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CHAPTER 12

What Makes the Local Environment Important for High Tech Small Firms?

MARINA VAN GEENHUIZEN AND PETER NIJKAMP

SETTING THE SCENE

Since the late 1970s, strong priority has been given to the establishment of new technology-based firms. From a regional-economic perspective, much research has been conducted on the spatial distribution of their establishment, and on favourable spatial conditions for their growth. Much less attention has been given to existing high technology firms and their adaptation to external changes in order to survive in their local environments.

In recent decades, there also has been a clear increase of uncertainty and risk faced by companies. New technologies have pervasively changed advanced industrial economies. For example, information and communication technology, biotechnology and new materials have produced impacts which clearly have gone beyond the use of the technology itself, such as the adoption of new modes of work organisation in production, and work practices. A crucial development also has been the increasing level of global competition. A major corporate response to global competition has been to place more emphasis on the number and rate of new product and process technology developments in order to improve long-term competitiveness. As a consequence of this, product life-cycles are progressively shortening in specific high technology sectors, such as micro-electronics.

At the same time, a fundamental change has taken place in the relationship between consumption and technology, as well as in the organisation of production. Patterns of consumption have shifted from mass products to (highly) differentiated products with fast changes in demand (Abernathy et al, 1983). Accordingly, emphasis has shifted, to some degree, from Fordist production for standardized mass consumption to production of customized goods on a flexible basis, including also flexible market relationships.

In view of the above changes and uncertainty, companies need to be strongly adaptive. Generally, companies adjust to changes in their environment in an incremental way. However, from time to time, there is a need for more radical change, such as a merger, the implementation of a new major technology, a shift to new product-markets, a physical relocation, or a large reduction in the workforce. A critical factor in these adjustment processes is their management (Pettigrew and Whipp, 1991).

This paper addresses first the relevance of the issue of survival. Quite recently, increased attention has been paid to the issue of corporate survival in the Netherlands, within the framework of a so-called demography of firms and company life-history analysis (see the following section). The paper proceeds with an exploration of corpor-

ate survival, by focusing on the management of competitive change and the concomitant needs that may be satisfied in the local environment. In this framework, various different streams of theory on regional economic growth are discussed. Empirical evidence on the relevance of the local environment in the Netherlands is then provided. The paper concludes with a number of policy implications aimed at an improved use of local resources aimed at a better stimulation of future growth of high technology small firms.

DEMOGRAPHY OF FIRMS AND COMPANY LIFE HISTORY ANALYSIS

The phenomenon of survival is increasingly given attention within a recently developed dynamic approach to firms. In this approach, an emphasis is put on particular traumas in the life of the firm which potentially affect its performance, in terms of profitability and organisation (Wennekers, 1994). Related to this is the increased attention paid to the study of demographic events in a population of firms, i.e. demography of firms (Willeboordse, 1986; Ritzen and Van der Ven, 1990; Struys and Willeboordse, 1990; EIM, 1992; Gordijn and Van Wissen, 1993).

A demographic approach to organisational change is not novel. In organisational sociology (ecology) this approach has been developing since the late 1960s (Stinchcombe, 1968; Freeman et al, 1983; Hannan and Freeman, 1989). The fact that so little empirical work has been done to date reflects problems in collecting suitable longitudinal data. In this respect, definitional problems have also played a role.

Firms can be defined in different ways, dependent on the aim of the study. For example, a firm may be viewed as a legal entity, or as an organisational unit around a particular production process. Furthermore, a firm may have organised its production in one or more production establishments. In regional economics, these establishments are important entities since they constitute the physical representation of production in an area.

A dynamic approach at the micro-level means that individual firms are followed through time. This causes additional problems of definition, particularly regarding death and survival (Hannan and Freeman, 1989). For example, when a firm shifts to produce a radically new product, it may be questioned whether it remains the same firm. Clearly, the same is true when the majority of a firm's shares are acquired by another firm.

From a regional perspective, and analogous to population demography, demography of firms focuses on the processes of birth, death (mortality) and migration of the unit of analysis (Gordijn and Van Wissen, 1993). These changes in firm size are important since they affect the aggregate employment levels of a region. Table 1 gives some examples of data generated through a demographic approach to firm dynamics.

It appears that birth rates and death rates on a regional basis are highly correlated (0.79). For example, in regions with high levels of firm formation, there is also a high level of failure. This is related to the fact that failure is most common at a very young age (Stinchcombe, 1968). Accordingly, the survival rates (Table 2) indicate a reducing level of closure with increasing age, although the time-series available on Dutch firms (1987 to 1994) is still rather short.

