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New Firms Evolving in the Knowledge Economy; problems and solutions around turning points

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by

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Elizabeth Garnsey**

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New Firms Evolving in the Knowledge Economy; problems and solutions around turning points

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Abstract:

This paper explores and explains the emergence and growth of new firms in the knowledge economy. The resource-based view, capabilities approach, and evolutionary economics are used as a foundation for a developmental approach. The development of the firm is conceptualized in terms of processes that include opportunity recognition, resource mobilization, resource generation and resource accumulation, which lead to the development of competences and capital in a base made up of productive, commercial and financial resources. Problems originating within or outside the firm may deplete the productive, commercial and asset base, leading to turning points in the life course of these firms. These have negative consequences when problems are not solved, but positive consequences when they lead to new solutions and the development of new competence.

The empirical study shows that even in an elite sample of young fast-growing firms, most firms face turning points in their life course, and thus do not grow in a continuous way. The study shows that quantitative growth indicators do not always reveal growth problems that have been faced by new firms. Some problems do not negatively affect the employment growth of the firm, and other problems are solved before growth stagnates. The qualitative analysis shows that young firms are almost always in disequilibrium: there is almost never a perfect match between the constituents of their resource base, between input resources and requirements for expansion. This explains why continuous growth is so unlikely. Although every firm seems to grow in a unique manner, there is evidence for the presence of a limited set of necessary mechanisms for the growth of (new) firms, which work out in particular ways given the specific context and history of these firms.

Keywords: New firms, firm growth, theory of the firm, resource based view, firm life course, organizational crises, knowledge economy

JEL classifications: D21, D92, L23, M13, M21

INTRODUCTION

Economic firms are institutions, sustained by corporate law and fiscal arrangements. They are basic units of the market economy and drivers of change. In the knowledge economy, new firms have proliferated as a result of the lowering of barriers to entry by information technologies and the associated emergence of new economic activities. But it is still difficult to understand these newcomers to the economy or the basis of the growth on which their innovative contribution depends. The bulk of economic studies of new firms offer cross sectional analyses and/or focus only on growth indicators. Few theoretically grounded studies examine their internal dynamics. Studies of internal processes tend to be stage models of growth, which have been criticized as empirically unsound and theoretically ungrounded. What is required is a conceptual scheme that is theoretically informed and has conceptual affinities with other current work (e.g. resource-based, evolutionary and complexity) and which supports empirical comparisons between new firms. In this paper we show how the resource-based view, capabilities approach, and evolutionary economics can be used as a foundation to develop and extend theory to explain the emergence and development of new firms.

This paper uses a process-oriented, longitudinal approach in comparing the start up and growth experience of 25 case study firms. The focus is on problem solving activities in the early life of the entrepreneurial firm. We analyse the problems and their solutions around turning points that mark a shift from a growth episode into a stagnation or setback. Where a number of problems can be solved at once, several growth processes may take place, e.g. a venture's technological resources may be created in the course of commissioned research or technical consultancy for customers, which yields revenues. New firms often turn to others for help in solving the problem e.g. through subcontracting. The solution of early problems leads to the development of competence that enables the firm to respond to changing opportunities and threats. An important lesson from evolutionary economics is the contribution of problem-solving to the development of routines and competences (cf. Nelson and Winter, 1982; Coriat and Dosi, 1998). These routines and competences are essential to understanding the firm's development. Only few new firms achieve growth on sustained and substantial basis. These successful firms accumulate resources which enable them to reorient themselves in response to changes in opportunity structure without succumbing to resource shortages. These become leaders among the new generation of firms.

In-depth examination of case studies identifies common development processes during the life course of new firms. This study examines growth paths of a number of new Netherlands firms, and focuses on the turning points which mark their growth experience. This enables us to draw general conclusions about growth phases and syndromes in young firms. Their experience reveals the way in which new firms grow by co-evolving with others, forming connections and partnerships with the complementary organizations that characterise the networked division of labour in the knowledge economy (cf. Autio and Garnsey, 1997). The key question in this paper is: how and why do new firms develop? In order to answer this key question we will analyse the growth paths of new firms and the turning points in these paths.

CONCEPTUAL FRAMEWORK

Although the knowledge economy has brought many opportunities for new firms to emerge and evolve, new firms continue to face endemic problems. These problems and their solutions are important drivers of heterogeneity among firms. There have been many studies on these drivers shaping firm heterogeneity. On the one hand, there is long tradition of empirical and conceptual studies on problems in relation with growth stages of new firms (Churchill and Lewis, 1983; Greiner, 1972; Kazanjian, 1988; Miller and Friesen, 1984; Terpstra and Olson, 1993). However, these studies have been widely criticized as empirically unsound and/or theoretically ungrounded (Bhidé, 2000; Levie and Hay, 1998; Storey, 1997). On the other hand, there are advanced theoretical approaches like the resource based perspective (Barney, 1991; Foss, 1997), the (dynamic) capabilities approach (Teece et al., 1997; Dosi et al., 2000) and evolutionary economics¹ (Nelson and Winter, 1982). These theoretical approaches have been criticized for their neglect of firm growth and change, and the lack of a clear conceptual model of the endogenous creation of new resources and competences (Foss, 1997, p.351-352). These approaches have been largely aimed at explaining short-term performance of firms (resource based perspective and dynamic capabilities approach) or long term change in industries, technologies and the economy as a whole (evolutionary economics). The dynamic capabilities approach aims at explaining innovation (new products, production processes, alliances). This approach could also be useful for studying specific changes in the life course of the firm, since it deals with the competences developed by a firm and in that way also provides insight into why certain changes in the organization have been realized successfully or not (Eisenhardt and Martin, 2000). However, for explaining the long-term development of new firms a developmental approach is needed, which explains how and why new firms evolve.

Development and growth of new firms

A developmental approach focuses on processes of change in new firms (Garnsey, 1998; Rathe and Witt, 2001; Stam, 2003) and builds heavily on the work of Penrose (1995). Such an approach aims at explaining endogenous processes of change, and explicitly takes entrepreneurship into account². Development is an iterative, non-linear process in which the new firm must continually adapt to unfolding opportunities. The development of new firms is driven by both internal and external dynamics. In this approach opportunities and resources are necessary conditions for the creation of a firm (cf. Sorenson, 2003). Perception of an opportunity to create value triggers the process of new firm formation. The recognition of such an opportunity is determined by the imagination of the entrepreneur. This opportunity can be developed with the resources

¹ Some authors have argued that evolutionary economic theories can be regarded as a subset of competence-based theories of the firm (Hodgson, 1999, p.247). Other authors have argued that competence-based theories (e.g. the dynamic capabilities approach, cf. Teece et al., 1997) are built on evolutionary economics (Foss, 1997, p.352).

