
A Theory of the Early Growth of the Firm

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Economic enterprise consists in the matching of resources and opportunities to create value. Growth processes of the new enterprise are here explored in a systems model inspired by Penrose. A sequence of phases in the early life of the firm reflects growth processes and problems, solutions giving rise to new problems. Firms must access, mobilize and deploy resources before they can generate resources for growth. Subsequent phases—in which growth reinforcement and growth reversal forces contend—are not universal, but are set in motion in an important minority of firms, the major job creators. Beyond the early phases, critical problems facing the firm are more diverse. The growth of the firm is related to the building of the competence needed to respond to changing industrial opportunities.

1. Introduction

Despite the revival of interest in enterprise, theoretical work at the micro-level on the origin and growth of the firm remains sparse. Most work on the firm assumes an organization already in existence with established operations, or deals with aggregate data at the industry level. For the analysis of the internal dynamics of the firm, literature reviews return to a single classic, Penrose's *Theory of the Growth of the Firm*, which first appeared in 1959. Penrose's conceptualization of the firm has won wide acclaim and has become the basis for the resource-based approach to the firm, work that has been hailed as a new economic paradigm (Barney, 1991; Peteraf, 1993; Fransman, 1994; Teece and Pisano, 1994; Montgomery, 1995). But while her ideas on the resources of the firm have been applied in the study of competencies and corporate strategy, Penrose's approach has not been used to address the questions with which she herself was concerned: what are the incentives for and constraints on growth in the firm? Penrose was concerned with growth in already established firms and not with the new firm. However, her approach can be used as a starting point for the analysis of the early growth of the new firm.

Penrose's Method

According to Penrose, in neoclassical economic theory:

the model of the firm is a model representing the forces determining the prices and quantities produced of particular products in the individual firm. . . . Hence if we become interested in other aspects of the firm we ask questions that the 'theory of the firm' is not designed to answer. (Penrose, 1959, p. 11)

However, Penrose did not set out to produce a critique of the neoclassical approach to the firm. Her line was: 'I tend my garden. Let them tend theirs.' Her model of firm growth was concerned not with the price and output behaviour of firms but with the firm as 'an administrative organisation in the real world', in which 'the firm's existing human resources provide both an inducement to expand and a limit to the rate of expansion'. For Penrose's firm, 'history matters'. There is a cumulative process of interaction between the 'market opportunities of the firm and the productive services available from its own resources' (Penrose, 1960, p. 14). Growth is essentially an evolutionary process which involves the accumulation of knowledge unique to the firm (Penrose, 1995, p. xiii).

Penrose studied case histories of companies and conducted detailed fieldwork in a company that had been restructured as a result of anti-trust regulation.¹ This evidence brought to her attention both incentives and constraints experienced by managers, and the influence of their perceptions and responses on the growth of firms. From these observations she distilled her conceptual model.

Though judicious case analysis can illuminate an area of enquiry, an acknowledged weakness of the case study method is that it can result in too complex a theoretical framework and too specific a focus to produce theory of general import (Eisenhardt, 1989, p. 547). This is often the result of conceptual work remaining too close to empirical detail. Penrose stepped back from her empirical observations to reflect on the broader issues raised by her studies of growing firms. She created a coherent conceptual framework where axiom and inference strengthen the argument from evidence. Because she put some distance between her theory and her findings, the reader may gain the impression that her approach is deductive. However, since her starting point was careful observation of experience, her method can also be characterized as inductive. She did not begin with a set of *a priori* assumptions about

¹ Penrose had intended to include the case study of the growth of the Hercules Powder Company, resulting from the demerger of Du Pont, in her volume on the growth of the firm, but was dissuaded by her publishers on grounds of printing costs (Penrose, 1960).

economic rationalism or methodological individualism, nor assume that knowledge, old or new, is an individual attribute, exogenous to the firm (Audretsch, 1994, pp. 48ff). She observed that learning takes place through shared knowledge and action and that the competence so achieved can extend the firm's productive opportunities.