Firm demography has an important role in the (spatial) projections on economic activities. Future projections on the number of firms can be used, for example, in the planning of industrial premises (zones), and as an input for projections on transport and housing (Gordijn and Van Wissen, 1993).

Table 1: *Some key figures on dynamics of the population of Dutch firms*

Type of data	Year	
Birth	1992	78,903
Birth rate	1992	10.7%
Birth	1993	84,962
Birth rate	1993	10.9%
Death	1992	37,031
Death rate	1992	5.0%
Death	1993	41,292
Death rate	1993	5.3%
Correlation between birth and death rates	1987–1992	0.79 a
Survival rate of firms established in 1987		
Survival rate	1989	85%
Survival rate	1991	75% b
Survival rate	1994	65%

a. Based upon regional figures.

b. EIM has calculated a lower survival rate based upon slightly different definitions as follows: after 4.5 years 60% of the established companies have survived.

Source: EIM, 1994; Kemper et al, 1994.

Thus far, the analysis in demography of firms has not included major changes that are related to the product life-cycle or organisation life-cycle, such as a second start, the implementation of new technology, or succession in the departure of an owner-director. In addition, the explanation of demographic events needs a complementary, more comprehensive, approach to firm dynamics. Such an approach can be provided by a behaviorally oriented in-depth analysis, involving named company life-history analysis (van Geenhuizen, 1993). In this approach, attention is given to particular types of corporate change in the medium and long term and also an explanatory background to observed changes.

It is clear that the demography of firms and company life-history analysis make use of different data sources. The demography of firms is based upon data primarily from registers, among others kept by Dutch Chambers of Commerce (Gordijn and Van Wissen, 1993). A drawback is, however, that demographic changes are sometimes reported after a delay, or sometimes not reported at all. In the Netherlands, the Central Bureau of Statistics (CBS) is the origin of material for the development of a longitudinal database. The CBS also keeps a separate database of all large enterprises in the Netherlands. In addition to this, there are databases established by regional labour organisations through brief postal questionnaires, but methods of data collection and maintaining responses are not uniform across the country.

Company life-history analysis makes use primarily of in-depth corporate interviews, and when available, of annual reports and other written documents (van Geenhuizen, 1993; van Geenhuizen and Nijkamp, 1995). This approach is rather time-consuming and has, therefore, thus far limited analysis to case studies. A further standardization of the method is, however, possible, in order that its results can be statistically generalized and used in investigations of populations of firms.

In the following sections we will turn to a comprehensive approach to corporate survival, consistent with company life-history analysis.

A MANAGEMENT APPROACH TO CORPORATE SURVIVAL

In general, companies change their strategies (product, markets, etc.) in an incremental way. From historical research it appears that radical adjustments occur infrequently (Mintzberg, 1978). Evolutionary economics studies report similar findings (Nelson and Winter, 1982). In evolutionary economics it is emphasized that organisations develop, stabilize and follow routines. These routines may change over time, but in the short run they function as stable carriers of knowledge and experience. This causes a certain degree of 'inertia'. Related to the previous point is the concept of search behaviour. Organisations change as a result of search for new solutions when older ones fail to work. Search behaviour also follows routines, for example, based upon perceptions and 'coloured' by the previous situation and selective biases in information processing.

Although companies have a 'natural' preference for incremental adjustments (Table 2, Box I), there are situations in which radical change must occur. For example, the company may adopt a totally new technology, or it may undertake a number of small changes at the same time (accumulation of minor moves) (Box II). Another stimulation of radical change may arise when a company cannot keep pace with market and technology competition (Box III). After some time a radical adjustment is then inevitable (transition to IV). Because of serious dangers associated with the management of risk and uncertainty, the transition from incremental adjustment to radical adjustment (from I to II, from I to IV, and from III to IV) calls for particular care.

Table 2: *A classification of corporate change*

		Company Change	
		Incremental (‘steps’)	Radical (‘jumps’)
Market	Gradual	I	II
and			
Technology Influence	Fast	III	IV

Source: Adapted from van Geenhuizen, Nijkamp and Townroe (1992)

Apart from the market and technology, an 'internal' source of change must be mentioned here, namely critical development points in the life of the company as an organisation grows. Reaching the size at which there is a need for additional management (aside from the owner-director) is one such point, as is succession when control of a business passes to a new manager outside the founder's family.

We now focus on the ability of companies to manage change in a successful manner, and the potential role of the local (regional) environment in the light of various concepts in regional economic growth theory and innovation theory.