² Although the developmental approach sketched here differs from current evolutionary economics (Nelson and Winter, 1982), it shares the major building blocks and key assumptions of evolutionary economics including 'dynamics first', bounded rationality, heterogeneity of agents, novelty, selection mechanism, and emergent properties (cf. Dosi, 1997; Hodgson, 2000). In an explanation of why firms differ, Nelson (1991) states that an evolutionary theory of dynamic firms consists of the concepts of strategy, firm structure and core capabilities. The developmental approach sketched here is in line with what Cohendet and Llerena (1998, p.10) have defined *an* evolutionary theory of the firm, namely "a theory which explains the structure and behaviour of a firm as an emergent property of the dynamics of interactions of both its constituent parts among each other and of the firm itself with its environment". These firms do not develop in isolation, but their fates are closely connected to their (local) environments. Although in order to abstract from contingent conditions, the focus in this paper is more on internal than on external dynamics.

entrepreneurs have direct access to, with the resources they can acquire outside the firm or those they can create internally (resource mobilization). Direct or indirect access to resources is necessary to develop this opportunity into a commercial output. These resources are subsequently deployed in order to develop and produce the good or service. Thus the new firm creates a productive base in the form of, e.g., technological competences or expertise in R&D. Often external co-producers are needed for specific modules to be added to the final product or service offering. In order to bring this final product or service offering to the market, commercial capabilities³ are needed such as legal, marketing and sales expertise. These form the firm's commercial base, which includes e.g. its reputation, or dealer network. To create value for customers on an on-going basis, a firm needs a productive and commercial base of some kind. In more abstract terms this means that the firm is able to generate resources through its productive and commercial activities.

In order to survive in a market economy, entrepreneurs have to solve basic problems. They need some way of accessing and mobilizing initial resources; they have to develop and produce the good or service and connect to suppliers and customers. The need for production and sale of goods and services to be sustained at a profit remains the central problem after problems of start up and early growth have been solved. Once the firm is up and running, returns from the resource generation process can be accumulated; the firm itself becomes an asset once it has an asset base. The asset base can be measured by the market value of the firm on the stock market or on the market for mergers and acquisitions. This value can only precisely be established when the firm exits (via a buy-out, a take-over, or bankruptcy) or realises an IPO. Investments in the firm that enlarge its asset base can be used to support further growth, whether through further exploration or through exploitation of existing opportunities.

Once a firm is functioning as an economic unit achieving returns, the question arises as to how and why its further development takes place. It might survive without growing, but ambitious entrepreneurs have or develop an intention to grow the business. However, there are several limitations to the growth (i.e. rate of expansion) of firms. Metcalfe (1998, p.45) identifies five specific kinds of limitations to growth: "in relation to the ability to purchase inputs and sell output as determined by the growth of relevant market environments; in relation to the availability of internal and external finance to expand capacity; in relation to the managerial implications of growth for the ability to control costs (Penrose, 1995); in relation to the growth of rival firms and thus the specific market of the firm; and in relation to the ability to imagine and articulate growth opportunities". According to Metcalfe (1998, p.45) all of these elements come together to determine the economic fitness of the firm. Kazanjian (1988) distinguishes six categories of dominant problems to growth in technology-based new ventures: those related to organizational systems, sales/marketing, people, production, strategic positioning, and external relations.

Further growth often requires inputs of resources before returns have been realized to pay for these. Reorganization of the firm may be a prerequisite for further growth. These necessary reorganizations constitute the 'turning points' in the development of the firm. When critical problems are solved successfully, the firm is able to continue to grow. However solutions are

³ These can also be called "marketing capabilities", which capture and reflect "how well a firm performs each key customer-connecting process (...) and in designing and managing subprocesses within the customer relationship management process (...)" (Srivastava et al., 2001, p.783).

hard to come by. This developmental approach shares with the stage models of growth (e.g. Greiner, 1972; Kazanjian, 1988; Hanks et al., 1993) the focus on dominant problems in the life of new firms. However, the latter type of studies focuses on taxonomies of problems in distinctive stages and assumes that firms progress sequentially across one specific sequence of stages. The developmental approach focuses on feedback effects as these problems are faced and solved and lead to the further development of the firm. Certain developmental *processes* are common in new firms as they mobilise and build resources to form a resource base capable of generating market returns. Firms that face and solve similar developmental problems in sequence may go through similar phases of activity (Garnsey, 1998). Researchers have identified such regularities in firms producing similar products on the basis of similar business models (e.g. Bell and McNamara (1991) on US computer hardware ventures). But different problems arise in firms that engage in different kinds of activities and are addressed in different ways, using different types of business models. The building of different kinds of resource base involves different sequences of activity. We have seen that problems may be addressed in parallel, or may recur. Moreover firms may or may not inherit a resource base from another organization through de-merger or spin-out. Thus there are no invariant phases of activity as new firms emerge; instead there are common requirements for development into an economically viable unit, achieved in a variety of ways.

The new firm's experience is shaped by changes inside the firm and changes in the firm's environment (cf. Tushman and Romanelli, 1990; Romanelli and Tushman, 1994). Changes inside the firm may be of a quantitative nature, like the increase in resources and activities, but also of a more qualitative nature involving a changing organization structure and/or strategy, and the development of competence through learning. In a competence-based view, the existence, structure and boundaries of the firm can be explained by the associated existence of individual or team competences which are in some way fostered and maintained by that firm (Hodgson, 1999, p.247-248). Competence is built cumulatively within the firm through team-based learning (Penrose, 1995). Competence is the product of problem-solving activities and enables the firm to respond to changing opportunities and threats. This is achieved as the new firm develops problem-solving skills and embeds these in procedures and routines⁴. These competences can be found in the productive and commercial base in figure 1.

As Penrose (1995) emphasised, the 'opportunity environment' depends on the entrepreneur's perceptions. But Penrose recognized that these perceptions are confronted by reality. Evolutionary theory represents the firm's environment as the source of selection forces that actually determine whether significant others choose to do business with the new entrant. This evolutionary issue is not directly addressed in modern resource based theory (Foss, 1997). Selection processes are experienced through the firm's interactions with resource providers (including investors, the knowledge environment, and labour sources), co-producers, customers, and competitors and regulators. Important features of the new firm's environment are the operations of the capital market that affect conditions of exit, merger and acquisition. The firm's environment may involve changes in the firm's input markets and its output markets. Important aspects of input markets are the supply of resources by resource providers, and the possibility to co-produce with other organizations or to hire or contract personnel. The growth and decline of

⁴ Routines are "patterns of interactions that represent successful solutions to particular problems" (Teece et al., 1997), which are resident in organizational behaviour. Next to this behavioural definition of routines, routines can also be interpreted as cognitive regularities (Becker, 2004).

product markets, and the changing level of competition are important aspects of the output markets. A key question in this respect is how firms and the markets and networks in which they operate co-evolve (Rathe and Witt, 2001; Richardson, 1972).

Figure 1 represents the internal and external dynamics involved in firm development. The ovals refer to resources and competences that accumulate over time as experience builds up and returns are reinvested in the firm's resource base (cf. Dierickx and Cool (1989) on "asset stocks"). The firm's resource base is represented in terms of a productive base, a commercial base, and an asset base for clarity, though in practice they are not separable.

