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COMPANY LIFE HISTORY ANALYSIS AND TECHNOGENESIS: A SPATIAL VIEW

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1. Introduction

The issue of (technological) innovation has received a great deal of attention in recent economic literature. Inspired by (neo)-Schumpeterian and (neo-) Fordist thought, the motives for and the impacts of innovation in an era of economic stagnation and restructuring have been thoroughly analysed, both theoretically and empirically. In addition to macro- and meso-economic analysis, micro-approaches to enterpreneurial behaviour have been gaining in importance. In this context, (product) life cycle phenomena, oligopolistic market behaviour, corporate strategies from industrial economics and institutional economic paradigms have become all focal points of recent economic research.

The spatial (urban and regional) picture of this innovation has also been analysed quite thoroughly in recent years. Space not only acts as a dimension upon which such dynamic processes are projected (e.g., in terms of of relocation behaviour), but it also provides the medium through which economic dynamics are generated and transferred (witness the importance of various kinds of incubation and diffusion theories). Spatial economic structure appears to provide the vehicle for the generation and adoption of innovations, not only in the industrial sector but also in the service sector (especially in the increasingly important producer services).Also spatial and socio-economic networks behind new technology, become the driving force for the ecolution of individual firms.

In general, the history of a firm and the trajectory of its technology are closely interwoven. An increasing interest in economic restructuring and innovation has developed in recent years as nations have sought mechanisms to emerge from economic recession. Following the arguments of Schumpeter, most economists now share the view that industrial innovation is an essential condition for the upswing phase in a long term Kondratieff cycle; as well as an accelerating force in emergence from medium term down turns. This view is held irrespective of whether a 'technology-push' or a 'demand-trigger' perspective on economic dynamics is advocated.

In this paper we adopt the convention that an innovation may be interpreted as the design, construction and successful introduction of new (or improved) commodities, services, production processes, managerial and organisational structures, or distribution processes. We are particularly interested in innovations introduced at initial points in time or stages of the history of a company, leading to a significant shift ("jump") in the performance of a firm. In general, innovation is distinguished from invention by commercial implementation in the market place. In particular, the focal point of this paper are the changing significance of different urban environments for the advancement of technological change and the relationship between this change and the evolution of corporate organisations (including the emergence of new external linkages).

In recent studies much attention has been devoted to those conditions which are favourable to the innovation process, the knowledge intensity in the firm, communication networks, market forms, capital intensity, accessibility to suppliers and to markets, organisational structures and so forth. The blend of all these conditions is sometimes referred to as technogenesis (see Kamann and Nijkamp, 1988). Innovations do not appear as 'manna from heaven', but they are the result of entrepreneurial strategies (see among others Freeman et al., 1982; Nelson and Winter, 1982; OECD, 1982; Rothwell and Zegveld, 1981; and Thwaites, 1978).

The conditions for technogenesis are unequally dispersed over space: patterns of innovation exhibit a clear geographic component, not only because of sectoral variation among firms in different areas, but also because of differences in locational requirements and in spatially discriminating urban and regional policies (e.g. an urban incubation policy, or a regional technopolis policy). Consequently, in the recent past many attempts have been made to analyse the geographic aspects of innovative behaviour (for example, Ewers and Wettmann, 1980; Goddard, 1981; Bruder, 1983; Gillespie, 1983; Malecki, 1983; Keeble and Wever, 1986; Nijkamp, 1986; Giaoutzi et al., 1988; Orishimo et al., 1988).

The city is the cradle of many new (commercial) ideas, but only a few of them have evident market success. Besides, there is in general a spatially unequal rate of failure, so that the (net) fertility in creating successful commercial ideas is a crucial matter of urban competitiveness and sustainability. In this context, one should consider not only the number of newly established firms, but also their - probably spatially unequal - chance to survive in the first few years. Recently, various new concepts have emerged in this field like "liability of newness." Analytical techniques such as hazard functions are to describe the changing rate of failure of new events. The generation and adoption of innovations are often carried out by new firms, so that the fertility of a city in producing and introducing innovations may be partially reflected in the number of new firms. With a high net success rate, the city is said to have a high seedbed or incubator function (see Davelaar, 1989).

The example of Route 128 on the edge of the Greater Boston Metropolitan Area provides one demonstration of the importance of geography in the innovation process. The development of many advanced and interlinked technologies in this area has not only resullted from the favourable setting of location and infrastructure, but also from the integration and the spatial proximity of all of the elements needed for the area to be a seedbed for new enterprises (the production environment, the scientific climate, the institutional and political support for new entrepreneurship etc.). Spin-off companies have emerged in many computer based activities from the interface of creative academic endeavour and innovative industrial enterprise.