Her approach contrasts with that of industrial economists who draw inferences about firm growth from aggregate data, rather than from observation of the internal dynamics of the unit of analysis. Penrose's focus showed that learning within the firm is a complex and contingent process, where for Jovanovic, for example, it is a necessary or circular inference from performance data that learning takes place in the firm (Jovanovic, 1982). Penrose saw that perceptions and beliefs were a key source of variation, where in Jovanovic's model: 'all firms have the same prior beliefs'. The concern with internal developments was combined with an awareness that opportunities stem from the industrial environment, and Penrose acknowledged the uncertain conditions under which firms must operate. In econometric models, radical simplifying assumptions are made to explain the growth and survival of firms, for example: 'there is no technological progress' and 'all demand changes are foreseen' (Jovanovic, 1982, p. 652). The object of the present paper is to explore how it is that variation and uncertainty in these areas make the growth paths of firms unpredictable and to identify common processes at work.

Penrose's objective was to make sense of experience, and her 'model' of the firm has interpretive dimensions. She was engaged in constructing theory, not in theory testing and proof. Nevertheless, her theory has drawn subsequent research into a process of enquiry analogous in some ways to scientific method. Interpretive accounts of this kind can be used to derive causal propositions and apply these to further empirical evidence which supports or challenges them. The model can accordingly be modified, extended and refined, and may give rise to measurable indicators. This iterative process has occurred in work on the resource-based theory of the firm, notably on competence studies and on resource-based notions of strategy inspired by Penrose (cf. Peteraf, 1993; Teece and Pisano, 1994; Fransman, 1994).

Building on Penrose's Work

The aim of the present paper is to use Penrose's approach to provide an account of the origins and early growth of the firm. An account of typical growth processes is proposed, to situate the experience of a given firm in relation to that of others and to compare across firms using a common set of concepts. Though this account is derived from case evidence, the aim is to

draw back from detailed findings sufficiently to depict general processes. This paper is concerned with theory building rather than theory testing, but implications of the model are compatible with recent statistical findings discussed briefly below (e.g. Reynolds and Miller, 1988; SBRC, 1992; Garnsey *et al.*, 1994; Kirchoff, 1994; Storey, 1994; Baldwin, 1995).²

Penrose defined the firm as an administrative unit with boundaries. She emphasized the distinctive internal activities taking place within firms; their members work together over time, combining resources in specific ways and building firm-specific competence.³

the growing experience of management, its knowledge of the other resources of the firm and of the potential for using them in different ways, create incentives for further expansion as the firm searches for ways of using the services of its own resources more profitably. (Penrose, 1995, p. xii)

According to Penrose, productive services make it possible to take up productive opportunities through the distinctive use made of the resources of the firm, including its technologies. We could say that problem-solving capacity, or competence, renders productive services. Penrose's work contains the seeds of other ideas used in this paper, in particular the concept of path dependence implicit in her insistence that 'history matters' and the concept of the firm as an open system, consistent with her emphasis on the continual interaction between the firm's resources and its markets.⁴

An open systems approach can overcome the problem of emphasis on internal conditions to the neglect of external conditions for firm growth or vice versa. The firm and its environment are viewed as operating in systemic interaction; neither firm nor industrial structure are prior factors, nor is either relegated to a theoretically residual category.⁵ The firm can be conceptualized as an open system of activity, an input-output system drawing in resources from its environment and converting these into products or services for which

² The UK and US firms studied in case study and action research by the author were mainly innovative, technology-based firms. Case examples are cited to illustrate the theory, not as verification.

³ The approach rejects the neoclassical assumption that the production function is given. For firms engaged in the same kind of activity, using the same equipment and staffing numbers, output ratios may vary as a result of unique teamwork, knowledge and experience.

⁴ There is implicit systems thinking in Penrose's approach (Garnsey, 1995). Penrose emphasized that firm growth is a cumulative, evolutionary process reflecting path dependence (Arthur, 1990).

