

1 Introduction

Innovation, the role of small firms, and the revitalization of the regions have all received a great deal of attention as possible means of stimulating economic growth. It is only in recent years, however, that the links between these topics have started to be appreciated.

One link is between new, small firms and innovation. If, as seems reasonable, many new firms are founded to exploit a new idea, then a lot of innovation will be concentrated in fledgling firms. Of course, large firms have the advantages in terms of resources, but small firms, it is increasingly recognized, may have an edge in terms of unfettered speed of response. Where the costs of R & D and of capital investment are high, as for example in much of the chemical or pharmaceutical industries, then large firms inevitably lead the way with innovation. But in many other industries, where the entry costs are relatively low, small firms play a large and, it seems, an increasing role in innovation¹.

The potential importance of small firms from a regional perspective has come to be recognized as a result of research into small firms' impact on employment. Awareness that small firms might play a crucial role in generating jobs first came about as a result of a study by Birch in the USA². Although this study has subsequently been questioned and criticized from a technical point of view³, the ideas which it put forward about the creation of jobs through the formation and growth of small firms have had an enormous influence. At the same time as Birch's study was being published, the large manufacturing firms in most industrial countries entered a period of rationalization and retrenchment, and ceased to be direct providers of growth in

employment. The role of small firms was therefore seen as increasingly important.

As hopes for economic growth and employment became increasingly pinned on small firms, it was also natural to ask how small business was faring in the regions, and especially those with severest problems of unemployment. If, on a national scale, small firms offered hope for a recovery of employment, could not the same be expected for regions with particularly severe economic problems? Here, however, the research evidence did not look reassuring: there were clearly big differences between the regions in self-employment and small firm formation, and it was the more prosperous areas, not the stagnating ones, where small businesses were growing faster⁴. So policy to stimulate or support small firms might be likely to stretch the gap between the regions, rather than narrow it. The brute fact of differences in small business formation between the regions clearly needed further investigation and explanation. If policies to stimulate small firms were to help declining regions, then the underlying difficulties of small firms in those regions needed to be better understood.

The research which forms the basis of this book brings together questions about innovation, small firms, and the regions. Moreover, as similar questions were being asked in the Federal German Republic (FGR) and the United Kingdom (UK), there seemed to be an opportunity for comparative research between the two countries. This was made possible by the support of the Anglo German Foundation for the Study of Industrial Society. So this study is concerned not only with the regional influence on small-firm product innovation, but also with the question of whether the FGR and the UK are facing the same or different issues.

Approaching the main questions

Our study starts out with a number of assumptions, which seem to us to be well enough established in previous research. It does not seem necessary to demonstrate that innovation is important, that small firms innovate, or that regional disparities exist. What we are concerned with is the relationships or links between innovation, small firms, and regional imbalances.

The central question is whether there are different tendencies to innovation in small firms from one region to another; and if so, what explains these differences. In order to answer this question, it is obvious that we must be able to give an account of the main influences upon innovation in small firms. It is only when we understand what is involved in innovation, as it takes place in small firms, that we can interpret the conditions helping or obstructing it in various regions.

Our approach to investigating and explaining innovation is in terms of *resources*. It seems reasonable to assume that on average, a firm with more resources of value for innovation is more likely to innovate than one with less resources. The question for our research then reduces to identifying the key resources for innovation, and examining how the availability of these resources differs from one region to another.

One of the most obvious resources likely to be important is human skill and talent. The capacity for innovation may, in some cases, stem from a single individual, typically the entrepreneur with a gift for invention. This may especially be the case in the very small firms, and such individuals may continue to be crucial for innovation even as firms grow larger. But the entrepreneurial view of small business may be unduly narrow. There could be other cases where innovation draws upon the capabilities of numerous individuals within the firm, the more so as it grows and diversifies. The lack of skilled and capable individuals, conversely, may prevent a firm from innovating and growing. Skills and knowledge for innovation can also, perhaps, to some extent be bought or hired on contract from outside organizations.

To the extent that small-firm innovation depends upon individual entrepreneurs, the availability of such entrepreneurs will be important for regional success in innovation. To the extent that innovation depends upon a wider range of skills and abilities, more general issues of the supply of qualified manpower will enter into regional differences.

Another obvious resource likely to be required for innovation is finance, since research and development activities cost money and there is likely to be a time-lag before a payoff is obtained. Financing can be either internal (out of cash flow or retained profits) or external (from loans, grants, capital issues, and so on). In either case, the regional context may be important. If internal funds are more important, then

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the question may be whether small firms are dependent upon the regional economy and whether the state of the regional economy gives them adequate financial strength. If external funds are more important, then the question is whether the availability of such funds differs from region to region.