However, in looking at the production milieu (or what may be termed the selection environment) of the spatial pattern of innovations, the dynamics of the processes involved too often have been overlooked. Unfortunately, static (or comparative static) analyses have dominated. Very few studies have considered the long term evolution of firms empirically, particularly from the perspective of innovative behaviour related to restructuring. This paper is focussed on the issue of the dynamics of strategies toward innovation within the individual firms.

2. Economic Dynamics and Innovation: a Helicopter View

In recent years, much scientific debate has been devoted to the validity of the long wave concept (for an overview, see Kleinknecht 1987). The question of the existence and cyclicity of the Kondratieff cycle has apparently stimulated many scientists to undertake innovative research.

Despite doubts on the existence of such regular long-term economic waves, it is a widely held belief that there are distinct structural adjustment periods in any given economy. Old industries and markets may disappear, whilst new industries and markets may come into being. The revival of Schumpeterian views on economic dynamics can be understood in this context, since one of the basic postulates of this writing is that innovations generate economic progress. Innovative firms have to find new niches in the market in order to cope successfully with the saturated markets for existing products. Thus both price competition (for existing products) and product competition (for new niches) may be meaningful strategies for the Schumpeterian firm. Innovation gives the firm a competitive advantage, which will then have to be defended (cf. Rothwell and Zegveld, 1985).

In this framework, product innovations may be seen as relevant for conquering new markets (or niches), whilst process innovations result in productivity and price advantages. In the literature two types of Schumpeterian models are distinguished (see Freeman et al, 1982; Winter, 1984). The first one is based on the concept of 'creative destruction' as a result of a permanent search by firms for new combinations of products and organisational arrangements, induced by scientific research. However, the benefits of a competitive advantage will soon be levelled off, as other firms enter the market through imitations or improvements of these new combinations. This leads to the so-called swarming process.

The second Schumpeterian model assumes that technology is an endogenous part of the economic mechanism. Additional profits generate more R&D, leading to innovation and hence to competitive advantage. On the other hand, losses may also lead to innovative behaviour in order for the firm to survive (the 'depression-trigger' hypothesis). These thoughts have led to debate on to whether innovations are the result of scientific research (technology-driven) or of market demand (market-driven). The latter 'demand-pull' hypothesis seems to be at odds with the 'technology-push' hypothesis, but it has to be added that both

strategies are well compatible in longer time perspective and may depend upon the market position and the life cycle of individual firms.

A related question refers to the clustering of innovations in time, both within a single company and within a sector of economic activity. If certain time periods generate clusters of innovation, then a wave-like pattern becomes more plausible. The life cycle of a product is likely to determine both product and process innovations within leading companies. Any regularity in the pattern of adoption of the new technology will then be contingent on the receptivity of potential adopters, as well as on the diffusion of the product in the market place.

There is empirical evidence to show that the economic performance of companies correlates with their innovation intensity (irrespective of the direction of causality). This relationship, observed at both the meso- or macro-economic level, suggests a direct responsiveness of firms to the anticipated benefits of technological progress. Clearly, the element of time is of decisive importance to the strategies of firms. Both their market conditions and their assets of capital, labour and organisation will strongly influence their competitive behaviour over time.

The changed organisational form of the firm seems to be particalarly important. During the late sixties and early seventies there was a strong tendency towards mergers and an increase in scale of production within one firm. This process was followed by a tendency of focusing on core activities and concomitant flexible production organisation, with the introduction of co-makers, sub-contractors etc. These two tendencies changed the position of the firm and its orientation towards innovation in a different way, for instance the rise of the low innovative branch plant and subsequently the rise of the low innovative firm in the secondary segment of the dual production organisation (see Piori and Sabel, 1984).

Following recognition of the importance of the time dimension, a variety of concepts pointing at the evolutionary processes of company behaviour have been introduced. These include technology systems, technological regimes, technology trajectories or natural trajectories. Irregular time patterns appear to be fairly usual, including disruptions. Not only the new technologies themselves may vary over time; also the economic driving forces may exhibit a fluctuating pattern, depending on the economic performance of firms in relation to their asset position and their market situation (see Ayres, 1987). In general, the dynamics of new technology systems show an irregular pattern as a result of a

multidimensional interaction between engineering, economic behaviour, scientific research and socio-institutional factors. But despite their irregular behaviour, it has become evident that the technogenesis and the technological swarming processes can be regarded as generating new life cycles of industrial sectors.

In each phase of the life cycle different objectives and strategies of both leading and lagging companies seem to be plausible. Thus goals of profitability, sales penetration, strategies of investment, marketing or price competition, within the firm, may all be related to the evolution of one or more technologies over time. Thus economic evolution and the pace of technological innovation are inextricably linked, though there will be irregularities between the two pathways.