⁵ Since the activities are interdependent, the firm can be viewed as a complex system. Various strands of systems thinking can be brought to bear on its analysis (Johnson *et al.*, 1974). A system is a set of interdependent elements forming a whole with emergent properties, attributes of the interactions of its component parts. A continuous system of activity is made up of individuals and groups who interact in roles and relationships. Systems thinking provides a method for conceptualizing interactions; a system is not an entity. System boundaries are drawn and initial conditions identified according to the purpose of analysis.

revenue can be obtained through exchange. Activity is organized and sustained as a result of capacity to mobilize, deploy, convert and exchange resources. The firm's position depends on the nature of its interactions with key players in its environment: with customers, distributors, suppliers, funders and competitors. These provide the firm's inputs, and purchase or pre-empt its outputs. As members of the firm learn to solve these problems and so acquire competence, they build up the firm's assets: tangible assets such as productive equipment and buildings, and intangible assets such as expertise and reputation. Because no one measure of growth is adequate, assets are used here as a composite indicator of growth; they also point to the likely purchase price of the firm. Statistical evidence often uses employee numbers to measure firm size, for reasons of data availability.

An open systems approach can provide grounding to theoretical work on enterprise. Entrepreneurs are initiators of activities that may become systemic. Enterprise we define as the capacity to match opportunities and resources in such a way as to initiate new activity that can create value. We share Penrose's recognition of the importance of entrepreneurial skills and outlook, and Schumpeter's view of the critical role of the entrepreneur (Schumpeter, 1928). In much analysis of the emergence of firms and their evolution, concern with collective structures and processes displaces attention from individuals as agents of change. Population ecology is concerned with aggregate data, examining the distribution of fitness across a population of firms (Hannan and Carroll, 1992).

In keeping with ecological tradition, our formulation is silent on the role, if any, of individual action. (Hannan and Carroll, 1992, p. 194).

And in evolutionary economics:

firms are the key actors, not individual human beings. Of course (implicitly) firms must provide sufficient inducements to attract and hold the individuals that staff them. But within these models, individuals are viewed as interchangeable and their actions determined by the firms they are in. (Nelson, 1995, p. 68)

In contrast with theories of enterprise and innovation that exclude the individuality of the entrepreneur, theory dealing with complex systems views individuals and local events as a critical source of diversity and change. Collective processes are made up of

the microscopic reality of diversity and individual subjectivity, which in fact provides the basis for the adaptive responses of the system and its creativity. (Allen, 1997, p. 2)

Individual agents of change have a place in the analysis of complex systems. The immediate impact of their actions is visible at the micro-level and can set off cumulative processes that work through to further levels of system aggregation. Entrepreneurs who effect new firm creation, and especially those who found leading companies, are a major source of industrial change over time (Baldwin, 1995).

Aggregate Evidence

A theory of the early growth of the firm must be consistent with evidence that shows a large proportion of firms do not survive as identifiable units beyond their first few years, and that only a small proportion achieve significant growth. These characteristics of start-up and growth are consistently revealed by the statistical evidence on small firm populations (eg. Audretsch, 1994; Kirchoff, 1994; Storey, 1994; Baldwin, 1995). Tracking and interpreting data on firm foundation, growth and closure are fraught with difficulty. Firms may change their name, activity, location and ownership.⁶ But persistent patterns are in evidence. One of the most comprehensive sources has data consistent with those of more recent and more restricted samples. About 800 000 new US firms were formed in 1977–78, as shown in the Small Business Administration database.⁷ Sixty per cent of these firms terminated as a continuing unit within the first 6 years; these included most of the new firms that contracted in size. Forty per cent survived for 6 years or more as continuing legal entities. Many of the surviving firms were 'plateau' firms (38 per cent of survivors showing no change in size). while fewer than half of surviving firms (46 per cent) showed growth in employee numbers (Kirchoff, 1994, p. 184). As regards employment creation, in the cohort as a whole, it was the 4 per cent of highest growth firms formed in 1977–78 that created 74 per cent of employment growth in the whole cohort of firms six years later (Kirchoff, 1994, p. 186). All available studies show that sustained job growth is concentrated in a small group of firms in a designated cohort. The longer

⁶ More work is needed on 'life after death' for small enterprises to trace how the knowledge assets of firms are sustained and put to use over time even when statistical data indicate termination. Survey data are able to trace business survival more accurately than establishment data, and these show 'failure' rates that are about half the rates derived from establishment data (Reynolds and Miller, 1988; Kirchoff, 1994, p. 160). If they remain an identifiable trading unit in the same line of business, we can designate this as survival. But it is not possible to distinguish fully between measurement effects and genuine group differences in UK data on small firm failure rates (Storey, 1994).