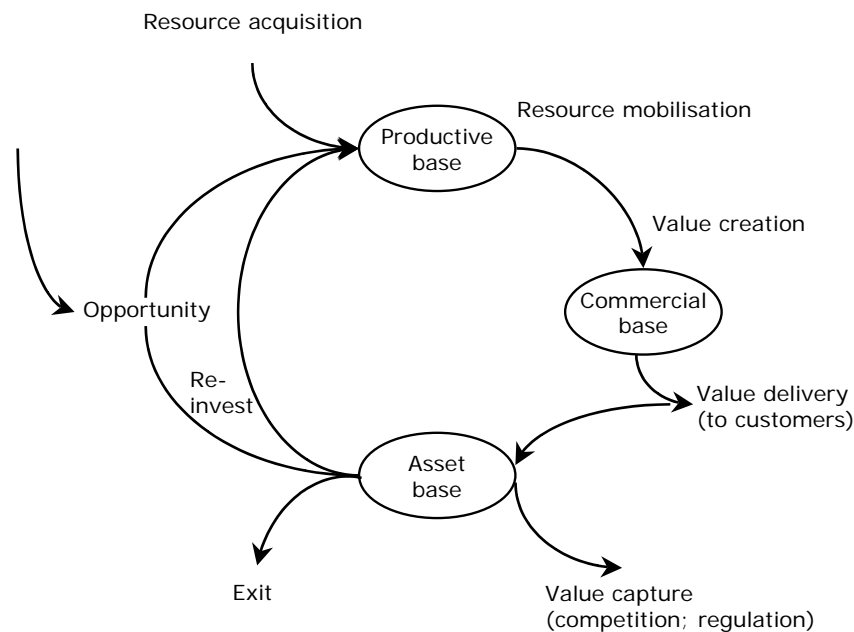


Figure 1. Internal and external dynamics of new firm development

In principle a new firm could embark on many different growth trajectories. Each firm has its individual and unique characteristics. Consequently, initial conditions and resource endowments incline the system in a certain direction, but the actual path taken is unpredictable because it is subject to contingent occurrences and singular initiatives. Nevertheless, the processes that contribute to their development have common features (Garnsey, 1998; McGrath, 2002). Opportunities must be detected and input resources accessed and mobilized in order to generate further resources on an on going basis for a firm to survive in a market economy. Thus for all firms, there is an initial opportunity search process:

The productive activities of such a firm are governed by what we shall call its 'productive opportunity', which comprises all of the productive possibilities that its 'entrepreneurs' see and can take advantage of. A theory of the growth of firms is essentially an examination of the changing productive opportunity of firms; in order to find a limit to growth, or a restriction on the rate of growth, the productive opportunity of a firm must be shown to be limited in any period. (Penrose, 1995, p.31-32)

This productive opportunity set refers to the opportunities that an entrepreneur recognizes in its environment and can take advantage of on the basis of the tangible and intangible resources of its firm. Other processes are commonly found in a new firm's early development as it seeks to solve common problems facing all new firms. Concepts from the resource-based view (cf. Foss, 1997) and evolutionary economics (Nelson, 1991) can throw light on some of these processes.

In contrast to growth, development is not based on quantitative indicators. There are quantitative growth indicators that could to some extent represent the internal dynamics represented in figure 1: e.g. the productive base in number of employees, the commercial base as level of turnover, and the asset base as the current market value of the firm. The development of firms can be represented in terms of the maturity of their resource base. Start-up is characterised by the emergence and formation of an initial productive base. A new firm that is surviving is able to achieve returns on its activities, which means it has some kind of commercial base (legal and marketing services). Firms that have entered into early growth have not only shown ability to survive in a specific product-market, but have also generated surplus profits in this or additional other markets, which have been invested in their productive base. These investments often lead to an increase of the number of employees in the firm. Before they have reserves to see them through fluctuations in their trading performance firms are vulnerable and their growth is at best intermediate. Many firms never emerge from this phase, facing a continual struggle to overcome short term fluctuations. Finally, some firms are able to accumulate resources in a growing productive and asset base. Competitive advantage of firms is a necessary condition for the accumulation of resources. The advantage is reinforced through reinvestment of extra profits ("internal accumulation", cf. Steindl, 1952). The implication is that as firms grow, investments to expand the productive base for existing products is no longer constrained by access to finance. To some extent, growing firms internalize a part of the external selection environment. As firms grow, also new opportunities may be identified – positively affected by the increased knowledge base of the firm – and investment in new product development may even become "institutionalised" (cf. dynamic capabilities: Teece et al., 1997; Eisenhardt and Martin, 2000). This resource accumulation process provides reserves (cf. Cyert and March, 1963 on "organizational slack"), which provide a buffer for external shocks and also the means to explore new opportunities, without endangering the current resource generation process.

RESEARCH DESIGN AND METHOD

We have chosen a longitudinal and retrospective, case-based research method to compare and explain the development of evolving firms, drawing on both qualitative and quantitative evidence. We start with quantitative evidence which points to uneven and discontinuous growth in new firms in our sample (see Garnsey et al. (2003) for a discussion of the methods used). Though this evidence does not directly map developmental processes, it does show that turning points, interruptions and setbacks are common in the growth paths of new firms. The qualitative evidence relates these metrics to underlying growth processes. Our research is in two parts. First a database is assembled to explore the growth paths of a group of evolving firms. This part provides background information on the development of evolving firms, insofar as quantitative growth indicators can measure this over time. Second, we conduct a series of comparative in-depth case studies to investigate more thoroughly the problems and solutions around turning points in the firms' development. The case studies involved the (pre-)life histories of these

evolving firms as told by the founder-entrepreneurs (company life history analysis; cf. Van Geenhuizen et al., 1992), but also a survey on indicators about the size, nature, inter-organizational relations and spatial organization of the firm. Key events affecting the development of the firms were uncovered with the critical incident technique (cf. Chell and Pittaway, 1998; Cope and Watts, 2000). In addition to these data obtained in the interview, additional information from company archives, the press and other media were collected. The empirical evidence will be used to answer three research questions:

1. *What growth paths of young fast-growing firms can be distinguished?*
2. *Why are there turning points in their growth paths?*
3. *How can the different growth paths be explained?*

The sample

The sample consisted of 16 knowledge-based service firms, 4 biomedical, 3 shipbuilding, and 2 graphics-media firms (see table I). We used the data of these firms to address the first two research questions, while we used a subsample with contrasting cases to answer the last research question (cf. Eisenhardt 1989; Pettigrew, 1995).

Table I. Characteristics of the firms in the research sample

Name	Sector	Current specialization	Nr. of employees
A	Knowledge services	Communication and organization advice	148
B	Knowledge services	Organization advice	250
C	Knowledge services	Organization advice	40
D	Knowledge services	Organization advice	26
E	Knowledge services	Market research	90
F	Knowledge services	Information and communication technology	140
G	Knowledge services	Information and communication technology	110
H	Knowledge services	Labour market services	200
I	Knowledge services	Government and education services	110
J	Knowledge services	Government services	300
K	Knowledge services	Information and communication technology	42
L	Knowledge services	Information and communication technology	85
M	Knowledge services	Information and communication technology / New Media	170
N	Knowledge services	Industrial automation	90
O	Knowledge services	Datamining	20
P	Knowledge services	Information technology	30
Q	Biomedical	Tissue engineering	95
R	Biomedical	Therapeutics research and development	140
S	Biomedical	Development and marketing of diagnosis and therapy prod.	26
T	Biomedical	Development and marketing of products for diagnosis	15
U	Shipbuilding	Development and production of composite constructions	23
V	Shipbuilding	Custom boat-building	52
W	Shipbuilding	Houseboat-building	42
X	Graphics-media	Printing and graphic design	31
Y	Graphics-media	Printing, graphic design, and multimedia	34

The evolving firms have been operationally defined as firms that have survived the first 4 years of existence (which are generally characterized by the highest failure rates), but are not older than 10 years (which means that they probably have not become mature and managerial firms, and that the founder-entrepreneur could probably be traced). They had to have reached a size of at least 20 full time employees, which is a crude indicator of company success and evolution. Finally, these are independent firms, i.e. owner-managed (with a majority stake in the firm). We

have a ‘control group’ matching successful, rapidly growing firms: evolving firms that did not continually grow (experiencing stagnation or even setbacks). This prevents a ‘success-bias’ to some extent; a problem of former studies like Kazanjian, (1988) and Terpstra and Olson (1993). Only the minority of the sampled firms grew in a continuous way.