We may conclude therefore that the birth, growth, maturity, decline and death of industries and technology systems are not two independent phenomena, but two closely interwoven processes. However, the abundance of the literature in this field is mainly macro- or meso-oriented. So far the analysis of individual company histories has only received minor attention from the side of the economists, although insight into individual life cycles - and their underlying backgrounds - would be necessary to give an unambiguous answer to the above mentioned questions of demand-pull versus technology-push behaviour. The same holds for the incubation hypothesis alluded to in the introductory section. Therefore, in the next section the attention will be oriented toward micro-oriented analyses of the dynamics of firms.

3. Economic Dynamics and Innovation: A Microscopic View

3.1 Theoretical notes

In addition to neo-Schumpeterian analyses of the dynamics of firms in relation to spatial change, there have also been advances in other branches of economics which have a direct bearing upon the framework of analysis for spatial industrial evolution. Especially in the area of industrial economics a greater understanding has been achieved of the processes of invention and innovation and of the patterns of diffusion of new technology within the firm and across industrial sectors. Important contributions to this field of research can be found for example in Stoneman (1983) and Coombs et al. (1987). In addition, greater insight has been reached into the impact of technological change on national economies, and this has allowed more penetrating analyses of technology policy (cf. Stoneman, 1987).

At the same time advances in economic theory of the firm have moved the focus of empirical work. These advances are using game theory as well as standard equilibrium analysis and dynamic simulation, drawing especially upon the 'markets and hierarchies' (or 'new-institutional') work of Williamson (1985) and others. A particular focus has been on the behaviour of firms in oligopolistic market structures. These lines of thinking have been profitably applied to the strategies of multinational corporations (Buckley and Casson, 1985), as well as to issues of technology transfer, economies of scope, quality control, divestment and integration within companies (Casson, 1987; Clarke and McGuinness, 1987). Technical change issues include diffusion, appropriability, the impact of uncertainty, imitation and the economics of patents and the general influence of different market forms. The core of this recent work, transaction cost theory, comes from the mainstream of economic theorising on the working of markets, and provides a fertile base for further work on innovation in companies and interactions with the urban environment.

There is also an important cross fertilization with the writing on 'Post-Fordist' industrial strategies and company organisation. This draws upon evidence found in all European nations, of moves by companies in the late seventies and early eighties towards more flexible regimes of capital accumulation and relationships with customers and suppliers over space. This greater flexibility has been fostered by advances in information technology at all levels, and is in turn sponsoring many innovations in process engineering and in organisational form. All participants in such companies, owners and managers and workers, are finding themselves under pressure to recast their relationships, in both formal and informal contracts (Scott and Storper, 1986).

Important events in the history of a firm involve changes in vertical integration, and/or horizontal integration, or disintegration in one or both of these. Such changes in the scope of the firm would involve events in either the **product** or **process** technology, or both. A significant change in the scope of the firm might involve a shift from a monoproduct to a multiproduct context, or from a monoprocess to a multiprocess context. These particular changes may usually be characteristic for younger firms. Events in the life of older, diversified firms may only involve shifts within a multiproduct and multiprocess context. The possibilities can be outlined by means of the following table(Table 1).

	MONOPRODUCT	MULTIPRODUCT
MONOPROCESS	- simplest productive organization	- differentiation of a single product - production of 2 or more different products that can be manufactured with the same process
MULTIPROCESS	- only possible through integration of various operations whose final output is a single product (negligible byproducts)	- products sharing some important characteristics (marketing, regulation) - processes sharing some important characteristics (organization, knowledge in various forms, regulation, input qualities) - products or processes which are not related (conglomerate diversification)

Table 1. Different product - process combinations.

Clearly, one may next also introduce all the various spatial possibilities of the location(s) of the firm and of its linkages - e.g., monoregion, multiregion, monourban, multiurban-monoregion - into this framework. This would also include an explicit consideration of the firm's spatial context.

Despite many advances in innovation research, various research issues remain to be uncovered or resolved. One missing link is the two sided relationship between the dynamics of individual firms (or specific branches of a given industry) and the growth pattern of their host city. Both theory and related empirical research are under-developed. There is a need for a more behaviourally oriented perspective on both urban and industrial dynamics, supported by empirical evidence.

There is also a need for a more solid prospectively-oriented modelling effort so as to generate plausible trends and scenarios based on empirical economic research. Thus, although economics has made progress in analysing urban-industrial dynamics in relation to innovations, various opportunities are emerging for a significant advance in understanding.