⁷ The 1977–1978 cohort of US Small Business Administration database provides the most comprehensive evidence, prior to the discontinuance of some data series; 95% of the cohort were single establishments with fewer than 500 employees, and 90% of these started with fewer than five employees. Growth was calculated by dividing each firm's employment in 1984 by its employment in 1977–1978 (Kirchoff, 1994).

the period studied, 'the more concentrated is employment creation in a small number of firms' (Storey, 1994, p. 118). UK studies found that under five per cent of a cohort of new firms provided over fifty per cent of all jobs in those firms 10 years later (Storey *et al.*, 1987, p. 152; cf. Cosh and Hughes, 1996, p. 11).⁸

The statistical evidence shows associations between sector of activity and growth and relates data on firm growth to such factors as the size of firm at formation and experience of founders (Kirchhoff, 1994; Storey, 1994; Baldwin, 1995). However, these aggregate associations, discussed further in the concluding sections of this paper, are difficult to interpret without a grounded understanding of the firm as a unit of analysis. Aggregate statistics on firm attributes and growth do not uncover the internal mechanisms and processes that were of interest to Penrose.

The Internal Dynamic; Growth Phases and Processes

A sequence of problems must be solved if the firm is to take form and generate revenue. The activities that are critical to overcoming these problems define the earliest phases, though there is overlap and often false starts and regression. Firms must access, mobilize and deploy resources before they can generate resources for growth; it is in the nature of these processes that they must take place sequentially. Subsequent phases—in which growth reinforcement and growth reversal forces contend—may result in accumulation as the firm moves towards maturity. The later phases are not universal, but are set in motion in an important minority of firms, the major job creators, as a consequence of growth. Critical problems facing the firm beyond the early phases are variable and not sequential.

The concept of growth phases used in this model has affinities with managerial literature on stages of growth, which are also derived from observation of individual firms' experience (Greiner, 1974; Churchill and Lewis, 1983; Quinn and Cameron, 1983; Kazanjian and Drazin, 1989; Churchill 1997). Although the management literature depicts such stages in a variety of ways, these models are useful as empirical generalizations that provide evidence on the early life of the firm. However, they lack an explicit theory of the firm. They have not built on conceptual common ground or found a unifying discourse that can integrate their approach with mainstream theories of the firm and industry (Montgomery, 1995).

⁸ Other UK evidence supports this finding; e.g. Gallagher and Miller found in a 1991 study that 18% of 20 000 new firms in the south-east of the United Kingdom accounted for 92% of all jobs created over a 5–7 year period in the 1980s (cited by Storey, 1994).

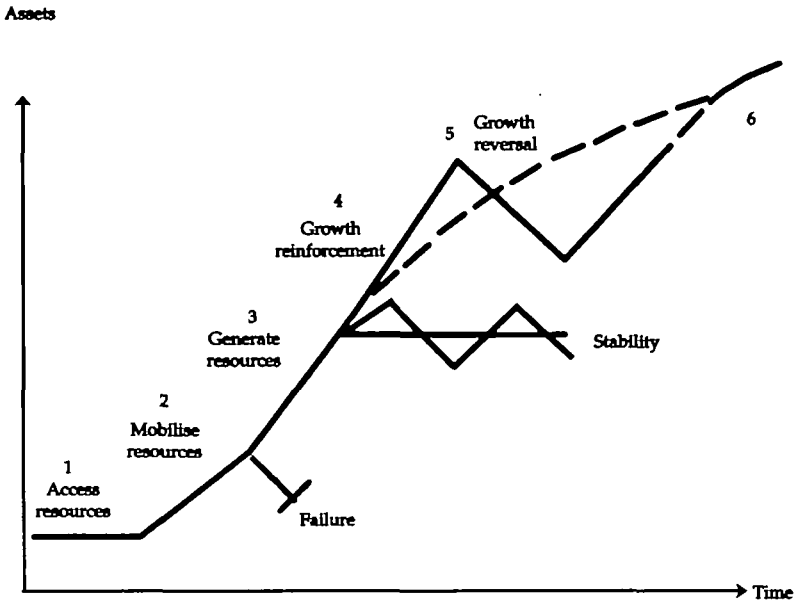


FIGURE 1. Growth paths, illustrating steady growth, early failure, stability with oscillation and a phase of growth reversal.

