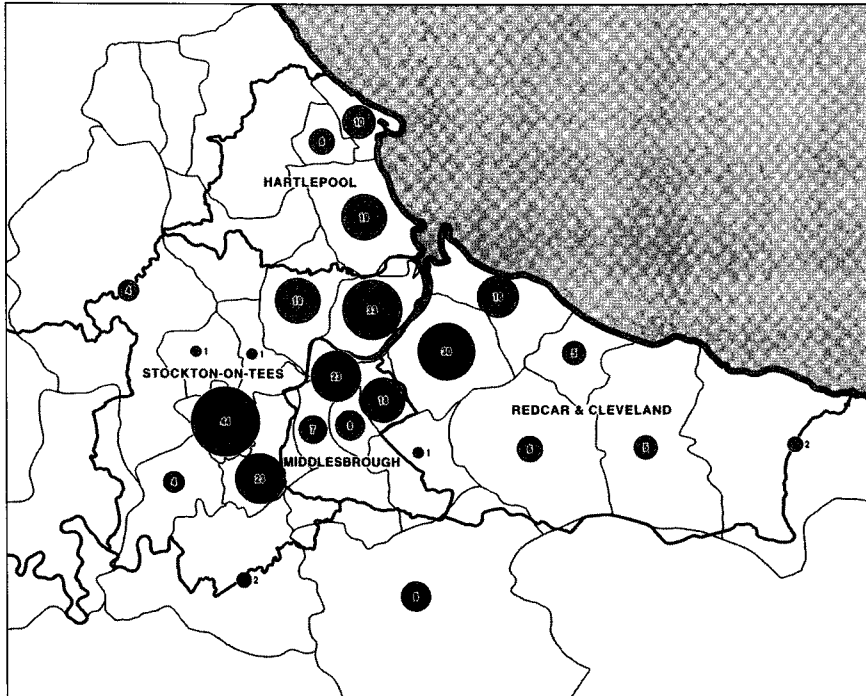


Figure 3. Number and location of surviving ex-supplier establishments to the steel industry in Teesside as of 2000.

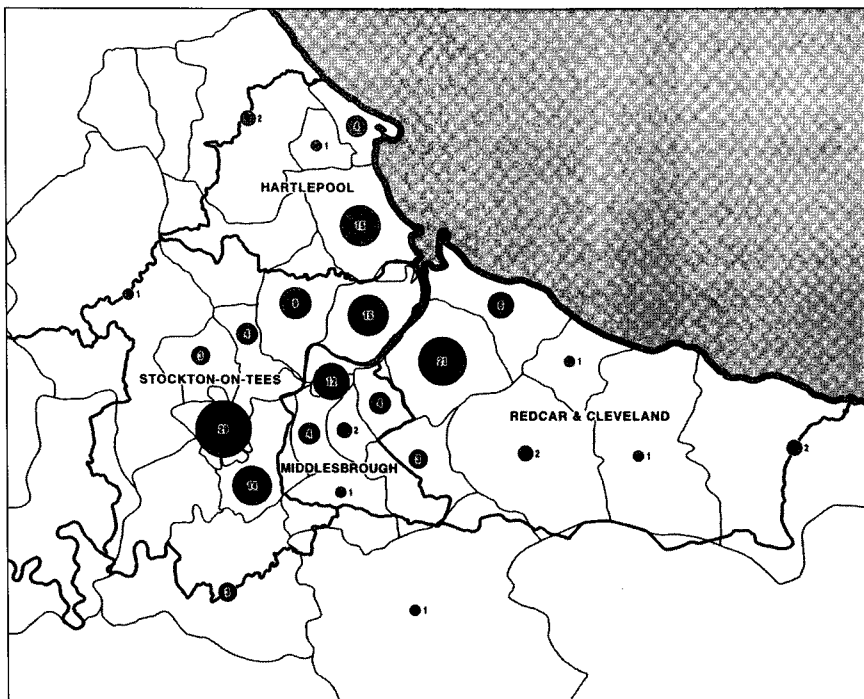


Figure 4. Number and location of establishments supplying the steel industry in Teesside in 1993 but no longer trading in 2000.

headings are of value as distinctive issues influenced establishments within each group.

**General engineering:** This group of establishments provided generalist engineering products. Their core competence was based on investment in off-the-shelf machinery, which might in itself be relatively advanced, but ownership of such machinery conferred no specific technical advantage that could not in principle be reproduced by others. Products were consequently partly generic, and competition was both particularly intense and highly localised. By and large they possessed (at best) limited design capacity. Relationships with local management in the steel industry were of significance for this group of establishments, which tended to be concentrated within the Teesside sub-region. Many of them were aware of the need for alternative markets in the face of price reduction, single-sourcing and a reduction in steel activity. They often reported a need for further marketing expertise, compounded by difficulties in generating the resource to fund such posts in-house.