Operational definition of firm growth

There are many indicators of firm growth: indicators in terms of input (employees, investment funds), throughput (productivity), output (sales, revenues, profits), and valuation (assets, book value, market capitalization). The various measures capture different dimensions of growth and are not necessarily aligned, though they may be⁵ (Vaessen, 1993; Storey, 1997; Delmar et al. 2003). Here we draw on the available data on employment of the sample of evolving firms. Growth paths are traced using quantitative employment indicators, in contrast with the development paths, which are based on qualitative indicators of development processes. The data points making up the growth paths are compressed and termed ‘B’ for a reduction in employment greater than 5%, ‘G’ for an increase in employment greater than 5%, and ‘P’ for a change in employment in either direction of less than 5% (between two subsequent years, with a change of at least two employees). The resulting measures were coded to represent the turning points in evidence and presented as archetypal growth paths (cf. Garnsey and Heffernan, 2005). In this study the operational definition of the start is *the formal registration at the local Chamber of Commerce*: the point zero in the growth paths. From a developmental perspective, however, development processes begin earlier than this. After the start-up phase, the growth paths start to diverge. After the initial start-up firms may experience growth, setback, or plateau (or sequences of these phases).

GROWTH PATHS EXPLORED

In this section we will address the first research question – *What growth paths of young fast-growing firms can be distinguished?* We examined the data on an exploratory basis to see whether it was possible to summarize trends without losing relevant information on comparative growth paths. Among the sample were firms with a continuous growth path that began to grow early on. For the group of firms with a delayed onset of growth, several years may elapse before they exhibit growth. A somewhat different order of growth is characteristic of the plateau path. These firms begin to grow quite soon, but for a few years after this, growth stagnates. The fourth growth path is the least regular. Firms in this phase suffer from one or more setbacks during their life course, but they differ with respect to the other characteristics of their growth path (delayed growth: firm I; continued growth: firms C, D, and H; plateau: firm O). The sequence and duration of the growth phases during the life course of the evolving firms are shown in table II.

⁵ However, research by Wiklund and Shepherd (2005) on a sample of all Swedish firms incorporated during the 1994-1998 period and their growth over their first six years of existence revealed only low correspondence between different growth measures.

Table II. Sequence and duration of growth phases in the growth paths*

Firm		Age (in years):										
		1	2	3	4	5	6	7	8	9	10	11
Continuous growth (G→G)	A	G	G	G	G	G	G	G	G	G	G	
	B	G	G	G	G	G	G	G	G	G		
	J	G	G	G	G	G	G					
	K	G	G	G	G	G	G	G				
	L	G	G	G	G	G	G	G	G			
	N	G	G	G	G	G	G					
	Q	G	G	G	G							
	R	G	G	G	G							
	S	G	G	G	G	G	G	G	G	G	G	G
Delayed growth (P→G)	E	P	G	G	G	G	G	G	G	G	G	
	G	P	P	G	G	G	G	G	G	G		
	P	P	G	G	G	G	G	G				
Plateau (G→P)	F	G	G	G	P	P	G	G	G			
	M	G	P	P	G	G	G	G	G	G		
	T	G	P	G	G	G	G	G				
	U	G	G	G	G	P	P	G	G			
	V	G	G	G	G	P	P	G	G	G	G	
	W	G	G	G	G	G	P	G	G			
	X	G	G	P	G	G	G					
	Y	G	G	P	P	P	P	G	G	P		
	C	G	G	G	G	G	G	G	G	B	B	
Setback (G→B)/ Mixed	D	G	G	G	G	G	G	B	G			
	H	G	G	G	G	B	G	G	G	G	G	
	I	P	P	B	G	G	G	G	G	G	G	G
	O	G	G	B	G	G	P	G	G	G	B	

* codes of the growth phases: P = Plateau (employment change less than 5% per year); G = Growth (employment growth at least 5% per year); B = SetBack (employment decline at least 5% per year).

There is clear evidence of uneven growth. During a favourable economic cycle, only nine firms grew continuously over the period studied, with another three firms growing continuously after a delay, or a preparatory period. The firms with continuous growth had already gone beyond the 50 employees size within five years after their start (firms J, N, Q, R). Another eight firms experienced periods of interrupted growth, staying temporarily on a plateau. Only five firms had serious setbacks, with two of them also experiencing plateaus.⁶ Judged by the low incidence of setbacks, this is a successful sample of start ups (cf. Hugo and Garnsey, 2002; Garnsey and Heffernan, 2005). Most firms have grown in an organic way, but four have also grown through takeovers (firms E, H, and Y) or a merger (firm R). The biomedical firms Q and R were recently successful in realizing an initial public offering (IPO). The growth curves of the cases in the different types of growth paths are shown in figure 2.

⁶ There might be a selection bias, since not all the firms were studied for the full ten years.

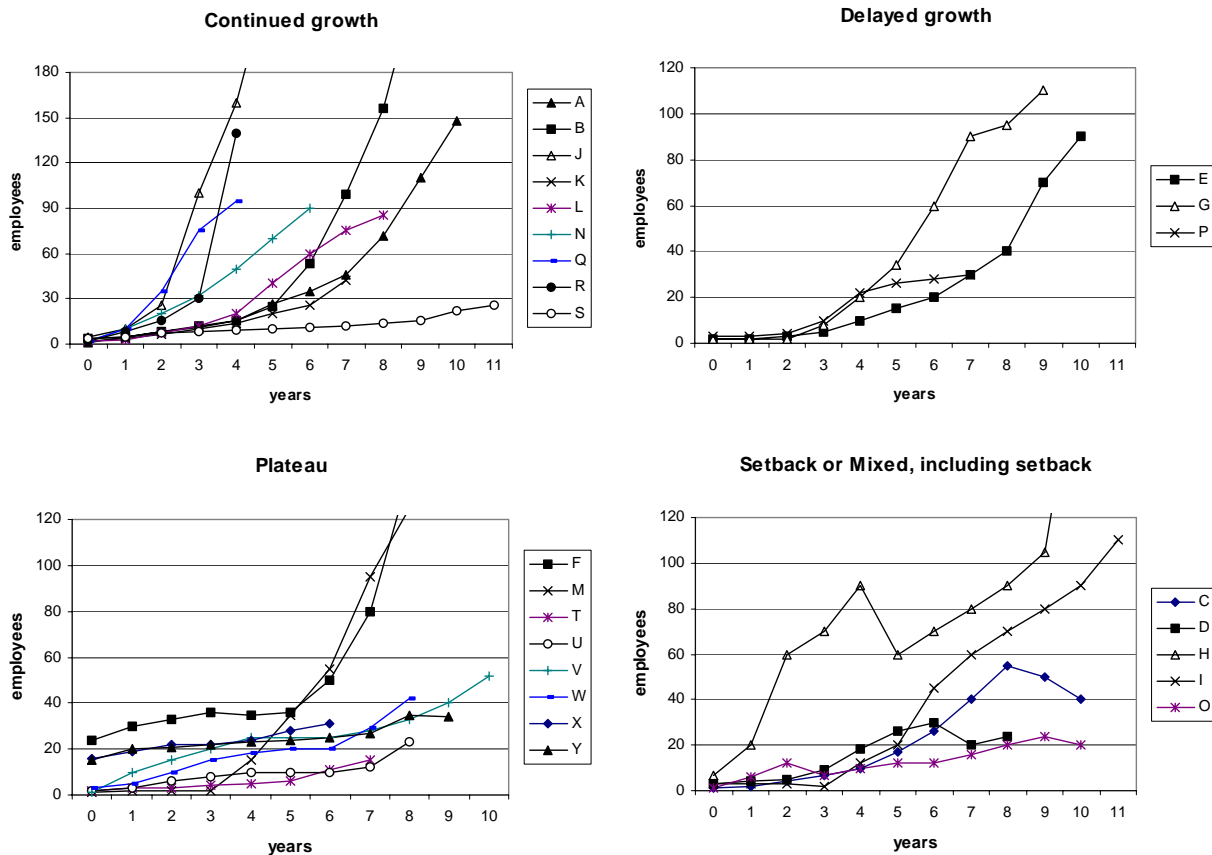


Figure 2. Growth paths of the sample of evolving firms

PROBLEMS AND PROBLEM-SOLVING

In this section we will analyse the problems of evolving firms that have led to stagnation or setbacks during their life course and how these problems are solved. We will focus on the firms experiencing delayed early growth, long periods of stagnation and/or growth setbacks.