Another resource likely to be important is the plant and equipment available to the small firm. New products have not only to be designed and developed, but also produced, and up-to-date plant and equipment is likely to make both development and production more effective. The availability of plant and equipment will depend in part on the resources already discussed: on finance for purchase, on skills to apply and operate them. But it may also be facilitated by local equipment suppliers and by other sources of expertise, so that additional regional differences may appear.

The resources described so far are all tangible and obvious, but others of a subtler nature may also be important. Innovation may be influenced by the relations between a small firm and its customers or potential customers. Close, trusting relationships and supportive customers may reduce the risks of innovation and provide a flow of information about opportunities for new products. Market relationships with the opposite characteristics may on the contrary stifle innovation. More generally, information about the market-place and about technological developments are likely to be important resources for innovation. Small firms may have particular difficulties in getting information and keeping abreast of external developments. It is not so easy to imagine how one region may differ from another in these respects, but it is essential to explore the issues. One useful notion is to identify the kinds of 'linkages' which small firms have. Which industries do they serve, for example, and are those industries locally based or widely dispersed? A strong and interconnected local industry may provide rich sources of information and ideas for new products. But conversely, if small firms are tied to local industries in an economically declining region, their chances for innovation may be more limited than those of firms with national or international markets.

These are the explanations of small-firm innovation which we attempt to assess in this book, and through them we seek to examine regional differences. It might be objected that by concentrating upon

resources, we have neglected *motivation* or incentive to innovate. It is true that, in our research, we decided not to attempt any detailed investigation of the financial returns to innovation for small firms (although we did collect a few indicators of financial performance and growth). But we do not see this as a serious limitation. It seems reasonable to assume that small firms have similar motives in innovating, whatever region they are located in. The tax regime for small firms, in different regions within a country, is broadly similar, so that this aspect cannot enter into regional differences. Government grants and loans may differ by region, but this we already cover under our consideration of finances for innovation. Moreover, through our analysis of market relations, we indirectly examine the most important incentive for small firms: the opportunity to find sales outlets for new products.

However, in approaching the subject of small firms' innovation from the point of view of resources, we do not wish to propose a mechanistic, input-output model of how innovation takes place. This would, indeed, be particularly inappropriate in the case of small firms, where the outlook of entrepreneurs may be of great importance. Our preferred assumption would be that, even when all inputs have been specified (and in practice, we will always be far from achieving such a complete specification), the outcomes will still not be fully determined, because individual ideas and choices may intervene significantly. Thinking about innovation in terms of resources is a convenient way of organizing our investigation, but it is not exhaustive. One of the interesting questions is how much variation in innovation remains to be explained, after we have examined the role of the more obvious influences such as human resources.

The research

To develop these general questions and ideas into a research study, we had to make decisions or choices of four main kinds. First, we had to decide what kinds of 'innovation' we were going to cover. Then, we had to decide what range of small businesses to study. Similarly, we had to select the regions to be compared. Finally, we had to make choices of method: how to collect information about the small firms and about the regional environment.

Innovation

Innovation is generally regarded as being of two main kinds, relating respectively to products and processes. We decided to focus on product innovation, because this type of innovation appears to be of particular importance for economic growth and for international competition. But we defined *product innovation* broadly rather than narrowly, as 'the development of new products, changes in design of established products, or use of new materials or components in the manufacture of established products'. In short, we took innovation to mean the same as new or altered products.

With such a broad definition, it was particularly important to have ways of distinguishing various degrees or 'intensities' of innovation. These will be explained as we go forward, but for the moment there is one special aspect to be highlighted. We questioned the small firms quite closely on their use of *microelectronic components or assemblies* within the design of their new products. We share the widely held belief that microelectronics represents a watershed of innovation. Accordingly it seemed to be of crucial importance to determine which firms were involved with this technology and which stood outside it.

Though we focused on products, we did not entirely ignore processes. As we have already suggested, a firm's ability to develop a new or improved product may be affected by the availability of up-to-date plant and equipment for its production. On the other hand, improved process technology, with the opportunities it offers for lower costs or for enhanced quality and reliability, may give some firms another way of competing and staying in business, while sticking to their established products. In either case, process technology is important for understanding innovation as we have defined it. However, we restricted ourselves to collecting a few relatively straightforward indications of process technology, again emphasizing those kinds of plant and equipment which involve the use of microprocessors.

Industry and regions

Practical considerations largely guided the choice of industry and regions to study. The difficulties of defining what constitutes innovation in the service industries steered us towards manufacturing.

Within manufacturing, we wanted to choose an industry which was important in both the FGR and the UK, and one where we could expect to find many small enterprises and much product innovation. The industry which meets all these requirements is called *mechanical engineering* in the UK and the *machine building industry* in the FGR. The British name is rather broader, but the German name is a more concrete description of the kind of firms we actually studied: in fact, most of these were either making machines, or assemblies or parts for machines. In both the FGR and the UK, it is important to note, the industry definition excludes firms primarily engaged in electrical engineering or electronics.