In the model here proposed, early phases are conceived as manifestations of critical problems that unfold as firms grow. They reflect the need to build the competence to address these key problems if the firm is to survive and succeed.

Figure 1 shows the path of sustained growth achieved by a successful firm and also alternative paths that are more commonly followed. The growth line in Figure 1 can be interpreted as an approximate indicator of the value of the firm, or its adjusted purchasing price, varying greatly between firms in rate of growth and value attained over time.

Steady rapid growth through to maturity is unusual (Kirchoff, 1994; Storey, 1994; Baldwin, 1995). Case study evidence on the internal dynamics of growth suggests that there are three more common scenarios (among many possibilities), as illustrated in Figure 1: early failure;⁹ an early growth plateau once resource generation is achieved (albeit with oscillations); and growth reversal following early expansion. Setbacks are successfully offset in the steady growth scenario: the dashed line denotes continuing growth through what might otherwise be a reversal phase.

In some cases, a division of a corporation may be segmented off to operate

⁹ There may be a brief 'honeymoon' period (Levinthal and Fichman, 1991).

as a new firm on an independent basis, or a new commercial activity is initiated within another organization such as a laboratory. If the unit is turned into an independent firm when it already carries out work for customers, it may appear that the early phases of development are dispensed with. But if early problems surrounding resource access, mobilization and early resource generation have already been overcome, these must have been dealt with at some previous date. To understand the growth of a firm formed through segmentation or in an incubator, it remains necessary to understand how these early problems were addressed and the further consequences of the solutions adopted. This is very clear in Penrose's account of a company formed through demerger, where subsequent growth was made possible by the technologies and expertise earlier developed (Penrose, 1960). Incubation inside another organization during early resource access, mobilization and deployment is likely to enhance a firm's prospects by protecting it from early hazards.

In what follows, the exposition of the growth model takes the form of composite account of typical growth phases. This is set out as a narrative which also constitutes a research agenda. The examples are given as illustrations, not as verification. In proposing an explanation for how a firm's growth is stimulated or held back, this exposition is an invitation to compare other firms' experience with the composite account here provided, in order to find common patterns and to use evidence to challenge, refine and extend the model.

2. Exposition of the Growth Model

Resource Access; The Early Prospecting Phase

Those embarking on a venture identify opportunities, decide on their activity and deploy the necessary resources. In new firms, the entrepreneurs' experience, personality, perceptions and resources are formative. The founder or founding group not only shape initial conditions but provide the venture with its essential assets and impetus. Their ambitions determine whether there will be an early drive for growth or modest aspirations for the firm. Key relationships during the preparatory phase are among the founders themselves and with former associates, including potential sponsors. The first phase is dominated by search activities, and initial problems centre around the perception of opportunities and resourcing prospects. Incubated start-ups enjoy advantages through privileged access to resources.

The preparatory phase is formative. Early choices shape future options and

can lock out alternatives.¹⁰ In particular, choice of activity is of critical importance. Choice of activity shapes the technology required and the firm's organizational parameters (Woodward, 1958).

The choice of sector determines the external influences to which the venture will be subject, including the maturity of the market in which they have to operate, competition and supply conditions.¹¹ The prevailing conditions for a firm entering a new market with a new product will differ signally from those of a firm refining a product for an established market (Romanelli, 1989). The founders are selecting their firm's industrial environment. Prospects for new firms are better in growth markets (Eisenhardt and Schoonoven, 1990) but many new growth markets are highly uncertain, creating the classic problem of the early entrant unable to appropriate the returns of pioneering innovation (Teece, 1986).

In many cases, sectoral options are closed because the entrepreneur has limited expertise and resources (Oakey, 1995). While a local or institutional resource base may be widely available to potential entrepreneurs, experience is rendered distinctive by choices and by chance occurrences that can set off a sequence of further contacts and openings.