Many factors contribute to (or inhibit) the successful management of change in companies. According to Pettigrew and Whipp (1991), five factors can be distinguished. Four of them are independent factors, while the fifth is concerned with the coherence of the other four:

- **Environmental assessment.** It is important that an understanding of the economic environment (particularly competition) is achieved across the entire organisation of the company by means of open learning. Critical features include the mastering of assessment techniques and the ability to link assessment results to the central operations of the business.

- **Leading change.** Leadership cannot be described in general terms because it is very sensitive to context. There are nevertheless, various essential conditions, such as the building of a receptive climate for change by legitimising the need for change, and by building the capability to implement required changes.
- **Linking strategic and operational change.** Apart from conditions such as the capacity for appropriate action, strategic intentions must be broken down into actionable tasks and the latter must become the responsibility of change managers. It is important to note that strategic intentions may change during the process of implementation, leading to a new framework for strategic choices.
- **Human resources as assets and liabilities.** Human resource management (HRM) is of vital importance as it is concerned with all capacities necessary to be successful in competition. It includes recruitment and training, as well as employee relations.
- **Coherence in management.** The need for coherence arises in many ways from the demands of the previously noted factors. Both intended and operational action should have an appropriate level of consistency, consonance, advantage and feasibility. Human Resource Management activity has an important task in producing an internal knowledge base to serve this coherence during change.

The local milieu may offer benefits regarding two particular aspects of management of change (i.e. environmental assessment and human resource management). Environmental assessment is based upon new and specialized information, to be obtained via general and specific local networks. It is essential in this respect that the company receives the information in a timely fashion, so that it can anticipate changing circumstances and respond quickly. According to the classical incubation, filtering-down and contact-systems theory, the conditions to satisfy these needs are favourable in metropolitan areas, based upon concentrations of similar firms, relevant institutions and a large population (Thompson, 1968; Leone and Struyck, 1976; Pred, 1977; Davelaar, 1989). Moreover, it is argued that metropolitan areas also offer the best conditions for human resource management, by means of their many (specialized) education and training facilities, and labour market characteristics. More recently, however, dis-economies of agglomeration in metropolitan areas have been noted, such as specific labour market shortages and the congestion of the traffic infrastructure (Biehl, 1980; Nijkamp and Schubert 1984).

In addition, it has been recently acknowledged that specific non-metropolitan areas may offer strong supportive resources to the management of corporate change. Accordingly, information needs are satisfied in localized learning processes, based upon a dynamic territorial interplay between actors in a production system, local culture, tradition and experiences (Camagni, 1991). This line of thinking supports advocates of a strong emphasis on localization. Writers of this type argue that a basic shift towards flexible specialization has taken place, leading to a new era of vertically disintegrated and locationally fixed production. This philosophy draws largely upon the work of Piore and Sabel (1984) and Storper and Scott (1989). The empirical evidence for this view is found in high technology regions such as Silicon Valley, Boston, the M4 Corridor of South East England, and in semi-rural areas such as 'Third Italy'. Although the success of economic restructuring in these regions cannot be doubted, the pervasiveness of the trend for flexible specialization and concomitant localization is not sufficiently proven (van Geenhuizen and van der Knaap, 1994; Gertler, 1988). Together with the trend towards localization there is also a tendency towards globalization, associated with the growing influence of multinational corporations and their global networking with smaller firms (cf. Amin, 1993).

The above viewpoints on regional economic growth indicate a lack of consensus on the type and scale of the relevant spatial context for small firm operation. The following section explores the significance of the local environment empirically, based upon applied research in the Netherlands.

THE LOCAL ENVIRONMENT: EMPIRICAL EVIDENCE

This section explores the significance of various local attributes for small and medium-sized companies. The focus is particularly on the role of the local environment in terms of knowledge transfer, labour recruitment, and training potential. We also seek to explore the varying importance of differing local environments. To this end, the approach used is company life-history analysis, based upon 21 case studies in the Netherlands. Most of the case studies are located in North-Brabant (see Figure 1).

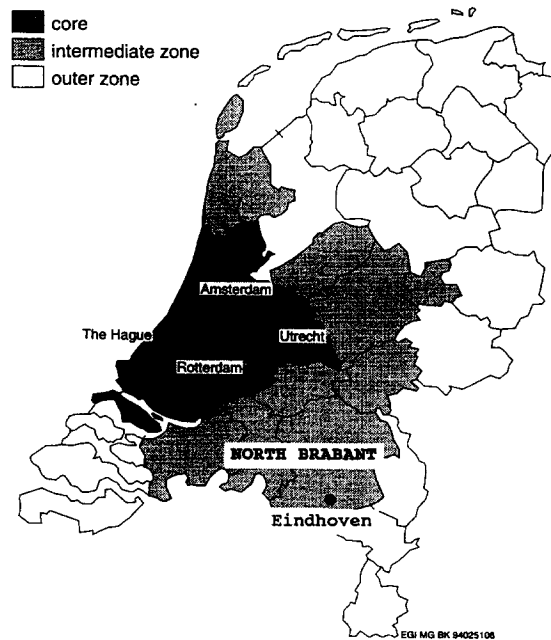


Figure 1
The study region

The case studies satisfy the following criteria:

- Small and medium-sized firms (of less than 300 workers in 1991).
- Highly innovative firms (in both products and processes).
- For reasons of contrast: both representatives from traditional industry and modern industry (i.e. textiles, machinery and electronics).