In a market economy, a necessary condition for a firm to thrive is a resource generation process that allows outputs to be sold at more than their production and delivery costs. Almost all case study firms have realized such a resource generation process, and can thus be regarded as viable for the time being. The firms that have not yet reached viability were the biomedical firms Q and R. Those that have only done so recently are the knowledge service firm O, and shipbuilding firm W (only a very short profitable period after start-up). During the period of financial dependence these firms could only survive because they continued to receive inputs from resource providers (formal investors) who believed in their long-term profitability.

Clearly, choice of activity has important implications for the need for resources of all kind, not the least for financial capital. Knowledge service firms have to mobilize only a few tangible

resources such as computer and office facilities, while shipbuilding and graphics-media firms need many more tangible resources, and thereby financial resources. Higher resource needs are more difficult to sustain, and are a challenge to continuous growth. This is a factor in the plateau growth exhibited by the shipbuilding and graphics-media cases in our study. The creation of an enduring input-output process requires certain essential input and output relationships. As it takes form, the firm becomes an open system interacting with others in the production environment.

Essential input relationships are internal to the character of the activity in question (cf. Sayer, 1992). Biomedical firms stand out in this respect; they need considerable investment for specific facilities (such as laboratories), and highly skilled scientific and technical labour. Many of these biomedical firms grow in employment terms (productive base) before they reach the initial survival phase (commercial base) enabling a minimum scale of operation. These firms also face the growth problems associated with the early growth phase after initial survival. The venture capitalists of the biomedical firms Q and R compelled these firms to change their organization and control structure at an earlier stage than that in which problems could arise. The growth of these firms was thus reinforced by the accumulated experience of their financial relationships, even before they entered the initial survival phase.

The evolving firms with delayed growth have failed to grow after their start-up. In some cases this can be the result of a demanding resource mobilization process before resources for growth are obtained, but this does not apply to the current case studies. The entrepreneurs of the evolving firms with a delayed growth path were willing to grow, but lacked the opportunity to expand, or were constrained by other factors in the first instance. One example of such a constraint is a non-competition clause in an agreement with the former employer (firm G). A delayed start can be substituted by serial entrepreneurship; that is to say, by setting up another business until the constraints on growth have elapsed.

In only a few cases was delayed growth related to a lack of opportunities. Often delayed growth cannot be accounted for by one reason alone, but rather by a combination of reasons. The reasons for delayed growth as stated by the entrepreneurs are summarized in table III.

Table III. Reasons for delayed growth

Source of problem:	Reasons stated:
Internal	Entrepreneurs wanted to do everything themselves (no delegation) (E)
External	Two-year embargo on approaching customers and employees of former employer (G); internet not yet accepted as general communication medium (G); constrained market opportunities (because of regulations) (I)

There are limits to a firm's *rate* of growth (Penrose, 1995, p.194), but why do some new firms actually stagnate or decline? These firms face problems they have been unable to resolve. The reasons for the plateaus are summarized in table IV. In one case the entrepreneurial team did not work effectively, pointing to a key problem area. Two firms outgrew their resources and failed to resolve marketing problems and financial problems respectively. Establishing an effective organization structure was another problem that had to be dealt with for growth to continue. Firm X mentioned geographical expansion and a lack of coordination competence. For many firms, the failure to grow was the result of failing to solve problems of relationships with other organizations. In one case problems with a key financial relationship were not solved (O), or problems with dissatisfied customers (U) remained unresolved. Networks are not always

beneficial in organizing growth (cf. Powell & Smith-Doerr, 1994; Johannisson, 2000). The financial relationship of firm O can be characterized as lock-in: in the first instance this relationship enabled the growth of the firm with capital inputs and the supply of new customers, but subsequently the interference of this major shareholder made the entry of new external investors impossible and constrained the growth. The environment was mentioned several times, relating to the labour market, shareholders, customers and a declining local market. Thus, as with delayed growth, a combination of factors caused the plateau in each case.

Table IV. Reasons for the plateau

Source of problem:	Reasons stated:
Internal	Organization structure (F); part-time entrepreneur, next to two academic studies (M); lack of marketing competence (T); too busy with production and too few marketing efforts (V); conflict between partners in the entrepreneurial team (W); capital shortage (W); organization structure (W); problems with coordinating businesses in two regions (X)
External	Problems with recruitment of new personnel (F); interference of major shareholder that prevented new investments (O); financial claims and lawsuit by two major customers (U); Declining local market (X)

Most evolving firms in our sample solved these problems successfully, leading to a continuation of the growth after two or three years, or even entrance into the accumulation phase. For firm Y there were no clear problems to be resolved but the plateau was interrupted only by a few years of growth.

Sometimes firms face severe problems that are not detectable as setbacks in their growth path, for example when success in one business unit compensates for problems elsewhere in the company. For example, one important customer of firm I had a major disagreement about the service delivered, which led to a large financial claim that has constrained the growth of one of its two business units for some years. However, the firm as a whole continued to grow, because the other business unit was not affected by this claim and continued growing steadily.

Only five evolving firms in our research sample went through a growth reversal. For firm C the setback was brought about by the founder's lack of managerial skills in combination with the attempt to serve too many market segments. Attracting an experienced owner-manager from outside and a focus on fewer market segments has solved these problems. The setback of firm D was caused by a failed attempt to change the organization structure to a team structure. The problem was solved by the appointment of a new director from within the firm, the introduction of a (more) simple organization structure, and concentration on fewer market segments. Similar coordination problems also led to the setback of firm H. Firm O has even gone through two setbacks. The entrepreneur gave a direct reason for the first setback: a conflict between the consultancy and development personnel on the strategy of the firm. The founder-entrepreneur had a preference for development activities, and this led to the exit of the consultancy personnel. This firm had not made any profits before the first setback, and this state of affairs was reinforced by the fact that the initial financiers did not want to put any more money into the firm. Only after this first setback did new financial participants invest more money and enable the 'revival' of the firm that resulted in resource generation two years after the setback. However, the financial partners stopped the flow of financial inputs again at that moment, and according to the entrepreneur that was constraining the subsequent development of the firm. Table V summarizes the reasons mentioned for setbacks.

Table V. Reasons for setback

Source of problem:	Reasons stated:
Internal	Lack of managerial skills of the founder (C); too many market segments (C); Organization structure (D and H); Conflict between consultancy and development personnel (O)
External	-

Inter-organizational relationships relatively often cause growth *difficulties*. The problems can often be (partly) resolved through personal relationships and the support and services of inter-organizational relationships. For example, firms T, U, and W recruited an external mentor to solve their problems, firm P was supported by a marketing agency and a corporate identity agency, and firm X sought the support of a regional development agency.