The example of others closely affects decisions to found a company. Contacts are a key influence. Knowledgeable people form part of the wider resource base provided by certain local districts. Face-to-face interaction promotes trust and learning, and accounts for the proximity of start-up activity and the local clustering of firms in related sectors. People coming together from a number of settings bring with them more contacts and access to resources than do lone entrepreneurs, a factor explaining the better growth prospects of firms with several founders (Feeser and Willard, 1990; Oakey, 1995). The organizations they come from provide resources and often act as incubators of spin-out ventures.¹² Time spent identifying potential customers and how their needs may be met improves future prospects (Feeser and Willard, 1990, p. 95). This is early assessment of strategic alternatives, though it may not be conceived as such since many entrepreneurs do not have an explicit strategy but respond to opportunities as they arise.

In addition to making use of favourable structural factors (e.g. opting for a growth market) entrepreneurs can identify neglected opportunities by

¹⁰ The preparatory or resource access phase is seldom identified in the management literature on stages of growth (Churchill, 1997, p. 214). However, the failure of firms often occurs because their founders have little knowledge of their chosen area of activity and neglect preparatory work.

¹¹ Capital requirements of service activities are lower than those of production firms, an attraction in economies where start-up capital is scarce (Harrison and Taylor, 1996). However US manufacturing companies show greater growth and survival (Kirchhoff, 1994).

¹² For example, Fairchild in Silicon Valley; Cambridge Consultants in Cambridge, UK.

recognizing the value of resources that cannot be accessed through the market. For example, public domain knowledge produced by research laboratories, a previously untraded resource, may be used, or talent nurtured, while family and friends provide uncoded contributions.¹³ The capacity to recognize and derive value from untraded resources is a key skill of enterprise, together with the recognition of opportunities. This may be stimulated by approaches from users (von Hippel, 1988). But in new areas, potential users may need to be encouraged to realise that their needs could be met in new ways. Market awareness is critical from the outset. Penrose attributed the success of an innovative firm she studied to the ability to 'demonstrate uses of their own products and to suggest to customers new ways of doing things, but also to adapt their products to customer requirements and learn what kinds of new products can be used' (Penrose, 1960, p. 13).

After a period when alternatives are canvassed, commitment of time and effort to a particular product range or set of services is required for start-up. Once this investment has been made, contacts and knowledge are built up which are project- and sector-specific. 'Lock-in' operates when current and future resources are pre-empted by such choices. Turning back involves writing-off prior effort and expenditure. Entrepreneurs often reflect later that had they known what was in store for them, they would have given up early on. Later a variety of pressures, including self-induced ones, prevented them from turning back (Kaplan, 1995).

Preparatory search processes may be short lived or long drawn out. From awareness that there are commercial implications of research, it may take 20 years or more to ascertain feasibility and organize the support required to realize eventual economic return from the project, especially where complex technology transfer is entailed. Hence Schumpeter's celebration of the courage and tenacity of entrepreneurs who make their firms agents of economic change (Schumpeter, 1928). A company built on an innovative idea is often the incubator and carrier of the innovation, and the fate of the company and of its innovation are often linked (Rosenberg, 1994).

Access to finance—the most versatile of resources and the most sought after—illustrates the interweaving of broad structural influences and specific contingent factors in the shaping of individual firms' experience. For entrepreneurs, convincing funders of the prospects for their venture is the key to openings beyond their own immediate means. Their success in so doing depends not only on their skill and persuasiveness but on chance contacts and

¹³ For example, the version of the Unix computer operating system adopted by Sun Microsystems for workstation use was developed at the University of California, Berkeley and made freely available. Acorn Computers made use of technology developed at the University of Cambridge.

occurrences. Individual entrepreneurs show varying ability and desire to raise funds in similar circumstances.¹⁴ However, overall, funding is influenced by structural factors, by institutional arrangements for investment in new ventures (Garnsey, 1995). Financial institutions drive the selection process in a market economy, making available the additional capital which fuels extensive firm growth (Schumpeter, 1928; Nelson and Winter, 1977).