The industry is one of the largest in both countries, and important for exports, but in the FGR it has been rather successful, while in the UK it suffered a severe shake-out and contraction in the late 1970s and early 1980s. A further reason for selecting this industry is the great influence it has on other industries: new machines mean higher productivity for those who install them, so that the effectiveness of the machine building industry affects all others.

Resources available for the research limited us to two regions in each country. Our choice of these regions was partly shaped by our choice of industry, partly by the desire to achieve a reasonable degree of comparability between the FGR and UK studies. Most important was to select regions, within each country, which contrasted in their recent economic performance: a struggling region and a strong one.

In Britain, we selected the East Midlands and the North as our regions. ('North' is the official title of the region which is known in common parlance as the North-East; we will often refer to it by the latter name.) The North-East has throughout the post-war period been regarded as a region of relative decline, and it has suffered particularly severe decline in manufacturing employment during the recession of the early 1980s. Most of the firms in our sample came from the Tyne and Wear and Teesside areas which have high industrial concentration. These are areas of traditional heavy industry and of more modern process industries; there is a substantial proportion of mechanical engineering firms.

It was tempting to select an area of 'high-technology' growth within the South or South-West to contrast with the North-East, but we

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decided against this because the mix of industries and occupations would have been so different. The East Midlands like the North-East has high levels of manufacturing employment, most of which is concentrated around Nottingham and Leicester, and includes traditional industries such as textiles. It also has a particularly high proportion of mechanical engineering firms. However, compared with the North-East it has ridden the economic storms of the past decade relatively well, and its rate of unemployment has been close to the national average despite its dependence on manufacturing.

Hence the contrast presented by the two British regions is not one of extremes. We expect that product innovation will be at a higher level in the East Midlands, but we would not expect the nature of innovation to be entirely different in the two areas. And because both are established manufacturing areas, it becomes particularly interesting to ask why one should have adapted better than the other to changing conditions.

In the FGR, the contrast between the two areas selected for study was perhaps greater than in the case of Britain, but a similarity remains, in that both are areas of high concentration of manufacturing. Within the Land (region) of Nordrhein-Westfalia (NRW) the study concentrated on the eastern Ruhr district, and specifically the chamber districts of Bochum and Dortmund. This whole area has long-established and still important, but contracting, industries of coal, iron and steel. The decline of these industries has contributed to the exceptionally high rate of unemployment there in recent years.

The contrasting region is the Land of Baden-Wurttemberg, and within it the Middle Neckar district was chosen as the focus for study, with the chamber districts of Esslingen and Goppingen. The dominant industries of the region are vehicles and machinery, and its buoyant economy is reflected in not only a particularly low rate of unemployment but also the highest rate of employment for any area of comparable size throughout the FGR. The Middle Neckar is itself a traditional centre of machine-building.

The method

A combination of three methods was used to carry out the research: survey, case study, and collection of background regional data.

We first describe the UK part of the study. Here we began by obtaining a sample frame of small mechanical engineering establishments for each region, provided by Market Location Limited. The sample frame was designed to give coverage in the size range of firms with 11-99 employees.

The survey of small firms was carried out through *telephone interviews* with the most senior person responsible for products and product development. In most cases, this was either the owner or a director of the firm.

Piloting of our questionnaire made it clear that, within the resources available for the survey, we would not be able to achieve a high response rate. This was because of the difficulty of contacting busy entrepreneurs and persuading them to take part in a lengthy interview. We could probably have increased response by considerably shortening the interview, but it was more important to obtain full information than to increase the representativeness of the survey.

Accordingly, a quota sampling procedure was used, with interviewing continuing until a target of approximately 100 interviews was reached. After discarding some interviews because they either fell outside the size limits or the industry definition for the survey, we eventually obtained 98 interviews, representing a net response rate of 52 per cent. We obtained a larger sample in the East Midlands (55 firms) than in the North East (43 firms), not because of difference in response rate, but largely because of a greater availability of the smallest firms

Table 1.1 Size distribution of British sample, by region

numbers of firms

Number of employees	East Midlands	North
11-19	28	15
20-49	14	15
50-99	13	13
Total	55	43

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within our sample list for the East Midlands. The size breakdown of the achieved sample reflects this:

Following the telephone survey, a set of six case studies was completed in the UK, three from each region. The case studies were selected from those taking part in the survey, and were intended to illustrate a wide range of *approaches to innovation* on the part of small firms. They therefore included, not only examples of ambitious new products, but also of incremental developments, and even of reliance on process rather than product innovation. The case studies took the form of visits to the firms by one of the research team, with lengthy tape-recorded interviews with the chief executive and/or the senior executive responsible for product development. The interviews traced the development of the firm up to the present, and explored the firms' innovative activities, production processes, marketing, finances, and use of human resources. This also gave the opportunity to examine the production facility and the products at first hand.