The reasons for delayed growth, stagnation, and setbacks resemble the dominant problems mentioned in other empirical studies on problems during start-up and growth (see Kazanjian, 1988; Terpstra and Olson, 1993). But we want to take this study one step further, with an inquiry into the explanation of growth paths and turning points in the life course of young firms.

GROWTH PATHS EXPLAINED

In this section we deal with the third research question that required rich evidence - *How can the different growth paths be explained?* We used a subsample including eight cases within two industries (knowledge services and biomedical) with contrasting growth paths to answer this last research question. Both industries – knowledge services and biomedical – are knowledge intensive and characteristic for the knowledge economy. In this section we will explain why these firms have developed and grown in a different way. The particular growth paths of these case-study firms are shown in figure 3.

Firm B was on an ‘ideal’ growth curve, not achieved however without problems. The initial growth of the firm took place in the form of new (spatial) units with a high level of autonomy. After seven years in development, it went through a major transition. This involved the dissolution of the entrepreneurial team and a transformation of the organization structure from a multidivisional/cells organization into a ‘knowledge-based network organization’. The transition was triggered by two developments: first, a divergence within the entrepreneurial team; second, certain business units claimed too much autonomy and paid too little attention to the common good of the firm (a divergence in the productive base). These factors led to a simultaneous and discontinuous shift in strategy, control, and organization structure. With the help of an external advisor a new strategy process was designed with a new organization structure: a knowledge-based network organization. This specific organization structure promotes the organization of synergy between people and business units, the organization of collectivity, sharing of knowledge, and a less strict division of labour. The consequence of this new organization structure was that the autonomy of the business units became combined with the coordination and sharing of knowledge within the whole system of the firm. This organization structure enabled a persistent growth rate and a way of systematizing the whole organization flexibly and effectively, facilitating the continuous state of reorganization. In addition to these changes in strategy and organization structure, the original entrepreneurial team was disbanded and control in strategic

decision-making became more decentralized. This reorientation also led to the start of the accumulation phase (with a robust asset base).

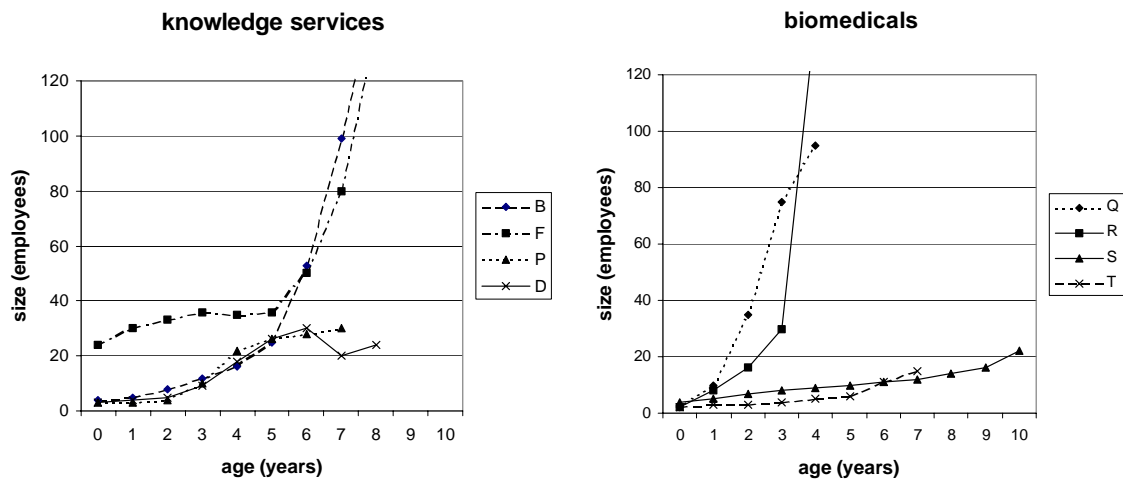


Figure 3. Contrasting growth paths of evolving firms in knowledge services and biomedical

Firm F started as a management buy-out of the Dutch branch of Digital Equipment Corporation, which explains its relatively large start-up size (with a considerable productive and commercial base already in place). Only after five years it started to grow, but in a quite explosive way, with an employment growth comparable to firm B at this age. This increased growth was enabled by the shifting focus of the company into a new technology – Microsoft NT applications – for which the demand was booming in the second half of the nineties. The competence in developing this technology has been built in cooperation with Microsoft Netherlands, later on this cooperation also supported the competence building in the area of the automatisisation of workflow processes (Microsoft Workflow). In this growth period the firm faced problems with the recruitment of new personnel (productive base): at that moment it was especially for relatively small firms very hard to attract ICT skilled personnel. Firm F solved its recruitment problems by starting retraining projects for new personnel from outside the ICT sector. These projects were done in cooperation with the local labour office and led to the start of a new business unit ‘education’ in this firm. For knowledge service firms like this one investment in human resources is often the largest ‘cost category’.

In its first five years of existence firm P had a growth curve comparable to the other knowledge service ICT firms. However, the growth did not increase after five years, but more or less stagnated. This was caused by a too diversified customer group that could not be served in a profitable way anymore (problems in the commercial base). The problems leading to this stagnation triggered a strategic change which is expected to lead to a new growth period within the near future. The entrepreneurs felt the need to make the decision to change the strategy, and to focus on a specific market segment: the knowledge intensive organizations, including advanced professional service firms and scientific organizations. This did not lead to a changing productive base, but to a changing commercial base. This change has been reinforced with the

support of a communication advice agency and a marketing agency, which led to an explicit change in corporate identity and market positioning.

The first five years in the growth curve of firm D were similar to firm B, however after these five years the growth curve did not increase as much as the one of firm B. Firm D is a medium-sized organization advice company that was started by two serial entrepreneurs. The clients were acquired via the entrepreneurs' existing professional networks (commercial base). Some of the first clients are still important customers. A high level of trust characterizes relationships with these customers: "Trust is fundamental for realizing organizational change with our customers"; "Selling is nothing less than the construction of trust through which goodwill can arise". After five years of stable growth, a change in the organization structure failed. This caused a setback in the sixth year of the firm, followed by a transformation. The change from a simple organization structure to a cells structure turned out to be a complete failure, and this was accompanied by the withdrawal of one of the founder-entrepreneurs. This withdrawal also brought about a decrease in the IT orientation and a shift of the firm into consultancy on organizational change trajectories (changing productive and commercial base). The resulting growth syndrome with huge financial losses led to a customer focus on a few industries and a few large customers rather than trying to take on all the customers who could be reached.

The biomedical firms Q and R stand out because of their extremely steep growth curves. They also stand out in a developmental way, as they do almost not generate any marketable output (no commercial base), and certainly not any large profits.

Firm Q is a fast-growing biomedical firm specializing in substitution medicine and tissue engineering. Two professors in biomedical sciences started the business activities of firm Q (cf. Zucker et al., 1998). They were pushed into entrepreneurship, because the University of Leiden was putting increasing financial constraints on their Biomaterials Research Group. They had the previous experience of starting two other biotech firms. They sold their last firm for a substantial sum and used the proceeds to fund this firm. So they both came out of the academic research group and can also be seen as serial entrepreneurs. The first employees were attracted in the first year. The firm has been financed by several venture capitalists and realized an initial public offering (IPO) four years after its start-up (external inputs to the asset base). Firm Q has become the market leader in tissue engineering in Europe. Only a few research groups and biotech firms are active on this market. It is an R&D driven organization with an extensive intellectual property portfolio and a wide range of (yet to be commercialized) products. Some products have been sold on the final market, delivering some modest returns. It is expected to make some profits within a few years. During its life course the firm has increased the number of R&D agreements with academic research and clinical institutes all over the world. The firm was transformed from an academically oriented research institute into a stock listed company very quickly. The transformation was facilitated by the entrepreneurial capabilities of the two founders, who had already founded and developed two similar firms.