Resource Mobilization

Until they set up a resource conversion process that generates revenue, the founders are dependent on transfers of income. Initial endowments improve prospects (Levinthal and Fichman, 1991; Hannan and Carroll, 1992). However, activities that necessitate higher initial capital endowments are more prone to the lock-in problems created by irrecoverable costs. Where the economic environment, interest and exchange rates are unpredictable, services, which offer more immediate revenue returns and lower initial costs, may be a more attractive option to entrepreneurs than manufacturing.

A business plan is a current requirement for resource mobilization. This is a step towards creating viable links with key agents—funders, customers, suppliers—on whom the availability of resources and revenue depend. It is a demonstration of credibility, sometimes achieved through relationships with sources of knowledge, e.g. with a laboratory providing expertise. The plan is an exercise in strategy and self-presentation, in setting out objectives and proposing solutions to constraints.

There is iteration between preparatory prospecting and actual mobilization of resources. It is only when resources come to be assembled and deployed that resource access is fully tested. If expected resources are not forthcoming, new methods of obtaining requirements must be found, or the direction of the undertaking must shift. Some founders spend years seeking to mobilize resources, having to return to further prospecting as expected resources fail to materialize (Latour, 1987).

Penrose emphasized the importance of perceptions of opportunity. She described a firm's relevant environment as the set of opportunities for investment and growth that its entrepreneurs and managers perceive. This she saw as critical to the internal drive for growth. We can add that the way the new venture is perceived by outsiders may be the key to realizing opportunities, since this has a major impact on resource availability. A serious 'liability of newness' is lack of reputation, where the founding team have no track record

¹⁴ The founders of Hewlett Packard, for example, long showed reluctance to take on external funding, such was their aversion to the risks this entailed (Packard, 1995).

or established business relationships. Achieving credibility by association with others is one solution. Sometimes the appearance of such an association is sought, as through location on a university science park where a form of accreditation is implied in the address.

Certain firms may be able to generate resources very early. As we have seen, firms that form within an incubator or are segmented off from another organization may already be generating revenues at the time that they are officially incorporated. This may account for the statistical association between firms' 'birth size' and subsequent growth (Kirchhoff, 1994; Storey, 1994). In contrast, firms where there is a slow gestation of product and market have to trade on the prospect of future gain for investors to mobilize the resources they need. Biotechnology entrepreneurs have been able to convince funders that their excellent prospects for market growth and profits justify long-term investment (Kenney, 1986). Firms of this kind show a pattern of prolonged resource mobilization.

Despite the confident claims made in business plans, few teams can in practice anticipate their needs with precision. In a new start-up, the resource conversion process has to be set up without precedents or accepted ways of proceeding.¹⁵ Calculating what resources are required without incurring excessive overheads or crippling shortages involves steering a narrow course. As the group learns to save time and avoid early mistakes, routines and procedures form through trial and error and a division of labour emerges with specialist roles.

The initial mobilization phase leading to resource generation, in which the first products are developed and a market base established, demands major effort and succeeds only where there is mutual commitment. The success of this period often depends on the inspiration of the founders; a charismatic leader can encourage and motivate the team. The effort exerted by members of close-knit groups, struggling against the odds to make a project succeed, is legendary (Kidder, 1983). The very shortage of resources in these circumstances may provide focus and direction where there is a shared sense of purpose.

Mobilization problems recur later whenever a new product or service, or changes in market conditions, call for a new resource set. But early attempts to deal with difficulties provide formative experience and the emergence of particular procedures and practice which embody solutions to problems earlier encountered (March and Simon, 1958). Firm-specific practice comes to

¹⁵ Among the advantages of franchise arrangements and sequential start-ups by experienced entrepreneurs is that an example is available on which initially to model the new venture.

represent the experience and collective competence of its members, past and present.

The transition between the phase where initial resource mobilization problems predominate, and the phase where the firm is potentially self-sustaining, is gradual rather than abrupt. At a certain point, however, it becomes evident that the effort required to set things going initially is no longer required; then, as Penrose emphasizes, resources are released for growth.