3.2 A new research area

In this context the concept of company history analysis may provide new analytical insights into spatial industrial dynamics (see Van der Knaap and Van Geenhuizen, 1988). Company history analysis aims at identifying the key forces in the rise and decline of firms, particularly regarding strategic decisions on new investments, significant expansions, exploration of new markets, production of new commodities, adoption of new technology processes and new management styles. The research method is usually a longitudinal, retrospective and comprehensive analysis at the level of the individual firm, making use of content analysis of annual reports (or other written documents) and in-depth interviews with corporate managers. In this way this method yields data on relevant indicators in time series which enable the testing of hypotheses concerning cyclical or wave-like patterns of growth at the micro level. In the context of spatial industrial dynamics, company history analysis may provide answers to such questions as:

- what is the interaction between the history of individual companies over past decades, their innovative behaviour and the evolution of local urban areas (with an emphasis on exploratory and explanatory longitudinal study)?
- what are the empirical difficulties which have to be faced in a longitudinal analysis of an individual company life history (with an emphasis on an operational analysis and a research framework)?

Thus one of the main themes of company history analysis is to identify the role of urban environments in technological change and the ongoing renewal of firms. In general, the strategy of companies towards change and renewal is influenced by the dynamics of their markets and by their organisational characteristics.

It is plausible here that the nature of this interrelation between these main influences and the strategy of a company varies with different spatial environments. An urban environment which is characterised by significant urbanisation economies may act as a seed-bed for both new enterprises and for new strategies in existing companies, as is especially recognized in the urban incubator theory. A spatial concentration of innovative firms yields a creative synergy, favouring the potential of the urban area. In view of the limited empirical evidence in this respect, there is a clear need for more rigorous research and an improved empirical underpinning in this area.

The previous observations suggest that the principal research objectives of company history analysis are:

- to develop theory, research methodology and empirical understanding at the interface of new technology, company growth and urban economic development;
- to develop a historical approach to relate growth patterns of companies (rise and decline) to their locational characteristics;
- to use a longitudinal analysis to relate the adoption or generation of innovations in companies to their locational characteristics;
- to identify the spatial components in the main differentiating forces in the growth and innovation of companies.

A synthetic overview of the various elements to be considered in spatial company history analysis can be found in Figure 1.