Firm R is a biomedical firm focused on the discovery and development of therapeutics based on fully human monoclonal antibodies. The plan of a new firm had already been initiated more than a year before the formal start-up. The foundation of the start was the approval of a patent application in 1995. The idea for this patent was an opportunity recognized by one of the founders at a scientific conference in San Diego. The patent application led to discussions with

the chairman of the local university and the president of the academic hospital in which both the founders worked. At that time it was not clear if and how a biomedical spin-off could be commercialized. Two professors of Utrecht University founded the firm, with the academic organizations Utrecht University and the University Medical Centre Utrecht as external shareholders. The Dutch Ministry of Economic Affairs also subsidized the start-up. The firm was incubated within the academic hospital. At its start collaboration with Novartis (a world leader in pharmaceuticals) had already been initiated, and this proceeded in the next few years. In its second year, the firm reinforced its intellectual property base through agreements with two US pharmaceutical companies. In the third year, a CFO was appointed and the first venture capital round took off. This substantial venture capital investment (asset base) allowed the firm to continue fundamental research and prepare for clinical testing of the lead product candidates (productive base). In the fourth year, closer cooperation was started with another Dutch biomedical firm that had developed a little further than firm R, although in a complementary manner. Potential cooperation problems with this firm and some other operational problems in firm R led to the merger with this other Dutch biomedical firm. The merger of the two companies led to the creation of a 'new' firm with 150 employees. The founder-entrepreneur of firm R did not become CEO, but served instead as Chief Scientific Officer for the resulting new business organization. According to the entrepreneur of firm R, the merger "has enormous strategic value for both companies, and it will enable us to accelerate the development of our products". Neither the initial firm R nor the new merged firm made any profits. There was some income from the licence of its core technologies to commercial partners and entry into strategic alliances in exchange for fees, milestone payments, and royalties on products developed using their technologies. In the same year, the new firm realized an IPO that had already been planned by the other firm. Firm R had also planned an IPO, only over a longer term, which was thus accelerated by this merger (merger of the productive base led thus led to substantial growth of the asset base).

Firms S and T - both producing and selling diagnostic tests – grew hardly at all during their first years, and only slowly after this initial steady period. In contrast to firms Q and R these firms did produce some profitable products, i.e. they had a moderate commercial base. However, these firms did not have such a promising technology or biomedical product (productive base) that they could attract enormous sums of investment capital (asset base). They did attract some venture capital, but had to survive mostly on their own commercialised products, which they did with moderate success. Both mention that their commercial base is still not sufficiently developed, although they are investing quite heavily into their corporate identity and marketing skills (with market research and the support of external marketing advisors) next to their 'normal' investments in product development. After several years they both changed their firm into a more market-oriented firm, due to lagging profits, with a changed organization structure and more focused marketing efforts.

The solution of the problems during the early life course often involved learning and sometimes even the development of a firm-specific competence. Without the development of these firm-specific competences it would be impossible for these firms to continue to grow during their life course.

DISCUSSION

We already knew that most new firms never reach a substantial size (see e.g. Storey, 1997). However, we did not know that the few new firms that manage to grow to a substantial size often do not grow in a continuous way. Our empirical study revealed that even in an elite sample of young fast-growing firms, most firms face turning points in their life course (cf. Garnsey et al., 2003). These turning points are often caused by problems and constrain growth, and force the firm to focus again after a resource or competence shortage. However, these turning points also enable growth: in the short run – after delayed growth – and in the long run, when competence is developed in the problem-solving process.

The case studies showed that quantitative growth indicators do not always reveal growth problems that have been faced by new firms. Some problems did not negatively affect the employment growth of the firm, and other problems were solved before growth stagnated. The qualitative analysis showed that young firms are almost always in disequilibrium: there is almost never a perfect match between the constituents of their resource base, between input resources and requirements for expansion. This explains why continuous growth is so unlikely. The qualitative analysis also showed that certain growth mechanisms are more important in certain industries than others. For example, the early growth in the asset base of knowledge service firms was realized in a resource generation process with close ties to customers, while for biomedical firms this was mainly realized by acquiring financial resources from investors. However, in the long run the biomedical ventures also have to generate adequate resources from a product market, otherwise they will be taken over or abandoned by their investors before this occurs.

In contrast to the stage models of growth we did not find evidence for a universal sequential progress in the life courses of the studied firms. But although every firm seems to grow in a unique manner, there is evidence for the presence of a limited set of necessary mechanisms for the growth of (new) firms, which work out in particular ways given the specific context and history of these firms.

CONCLUSION

The growth paths of young firms is a topic that has received comparatively little attention in the literature, where cross sectional methodologies dominate. Yet it is only by examining the unfolding processes through which growth takes place that we can understand the constraints and success attributes so often cited in the literature. This study has shown that although each firm is unique, there are common processes that bring about development and common problems that have to be resolved if this is to occur. Because the requirements for survival and growth are experienced in common, there are common features to development. We found that certain growth paths are more common than others and reflect the relative success of new firms in solving problems they all face.

How and why new firms develop has been a central issue in this paper. A coherent answer to this question involves a developmental approach. We have used the resource-based view, capabilities approach, and evolutionary economics as a foundation to such a developmental approach. In this paper the development of the firm is conceptualized in terms of processes that include opportunity recognition, resource mobilization, resource generation and resource accumulation, which lead to the development of competences and capital in a base made up of productive,

commercial and financial resources. Problems originating within or outside the firm may deplete the productive, commercial and asset base, leading to turning points in the life course of these firms. These have negative consequences when problems are not solved, but positive consequences when they lead to new solutions and the development of new competence.

Evidence of this kind points to the micro-diversity that underlies aggregate trends, evidence that is lost if growth rates are averaged out and firms characterized by rate of growth, as in much of the “enterprise monitoring” that currently takes place. Policies of support and strategies for growth operate in the dark unless evidence of this kind is examined and the causal processes underlying development are analysed. Further work of this kind is needed to integrate qualitative and quantitative approaches.