**Specialised process service providers:** Within the wider north east of England there was a pool of establishments providing highly specialised process services to a range of customers, including (but not necessarily restricted to) the steel industry. These establishments were characterised by a genuine technological edge. They did not operate with standard off-the-shelf capital equipment, but rather had their own process design and control capacities. They offered (and supported) niche market products of considerable complexity, embodying a high level of intellectual capital and tacit know-how. Examples in this category included one of only four companies in the world that supplied tuyeres (key blast furnace components used to cool the protective shell) to the steel industry. These establishments, and others in this

category, shared a number of characteristics. They served a broad European (and in some cases global) market with products that embodied specific technological knowledge and capacities, and they supported the installation and operation of those products.

**Design-dependent:** This final group of suppliers differed from the others in that their core competence was solely knowledge-based. They acted as providers of design and project management services and as such had even higher skill requirements than the specialised process service providers. These establishments were generally small-scale employers of well-qualified people and they were located throughout the north east of England. For those that were locally owned in particular, the key issue concerned the ongoing reorganisation of local steel industry management functions. Several of these establishments reported that the loss of strategic roles from Teesside would affect their business adversely, as personal contacts were lost and contracts placed elsewhere. For this group in particular, the nature of relatively high-level communication concerning the sourcing of these knowledge-intensive services and activities was of significance.

Overall then, the evidence from this study demonstrated that the steel industry supplier cluster was in a process of dynamic evolution as its main local customer contracted. Some establishments had not unexpectedly ceased trading, but others had developed alternative business strategies despite - or even because of - the loss of local steel trade. The location pattern of the sector had shifted markedly over a relatively limited time frame, posing new questions for the wider array of policy agencies and local public authorities. Some of the establishments in the cluster were at the cutting-edge of process engineering technology - a far cry from

the classic image of steel production as a 'smokestack' industry. The evidence base for such conclusions is derived from research conducted on two occasions in response to moments of political concern over restructuring in the steel industry. The comparability between the two, and the extent of information made available in these times of crisis, enabled significant wider conclusions to be drawn.

## 5. Conclusions

The evidence reviewed in this paper suggests that there is as yet insufficient evidence to be sure about the effectiveness of industrial cluster policies as a tool for regional and national development. There is however a growing consensus that data limitations hinder evaluation. Within old industrial regions, there is equally some uncertainty about the conditions under which certain constellations of business and policy communities combine to limit or lock-in regional adaptability, as opposed to generating a search for alternatives. In this respect, as argued by Chapman (2005), there is a link with earlier debates in the 1950s and 1960s concerning growth centres and growth poles, and the risks of over-specialisation as advantages mutate into liabilities. Then as now, the challenge for policy is to ensure that regional economic trajectories remain open and able to adapt, rather than closed and inward-looking. This is for the benefit of both regional and national economies alike. In this context, the key question for cluster-based policies for old industrial regions is a simple one: does cluster policy enhance or hinder regional adaptability and national competitiveness?

In beginning to address this question, the wider implications (and limitations) of the evidence presented above concerning the steel industry supplier cluster in

north east England are of some significance. It is clear that a genuine evaluation of the effectiveness of both cluster operation, and of cluster policies, would rest upon similarly detailed knowledge of sub-national trade flows and information-sharing. This cannot be a static, one-off observation, but would require evidence gathered cumulatively over a period of time. Further, the key limit to the study reported above (due to the basis on which it was originally commissioned) is its concern for flows along the hierarchy towards the principal customer, rather than between firms in the cluster. Collection of such knowledge would also be an essential prerequisite to a fully-informed cluster policy. In other words, the key policy issue is presently one of information-gathering on sub-national trade and information flows. Without this, it is practically impossible to be clear about the developmental trajectories of particular clusters, or the impacts of cluster policy.

This gap in knowledge is fundamental. Addressing it might be pursued in a forward-looking cluster policy which proceeded on a case-by-case, region-by-region basis, within a broader comparative framework. It would not be easy, especially in old industrial regions - for as stated above, it is in precisely these regions where relations between business and policy communities can often be most problematic, lacking in mutual trust, with the business community often negatively disposed to policy intervention and the policy community showing limited flexibility. Yet unless this knowledge gap is tackled, several open questions - to do with the effectiveness of our understanding of the operation of clusters and of cluster policies, and the construction of regional adaptiveness - can only be answered, and only partly at that, at the theoretical rather than practical level.

## Notes

- 1) A survey of these establishments produced a response rate of 34 per cent. Asked what proportion of their business depended upon orders from the steel industry, firms with a turnover of £180m reported "to a great extent" and with a turnover of £660m, "to some extent". The employment dependent upon the steel industry was 3,300 jobs "to a great extent" and 12,000 "to some extent" (for details see Sadler 2004).
- 2) A survey of these surviving ex-suppliers produced a response rate of 21 per cent. Around 40 per cent indicated that the loss of steel industry business had a 'significant' impact on their operations, but only 25 per cent had consciously adopted alternative strategies in response to this loss of business.

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