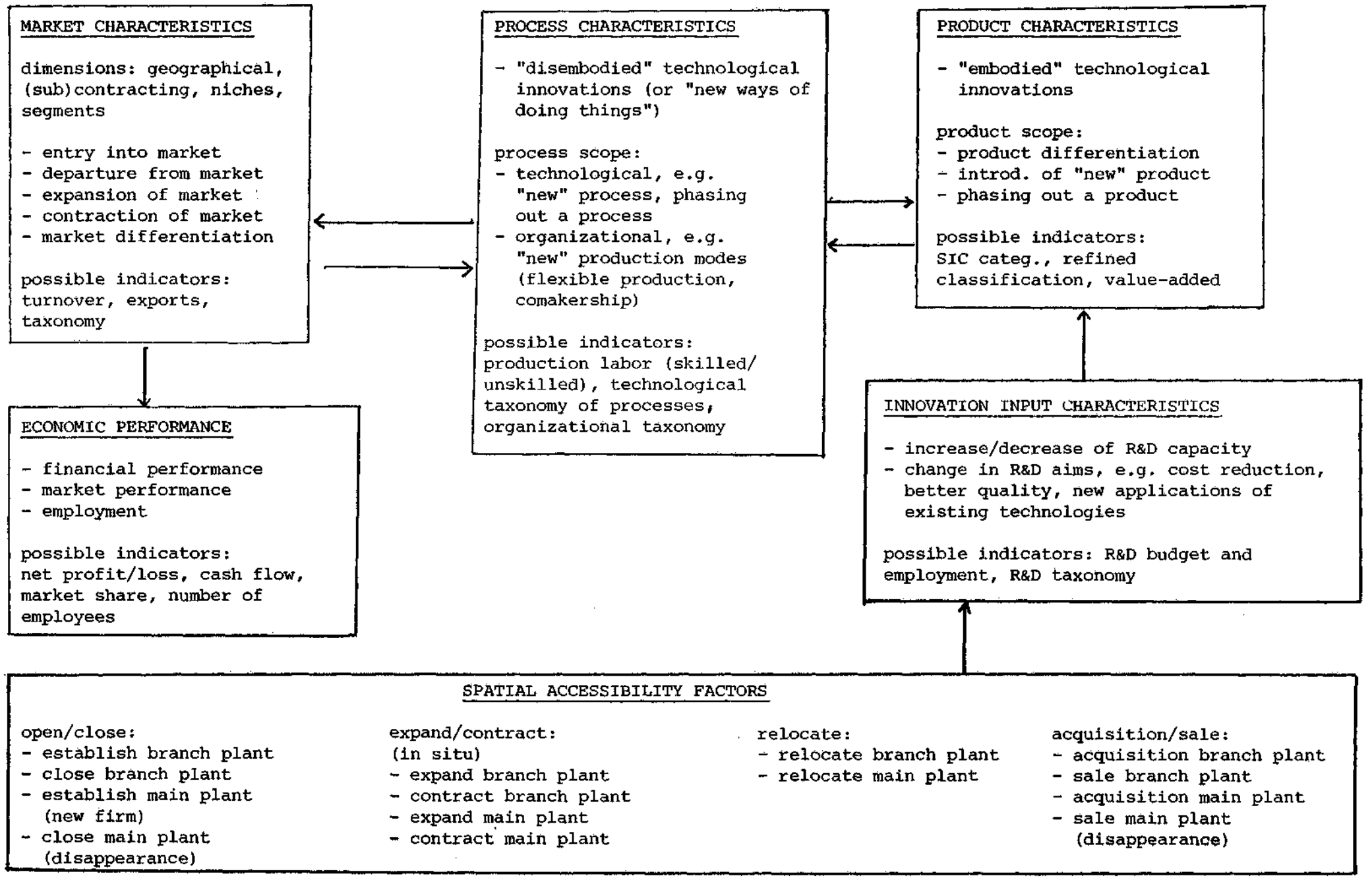


Figure 1. An overview of elements in company history analysis

3.3 Choice of firms

Research on the history of a company can take both a sectoral and a geographical dimension, seen from a long-term perspective. Leading sectors in the prevailing long wave have then to be identified and firms representing these sectors have to be selected within different urban environments. Given the different markets and different organisational characteristics of firms, it is then a meaningful strategy to analyse fairly homogeneous sets of firms. Under these conditions it is then possible to move to an in-depth analysis of the influence of urban environments with regard to both propulsive and constraining factors.

It should be noted that within the technology-to-firm relationship two different processes can be distinguished, viz. the establishment of new firms based on the new technology, and the introduction of this technology by existing firms. These processes are associated with different factors. For instance, a main factor in the establishment of new firms seems to be the presence of a reservoir of potential entrepreneurs (low entry barriers). A further important distinction should be made between the generation of new technology within the firm and the adoption of new technology by the firm. A reasonable time span for the research may then be one or two generations of firms, although in practice a time horizon of more than 35 years is almost infeasible due to the lack of precise information. The choice of the sector could be open: any sector exhibiting significant developments in the technology of either product or process over the time period under review. This criterion would encompass just about all sectors. The field may be narrowed however by considering those sectors normally associated with the fourth Kondratieff wave (petrochemicals, synthetic materials, electronics) and the fifth Kondratieff wave (new materials, biotechnology) (see Drewe, 1987, Kleinknecht, 1987, and van der Knaap and Linge, 1989). However, the link between these new products or technologies and sectors is not always clear. For instance, the application of modern biotechnology is very broad, viz. in pharmaceuticals, specialty chemicals, healthcare products, the food industry, and plant or seed production and protection (Daly, 1985).

A possible complementary approach is by focusing on the role of firms in the long wave, viz. selection of the "first innovators" in the sector located in different urban environments (whether or not they end up

being the commercial winner). In relation to the fifth Kondratieff wave, most relevant firms are likely to be still alive. However, some firms related to the fourth Kondratieff may have been completely merged or they may have closed down. The firms that failed are of special interest, but data are often scarce or less accessible.

An alternative strategie is by identifying traditional and modern sectors which display a relevant difference in spatial concentration. Next, the choice of firms within the sector can be based on this difference, in relation to the level of urbanisation. This approach focuses in particular upon spatial dispersion and on the impact of agglomeration economies.

A final alternative focuses on different urban economic evolution. The choice of cities will then be guided by the development patterns that have been followed in urban economic growth, e.g. a sectorally specialised development pattern, a diversified development pattern and a pattern involving sudden shifts in the specialisation or role of the city in the spatial division of sectoral activity.

3.4 Challenge-response model

From recent cross-sectional studies at the micro level it appears that the (relative) location or orientation to the urban core region has diminished in importance as an explanatory factor for differences in innovation activity. Manufacturing firms located in large urban areas do not exhibit a larger degree of innovativeness than firms located elsewhere. This raises questions about changes in growth strategy and the spatial requirements to survive successfully in different urban environments.

Technological progress may be regarded as an opportunity for the firm, because the firm can strengthen its competitive position by adopting innovations. However, the economic environment of the firm is characterised by threats as well, such as new entrants. These changes may be gradual, or sudden and radical. It is hypothesized here that the firm can react in two different ways, viz. an active response in which the firm can keep pace with the environmental changes, and a passive response.

If one would adopt a challenge/threat-response model of a firm, one may construct a success-failure development path matrix. Clearly, the extent to which the firm can respond effectively depends on the availability of information concerning the threats and opportunities and on the characteristics of the firm, such as age or life cycles and organisational characteristics (see Table 2).