REFERENCES

- Autio, E. and E. Garnsey (1997) Early growth and external relations in new technology-based firms. Helsinki University of Technology, Espoo, Finland.
- Becker, M.C. (2004) Organizational routines: a review of the literature, *Industrial and Corporate Change*, **13**, 4, 643-677.
- Bell, G.C. and McNamara, J. E. (1991) *High-Tech Ventures, The Guide for Entrepreneurial Success*, Addison Wesley, New York.
- Bhide, A. (2000) *The origin and evolution of new businesses*, Oxford University Press, New York.
- Chell, E. and Pittaway, L. (1998) A study of entrepreneurship in the restaurant and café industry: exploratory work using the critical incident technique as a methodology, *Hospitality Management*, **17**, 23-32.
- Churchill, N. C. and Lewis, V. L. (1983) The five stages of small business growth, *Harvard Business Review*, **61**, 30-50.
- Cohendet, P. and Llerena, P. (1998) Theory of the firm in an evolutionary perspective: A critical development, Paper to the conference "Competence, Governance and Entrepreneurship", Copenhagen.
- Cope, J. and Watts, G. (2000) Learning by doing. An exploration of experience, critical incidents and reflection in entrepreneurial learning, *International Journal of Entrepreneurial Behaviour & Research*, **6**, 104-124.
- Coriat, B. and Dosi, G. (1998) Learning how to govern and learning how to solve problems: On the co-evolution of competences, conflicts and organizational routines, In *The Dynamic Firm: The role of technology, strategy, organization, and regions* (Eds Chandler, A.D., Hagstrom, P., Solvell, O.) Oxford University Press, New York, pp.103-133.
- Cyert, R. M. and March, J. G. (1963) *A behavioral theory of the firm*, Prentice-Hall, Englewood Cliffs, NJ.
- Delmar, F., Davidsson, P., and Gartner. W.B. (2003) Arriving at the high-growth firm, *Journal of Business Venturing*, **18**, 189-216.
- Dierickx, I. and Cool, K. (1989) Asset Stock Accumulation and Sustainability of Competitive Advantage, *Management Science*, **35**, 1504-1511.
- Dosi, G. (1997) Opportunities, Incentives and the Collective Patterns of Technological Change, *Economic Journal*, **107**, 1530-1547.

- Dosi, G., Nelson, R. and Winter, S. G. (2000) *The nature and dynamics of organizational capabilities*, Oxford University Press, Oxford.
- Eisenhardt, K. M. (1989) Building Theories from Case Study Research, *Academy of Management Review*, **14**, 532-550.
- Eisenhardt, K. and Martin, J.K. (2000) Dynamic capabilities: What are they? *Strategic Management Journal*, **21**, 1105-1121.
- Garnsey, E. (1998) A Theory of the Early Growth of the Firm, *Industrial and Corporate Change*, **7**, 523-556.
- Garnsey, E. and Heffernan, P. (2005) Growth setbacks in new firms, *Futures*, **37**, forthcoming.
- Garnsey, E., Stam, E., Heffernan, P. and Hugo, O. (2003) New Firm Growth: Exploring Processes and Paths, ERIM Report Series Research in Management, Rotterdam (<http://hdl.handle.net/1765/1109>).
- Greiner, L. E. (1972) Evolution and revolution as organizations grow, *Harvard Business Review*, **50**, 37-46.
- Hanks, S. H., Watson, C. J., Jansen, E. and Chandler, G. N. (1993) Tightening the life-cycle construct: A taxonomic study of growth stage configurations in high-technology organizations, *Entrepreneurship: Theory and Practice*, **18**, 5-31.
- Hodgson, G. M. (1999) *Evolution and Institutions: On Evolutionary Economics and the Evolution of Economics*, Edward Elgar, Cheltenham.
- Hugo, O. and Garnsey, E. (2002) Investigating the growth path of young technology-based firms: A process approach, Centre for Technology Management, University of Cambridge, Cambridge.
- Johannisson, B. (2000) Networking and Entrepreneurial Growth, In *The Blackwell Handbook of Entrepreneurship*(Eds, Sexton, D. L. and Landström, H.) Blackwell, Oxford, pp. 368-386.
- Kazanjian, R. K. (1988) Relation of dominant problems to stages of growth in technology-based new ventures, *Academy of Management Journal*, **31**, 257-279.
- Levie, J. and Hay, M. (1998) Progress or just proliferation? A historical review of stages models of early corporate growth, London Business School, London.
- McGrath, R. G. (2002) Entrepreneurship, Small Firms and Wealth Creation: A Framework Using Real Options, In *Handbook of Strategy and Management*(Eds, Pettigrew, A. M., Thomas, H. and Whittington, R.) Sage, London.
- Metcalf, J. S. (1998) *Evolutionary Economics and Creative Destruction. The Graz Schumpeter Lectures I*, Routledge, London.
- Miller, D. and Friesen, P. H. (1984) A longitudinal study of the corporate life cycle, *Management Science*, **30**, 1161-1183.
- Nelson, R. R. (1991) Why Do Firms Differ, and How Does It Matter, *Strategic Management Journal*, **12**, 61-74.
- Nelson, R. R. and Winter, S. G. (1982) *An Evolutionary Theory of Economic Change*, Belknap Press, Cambridge, MA.
- Penrose, E. T. (1995) *The Theory of the Growth of the Firm (first published 1959)*, Oxford University Press, Oxford.
- Pettigrew, A. M. (1995) Longitudinal Field Research on Change: Theory and Practice, In *Longitudinal Field Research Methods: Studying Processes of Organizational Change*(Eds, Huber, G. P. and Van de Ven, A. H.) Sage, London.
- Powell, W. W. and Smith-Doerr, L. (1994) Networks and Economic Life, In *The handbook of economic sociology*(Eds, Smelser, N. J. and Swedberg, R.) Princeton University Press, Princeton, pp. 368-402.

- Rathe, K. and Witt, U. (2001) The Nature of the Firm - Static versus Developmental Interpretations, *Journal of Management and Governance*, **5**, 331-351.
- Richardson, G. B. (1972) The organization of industry, *Economic Journal*, **82**, 883-896.
- Romanelli, E. and Tushman, M. L. (1994) Organizational transformation as punctuated equilibrium: an empirical test, *Academy of Management Journal*, **37**, 1141-1166.
- Sayer, A. (1992) *Method in Social Science*, Taylor & Francis, London.
- Sorenson, O. (2003) Social networks and industrial geography, *Journal of Evolutionary Economics*, **13**, 513-527.
- Srivastava, R. K., Fahey, L. and Christensen, H. K. (2001) The resource-based view and marketing: The role of market-based assets in gaining competitive advantage, *Journal of Management*, **27**, 777-802.
- Stam, E. (2003) *Why Butterflies Don't Leave. Locational evolution of evolving enterprises*, Utrecht University, Utrecht.
- Steindl, J. (1952) *Maturity and stagnation in American capitalism*, Blackwell, Oxford.
- Storey, D. (1997) *Understanding the small business sector*, International Thomson Business Press, London.
- Teece, D. J., Pisano, G. and Shuen, A. (1997) Dynamic capabilities and strategic management, *Strategic Management Journal*, **18**, 509-533.
- Terpstra, D. E. and Olson, P. D. (1993) Entrepreneurial start-up and growth: A classification of problems, *Entrepreneurship: Theory and Practice*, **17**, 5-19.
- Tushman, M. L. and Romanelli, E. (1990) Organizational evolution: A metamorphosis model of convergence and reorientation, In *The evolution and adaptation of organizations*(Eds, Staw, B. M. and Cummings, L. L.) JAI Press, Greenwich, Connecticut, pp. 139-190.
- Vaessen, P. M. M. V. (1993) *Small Business Growth in Contrasting Environments*, Catholic University of Nijmegen, Nijmegen.
- Van Geenhuizen, M. S., Nijkamp, P. and Townroe, P. M. (1992) Company life history analysis and technogenesis, *Technological Forecasting and Social Change*, **41**, 13-28.
- Wiklund, J. and Shepherd, D. (2005) Knowledge accumulation in growth studies: The consequences of methodological choices. Paper presented at ERIM expert workshop "Perspectives on the Longitudinal Analysis of New Firm Growth" 18-19 May 2005, Erasmus University Rotterdam, The Netherlands.
- Zucker, L. G., Darby, M.R. and Brewer, M.B. (1998) Intellectual Human Capital and the Birth of U.S. Biotechnology Enterprises, *American Economic Review*, **88**, 290-306.