The third method of research used was to study existing published material to provide a background picture of the economic position in each region and of the factors likely to influence the growth of entrepreneurship, small businesses, and innovation. This information is chiefly reported in Chapter 6.

In the FGR, the research was of the same broad form, but with some differences of scope or emphasis. One important difference was in the size range to be covered. The German machine building industry contains fewer very small establishments and more in the small-to-medium size range, so a size distribution similar to that in the British sample would not have been so useful. Instead, the survey was divided equally between establishments with less than 100 employees and those with 100-250 employees, overlapping but not coinciding with the British sample.

It was also felt that the telephone survey method was less well established in the FGR and hence less familiar to businesses. So it was decided to use a postal survey in which the respondents completed the questionnaire themselves. The case studies were carried out before the postal survey, rather than afterwards, so as to gain insight into the firms' approaches to product development, which could be incorporated into the wording of the questionnaire. The research in the FGR collected

information from 42 firms through the questionnaire method, a smaller number than in the case of the British survey, together with six case studies. Further details of the sampling and response will be found in the separate report published on the German study⁵.

The surveys do not purport to be representative of small firms in a descriptive sense. In particular, we are not in a position to make generalizations about the proportions of small firms who do or do not innovate, because it is inherently likely that firms not innovating would be less interested in taking part in research on that subject. Hence there could be some tendency for the surveys to be biased towards innovative small firms. However, as the following chapters will show, the surveys succeeded in covering quite a wide range of small firms. We are therefore in a position to compare small firms of different types: for example, those using microelectronics components and those not doing so. It is around such comparisons that the study mainly revolves.

In addition, the surveys succeeded in collecting information about the innovative activities, human resources, and market relationships of small firms, which to the best of our knowledge is substantially new. These topics form the main subject-matter of Chapters 2-5.

Although the study is not based on large samples, its design is particularly suitable for making internal comparisons. Because the samples are gathered from particular areas (all of which have high concentrations of manufacturing industry), from a single industry, and from small or small-to-medium firms only, the variation between firms is much reduced relative to a national survey covering all types and sizes of firms. This means that variation due to the factors or influences which we are particularly interested in can be measured more sensitively.

In short, our aim is not to provide descriptive statistics on how much innovation of various types is taking place (that would require a larger and more representative survey). Rather, it is to assess and interpret the importance of various possible influences upon innovation, and among these, the influence of specifically regional circumstances. Strictly speaking, the influences identified apply only to the sample covered by the study, and cannot be widely generalized. Further research will be needed to test the findings with other samples, and so establish their scope.

Presenting the findings

This book is intended primarily for the British reader. Its aim, however, is not merely to present the findings of the British part of the study, but to deepen and illuminate understanding of small-firm innovation in Britain with the aid of the comparative material from the FGR. Despite great differences in the industries of the two countries, some remarkable similarities emerge as the process of comparison is developed. In our judgement, these similarities may point to some of the most important characteristics of innovation in small engineering firms.

However, the reader must not expect to find a simple, statistical, side-by-side comparison of the studies. Apart from other considerations, the differences in sample coverage and size for the two parts of the study (described in the preceding section of this chapter) would prevent such a direct comparison from being effective. In fact, it could only be misleading. Our approach is to conduct comparisons at the stage of interpreting the findings, rather than at the level of the data.

Our practice, therefore, is to present the British findings first, within each of the main chapters relating to the survey. After identifying the chief points, we then turn to the German evidence to identify similarities and differences of importance for a final interpretation, which covers both countries. As a result of this approach, the actual data from the German part of the study are used more selectively than is the case with the British data. However, the interested reader can obtain a more complete account of the German data elsewhere, since the findings of the German part of the study have already been published (see reference 5).

The book includes material from the case studies in the form of *excerpts*, rather than as continuous narratives. Groups of excerpts will be found in inserts, with a contrasting format, at various points of the text. Our aim in presenting the excerpts is a simple one. They are intended to illustrate some of the main points which we identify in the survey findings. For example, while the survey evidence indicates the general importance of *organized R & D activities* to these small firms, the case-study excerpts suggest the variety of ways in which small firms strive to put resources into R & D. We hope that these examples will bring to life the statistical material from the surveys.

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A concise summary of the findings from the research will be found at the beginning of the final chapter. This summary is followed by a more extensive discussion, which takes account of the findings from both the British and German parts of the research.