	Gradual changes (challenge/threat)	Radical changes (challenge/threat)
Active response	Success (incremental development)	Success (fundamental readjustment)
Passive response	Success or Failure (fundamental readjustment necessary after certain time of passive response)	Failure

Table 2. A challenge - response model for firm behaviour.

4. Experiences with Company Life History Analysis

4.1 General experiences

Clearly, in the field of economic history much research work has been devoted to descriptions of the evolution of given products, given firms or sectors as a whole. However, in general, these studies have not licitly on spatially discriminating or spatially decisive factors in the economic development of firms. Elements such as the structure of production, changes in market position and in market strategies, shifts in product specialisation and differentiation and impacts of external conditions were usually not explicitly analysed against the geographical setting of firms. Only a few studies have been conducted in which the

strategic decisions of firms (new products, new investments, new technologies, new markets, new organisation) were related to the locational interests of a firm from a longitudinal perspective.
(cf. Kramme and Hayter, 1975; Glasmeier, 1987).

An interesting example from the Netherlands of a longitudinal study on the growth of firms can be found in Van der Knaap and Van Geenhuizen (1988). In their retrospective analysis, annual reports (if available) and in-depth interviews have been used as data sources.
In various cases it appeared to be possible to reconstruct the life history of firms satisfactorily, although biases caused by memory gaps can never be completely avoided.

In order to evaluate the viability of company history analysis, case studies of companies have been carried out. To catch as much variety as possible, the selection was based on differences in size, number of products and plants, sector (traditional, modern) and major strategic changes in recent years. On average, the analysis of annual reports took approximately four working days, with one outlier of twice as long (a complex multi-product and multi-plant company). In most cases a structured interview schedule has been used, and in general managers with a long working career with the firm have been interviewed. The interviews lasted approximately two hours, but including travel time etc. one or two days per firm. In the case of complex firms two such interviews were necessary, with different managers. Selecting the right person for an interview and access to this person was much more difficult in large, complex firms than in small firms. In some cases a first introduction by the PR manager turned out to be useful.

In the framework of this company life cycle analysis, the following themes have been explored:

a. economic performance;
b. growth strategy, nature of strategic change and method of growth (internal, external);
c. innovation strategy;
d. background of strategic change (position of firm, dynamics of the market);
e. influence of urban environment.

With all of the case studies, no general access problems have been experienced, but such problems may be expected when the product development is surrounded by strict confidentiality, for example, related to production for military purposes or related to severe competition in top class research. With each of the above themes, a set of interesting data

availability and validity problems emerged from the Dutch study, as will be illustrated in subsections 4.2 - 4.6.

4.2 Economic performance

Financial performance indicators, like turnover, profits and cash flow, are generally available in annual reports. However, in some cases there are problems of comparison between time series, due to a change of methods of accounting. If there is no annual report, figures concerning the past are generally not available, or may be only roughly estimated. An attempt at finding exact figures by interviews is time consuming and causes resistance from the side of the interviewee.

Figures concerning market position are mostly available for recent years. While figures for the past do exist in written documents, it is time consuming to collect these, due to the spread of information within the firm. Hence, for practical reasons, missing figures concerning the past may sometimes have to be estimated by corporate experts. This estimation may of course suffer from gaps in the memories of individuals.

4.3 Growth strategy and related themes

Data concerning growth strategies with regard to products and markets are generally available for the whole observation period. However, the level of detail and accuracy of the time scale is lower for the 1950's than for later years. In the planning of interviews, this theme needs a precise definition of different possible strategies, such as product differentiation and diversification, in order to guarantee comparability of the firms.

As it is impossible to analyse all the changes in the growth of a firm, a selection should be made. A possible approach is to include only the most important changes - incremental as well as fundamental - within a survival or competition framework or within a challenge/threat framework. The "threshold value" of importance should be determined by an expert of the firm.

With regard to the method of growth (internal by the establishment of branch plants, or external by acquisition), information about the whole observation period is generally available. However, some companies are extremely active in joint research and production and in these cases the data are not always complete. Thus, data collecting with regard to

joint development-aims, type of relations or location of partners, may require additional interviews.

4.4 Innovation strategy

In general, measuring the level or intensity of technological innovation is restricted by the absence of valid indicators. Identifying and counting innovations is inaccurate due to different levels of novelty and interrelations between innovations. In addition, input-indicators such as the number of R&D workers and the amount of R&D budget, suffer from a lack of uniform definition. Hence, these figures should be interpreted carefully.