The importance of the local environment has been measured in a standardized way, by means of a questionnaire. Each company respondent was asked to value a number of precoded local attributes as follows: not important, important or very important. Accordingly, three series of scores were measured, i.e. related to the general performance of the firm, the introduction of a major product innovation, and the introduction of a major process innovation.

The data presented in Table 3 indicates the prime importance of the local labour market and of local training support. A second position is held by suppliers (of material, equipment). In the machinery and electronics sector, however, subcontractors and customers are equally important.

The prime importance of labour market and training support reflects various skilled labour shortages. Our in-depth analysis has revealed a loss of certain (handicraft) skills, particularly in the textile industry. At the same time, there is a shortage in education programmes concerning the application of modern technology in traditional fields, such as industrial process management and informatics in the textile industry. A general bottleneck in the labour market is a shortage of practical skills among young people who complete vocational training.

When considering knowledge transfer from the local environment to firms (Table 3), it appears that specific knowledge institutes or knowledge companies are relatively unimportant. It is particularly striking that the local (regional) universities play only a minor role. Furthermore, it appears that the local 'incubation' function (as evident in various formal and informal networks across the business world) is only important in the machinery and electronics industry.

The above finding on knowledge sources is underlined by a large survey among Dutch small and medium-sized manufacturing firms (BEA, 1993). Universities (or their transfer institutes) were found among the lowest rated sources of knowledge (3%), whereas the far largest source appeared to be suppliers (26%).

In order to investigate the role of the local environment in more detail, two 'extreme' types of companies in terms of the significance of the local environment, have been selected. These types are the following:

- Companies likely to have a strong local focus: textile companies which strongly depend on local traditional skills, as well as knowledge from local or regional suppliers (equipment, dye substances); machinery and electronics companies which strongly depend on local modern skills and training support, subcontractors and customers, and the local incubation function.
- Companies for which the local environment is suspected to be not important at all.

In order to find the background to these widely different patterns we will now turn to the history of various companies. The remainder of this section refers to them as 'locals' (strong local focus) and 'non-locals' (weak local focus).

Table 3: Scores on strongly significant local attributes in manufacturing (a)

	Textiles		Machine and Electronics		Totals	
	Abs	%	Abs	%	Abs	%
Labour market	9	37.5	16	41.0	25	39.7
Training support	8	33.3	17	43.6	25	39.7
Suppliers	6	25.0	7	17.9	13	20.6
Subcontractors	0	-	7	17.9	7	11.1
Customers	0	-	7	17.9	7	11.1
Marketing services	1	4.2	0	-	1	1.6
Techn. University	1	4.2	2	5.1	3	4.8
Technical services	0	-	3	7.7	3	4.8
Incubation (b)	0	-	6	15.4	6	9.5
Financial services	3	12.5	0	-	3	4.8
Maximum Score	24	100	39	100	63	100

a The maximum possible score is different for each of the two categories due to a different number of case studies (eight for textiles and thirteen for machine and electronics).

b Incubation function is the quality of bringing different actors together, leading towards the process of new knowledge creation (cross-fertilization).

What 'locals' share in their recent history is the occurrence of various traumas, such as the withdrawal of the mother company, a management buyout, or a significant contraction of the workforce (Table 4). Our examples illustrate that in the period before the trauma there is already a certain local orientation. After the trauma the company strongly leans on the local environment, in such a way that various internal functions are transferred to actors in a local network, such as the generation of knowledge, particular manufacturing activities, and the supply of capital. It remains to be seen, however, whether such a situation will stabilize or will change again, for example towards a continued local network orientation or reversion to a higher spatial scale of orientation.

Table 4: *Life-histories of 'locals' and 'non-locals'*
Major events or developments in 1980s

'LOCALS'

Case study 1

Established in 1976, as a subsidiary of a foreign company.
Trauma: withdrawal by parent company in 1989, subsequently management buyout in 1991.
Current situation: specialized textile printer, largely as (sub)contractor (a new output market has still to be established after ending sales-relationship with former parent).