The availability of R&D figures differs. Some annual reports offer time series from 1970 until now, but others only for the last few years. Hence, figures concerning the innovation activity depend heavily on estimation by corporate experts. In addition it should be noted that R&D figures ignore the existence of 'informal' R&D. Small firms, without a R&D department and a R&D budget, may have continuous innovation, incorporated in their production. This innovation is based on the continuous evaluation of mistakes and the changing specifications of customers.

In addition to a quantitative approach, an innovation strategy of a firm can be assessed qualitatively, with regard to the aims and the character of the innovation. In general the research experience using this approach was satisfactory, although for the 1950's and 1960's some bias was caused by memory-gap. The same restriction holds for the measurement of the years in which key innovations have been introduced.

4.5 Background of strategic change

The background of major changes in the growth and innovation performance includes influences such as market dynamics, technology or internal pressures. Data concerning the character of these influences and their intensity - gradual or radical - are generally available in annual reports. Also, these themes can be easily discussed in the interview, although some bias may be caused by personal interpretation of the interviewee. In case of doubt, external information sources may be used, like newspapers and branch societies.

4.6 Influence of urban environment

Data concerning promoting or constraining factors can only be derived from interviews. The questions concerning these factors should be very specific, e.g. referring to infrastructure or labour market characteristics because the interviewee is not used to thinking in general spatial terms.

In the study undertaken by Van der Knaap and Van Geenhuizen, most of the above mentioned factors have been taken into consideration. Various small and large firms were analyzed in a longitudinal way, while they also considered the firm's location in relation to the urban hierarchy of the place concerned.

A compact illustration of the results of such an analysis can be found in Figure 2, which describes the long-term strategic performance and locational responses of two small independent firms, viz. UCO (contact lenses) and Sensor (geophones). This figure depicts the number of changes (events) and the period of time between successive events (episodes) for four different items. The bars with the numbers present the episodes and the time-length in years. The end of one bar and the beginning of the other marks an event.
from the labour-intensive fieldwork within company history analysis follows that the number of empirical observations will be restricted. This raises questions about the generalization of the results of this method. The following strategy can be adopted. First, a number of general, testable hypotheses will be formulated. If the empirical results are not in contradiction with these hypotheses, an acceptable generalization is achieved, within the space- and time-dependent general frameworks. In addition, the empirical outcomes will give rise to new hypothetical relations and structures which will result in the development of models.

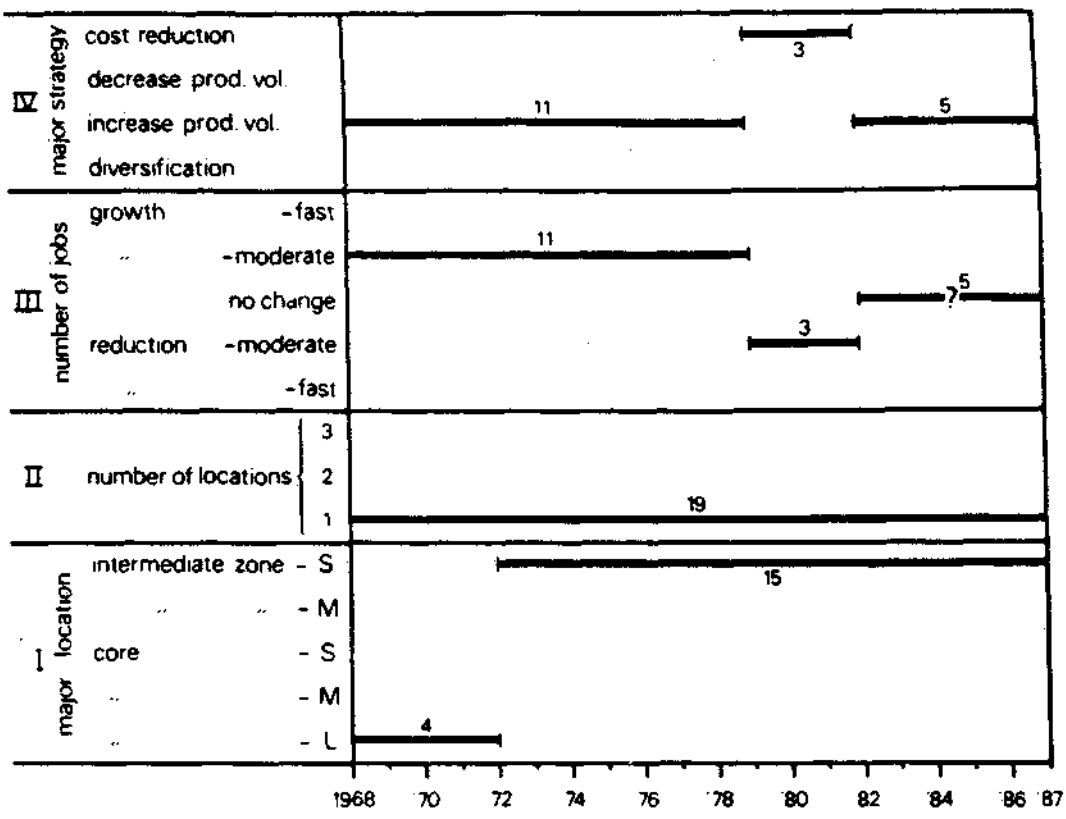
5. Conclusions

At the intersection of spatial and temporal dispersion of innovation, some research issues remain to be uncovered at the level of individual firms. One such issue is the question of demand-pull versus technology-push behaviour. Another important issue is the dynamics of incubation and the conditions favourable to innovation (technogenesis). These include the establishment of new firms or new technologies, as well as the generation of new technologies within existing firms and the process of adoption. Within this framework company history analysis provides new analytical insights into the spatial differentiating factors in the rise and decline of individual firms, particularly regarding significant expansion and contraction, new products, new technology processes, new organizational forms and new markets.

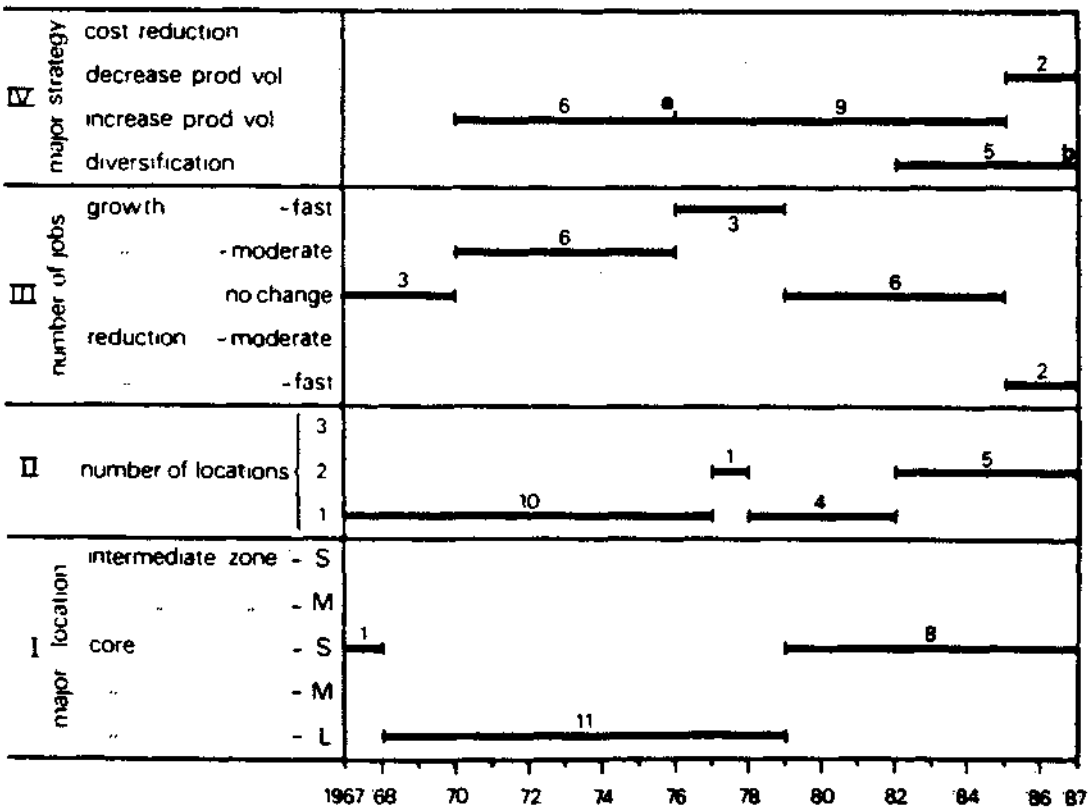
The method of company history analysis proposed in this paper is a longitudinal, retrospective and comprehensive analysis, based on content-analysis of written documents (annual reports) and in-depth interviews with corporate managers. The method yields data in time-series which enable the testing of hypotheses concerning cyclial or wave-like patterns of growth at the micro level. Until now, most of these hypotheses have only been investigated with cross-sectional data or with time-series at the level of branches or sectors. With company history analysis development trajectories may be traced from different viewpoints, e.g. smooth development or irregular patterns, successful adjustment pattern or failure, diversified, specialized or qualitative role change. Clearly, a further development of company history analysis will open up a rich research area.

Figure 2 Strategic performance and locational adjustment

a. UCO



b. Sensor



L = large cities, M = medium-sized cities, S = smaller settlements

Source: Van der Knaap and Van Geenhuizen, 1988

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