Case study 2

Established in 1946.
Trauma: management buyout in 1979.
Increase of product range in 1984.
Taken over by regional company in 1988.
Trauma: strong reduction of employment in late 1980s. Since then, production increase through subcontracting out.
Current situation: design and manufacturing of packing machines for tobacco and food industry on customers specification.

'NON-LOCALS'

Case study 3

Established in 1970, as a joint venture with foreign company (US). Production based upon foreign technology.
Additional new product technology (since 1976), developed in national network.
Current situation: mass manufacturing of carpet backings, customized manufacturing of synthetic grass yarns (world-wide projects).

Case study 4

Established in 1923.
Continuously a partial 'converter': subcontracting of design to national network, and subcontracting weaving and printing to regional and national network.
Market focus: continuously national (top segment)
Taken over by foreign company in 1991.
Current situation: customized and project-like 'converting' and manufacturing of interior textiles.

Case study 5

Established in 1877.
Joint venture with foreign company (US) in 1973.
Continuous product improvement (1970s-1980s).
Current situation: design and manufacturing of industrial combustion installations (co-designer and co-producer with customers in various locations).

'Non-locals' have a strong orientation outside the region of location, dating back in some instances to the 1960s and 1970s, (e.g. based upon an origin elsewhere or product technology from abroad) (Table 4). Such companies have developed 'mobile' resources related to top segments of markets in which they operate. They continuously follow new customers into all parts of the world.

Our applied study of the local relationships of small and medium sized firms has pointed to a small significance of knowledge sources. However, this does not exclude the existence of opportunities for an improved use of such facilities. A better use of local resources will be the subject matter of the concluding section.

POLICY IMPLICATIONS

This paper has discussed two promising approaches to the study of firm dynamics, namely the demography of firms and company life-history analysis. The two approaches can contribute an insight into the survival of companies in a complementary way. This paper has used company life-history analysis in a part of the study where there was a need for in-depth analysis, i.e. of a variable significance of the local environment.

The analysis has discovered that the labour market, including training support, forms the single most important factor in the local environment for small and medium-sized companies of our study. All other attributes in the local environment, including various external knowledge sources, are clearly less important.

Given the significance of the local labour market, a thorough understanding of local labour market shortages is of prime importance from a policy point of view. Our in-depth analysis has pointed to the following labour market and training demands:

- To preserve and improve specific traditional (handicraft) skills in regions that need these skills in the future.
- To add practical skills to theoretical skills useful in companies (i.e. skills learned in school are often of small practical value).
- To upgrade technologies in traditional crafts such as in textiles, in the fields of information technology (CAD-CAM) and industrial process management.
- To adjust the attitudes and mentality of employees towards increased flexibility (job rotation, flexible demand, etc.).
- To give stronger attention towards the training of entrepreneurial skills and to anticipate major changes in needs over time.

A second important local factor appeared to be the presence of suppliers (of machinery, production materials, etc.). Local sources of specialized knowledge, such as universities, played only a minor role in the local environment of SMEs. It must be emphasized that the material relationship with local suppliers also generally includes a strong knowledge component.

Regarding the small role of universities and other educational or research institutes, it is widely realized that the potential for technology transfer is 'under-utilised'. A number of major barriers are encountered in this respect (Charles and Howells, 1992; van Geenhuizen, 1994). First, there is a lack of transparency of the supply structure of knowledge towards SMEs. In the Netherlands, various commercial knowledge suppliers have entered the market since the mid 1980s, while a system of regional Innovation Centres was established in addition to the older academic Transfer Centres. Moreover, there is also the branch-specific system of knowledge and information transfer and consultancy. A further important barrier to knowledge transfer from

universities to small firms is the lack of an appropriate image of universities and lack of knowledge about their potential as a knowledge source. In the light of the above findings, the following policy suggestions include:

- Encourage an intensive networking between universities and high technology SMEs, particularly by improving the accessibility of universities to these firms (remove thresholds (for example bureaucracy).
- In order to increase transparency of the knowledge supply, encourage a number of public knowledge intermediaries to merge into one or two institutions.

This paper has also brought to light that the local environment may increase in importance when companies face certain traumas in their lives. These traumas originate outside the company, such as in the market, but may also result from the evolution of a company as an organisation. In this respect, local policy may contribute to the following:

- Support through the knowledge infrastructure (such as consultancy) the development of the firm's ability to anticipate traumas; local knowledge sources may be focused to a stronger degree on producing 'early warning-signals'.

From the previous discussion it can be concluded that there remain strong opportunities for the further improvement of local conditions for the survival of high technology small firms.

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