Resource Generation

Once sufficient resources have been mobilized and deployed to allow a production cycle to take place, the firm can build on experience. The effort of mobilizing resources anew entails transactions which are themselves costly of resources. This is a major reason for establishing a firm with a continuous resource conversion process that can be self-sustaining and allow the build-up of competence. Unlike a series of projects organized afresh each time, a firm can embed a learning process in its recording and problem-solving routines. Continuity allows the consequences of decisions to be experienced (March and Simon, 1958; Casson, 1990, p. xix). This rationale for the firm involves more than relative transaction costs (Williamson, 1975).¹⁶

Since continuous revenue generation requires demand and an outlet for the firm's products or services, key relationships are with customers and distributors. Much necessary learning now concerns how to undertake and conduct these key interactions and to develop effective supplier relations. There are incentives to establish formal alliances with customers and distributors, rather than leaving these key connections to chance. However, alliances have to be conducted under conditions where there are asymmetries of power between potential partners and prospects of take-over by the more powerful partner.

In the course of learning by trial and error, many new firms lurch from underproduction to overproduction as their members miscalculate resource needs in relation to customer and supplier behaviour. Problems arise over instability in orders and key supplies; managers have to be able to anticipate the knock-on effects of fluctuations so as to avoid production shortfall and gluts. Systems dynamics points to the effects of overshooting, and delays between action on behalf of the system and feedback from the environment (Forrester, 1961). Inadequate information about markets and production can

¹⁶ The costs of setting up a firm are not taken into account when both markets and hierarchies are assumed to be already available for static transaction cost comparison (Williamson, 1975).

lead to oscillations of output to levels above and below what is required—this can produce fluctuations in growth performance, as illustrated in Figure 1.

As a firm moves from the initial conditions of resource access and mobilization into cycles of resource generation, it moves from experiencing a series of new problems to a state where recurrent problems arise, for which problem-solving responses can become embodied in routine procedures (Simon, 1955). March and Simon identified the routinization of problem-solving responses in organizations experiencing recurrent problems, and hence having past learning to draw upon. The search for solutions here involves selecting the appropriate response from the available repertoire (March and Simon, 1958). Evolutionary economists have stressed the importance of firms' routines in their capacity to adapt to and survive in the industrial environment; these processes are developed initially in the firms' early years. (Nelson, 1995).

In creating a repertoire of solutions, firms face problems that are often sector specific, since each industry has its own cycles and sources of uncertainty. Each firm also has unique problems. Growth is limited by the rate at which new members can be assimilated, acquire experience in the firm and learn to solve problems together effectively. While funds allow other resources to be bought in, it is impossible to obtain staff from outside with experience of working together in that firm, and the pace of growth is constrained by the demands of internal teamwork (Penrose, 1959). Firms that develop effective practices for assimilation of new recruits are at an advantage in expanding rapidly to reach a viable size.

How large the firm must grow in order to achieve viable production depends in part on the scale requirements of the production process. In conventional economic theory, a firm needs to grow to reach the minimum size required for efficiency in its industry by investing the level of capital required by the production function. However, innovative technology and organization can alter this level, as with the advent of mini steel mills, small electricity generators and the transition from mainframe to microcomputers.

When a viable market position has been secured, in which the resource recovery process is assured, the firm may enter a more or less extended stable phase. Even where a firm has few resources, these may suffice for its activities. Many firms remain small, often in a niche market, not always realizing a fully economic return on assets, but satisfying the founders, or reflecting their disinclination for further growth. This explains the high proportion of firms characterized by little or no change in employment size in the statistical data [after 6 years, about forty per cent of surviving firms, in the US national data (Kirchoff, 1994, p. 184)]. The niche market may itself limit potential growth

for the firm's products, so that without a change in product, the firm cannot move off this plateau even if growth is viewed as desirable. Extending or shifting the product range calls for further resources and is subject to limits on sources of funding.

Some firms achieve an acceptable return on assets and avoid further growth which might put in jeopardy what has been built up. The greater the risks involved in mobilizing for growth, the more likely firms are to remain in a relative 'comfort zone'. Such firms are sometimes described as 'lifestyle' companies that afford their founders the revenues they require without the hazards of further growth. But under conditions of rapid change, the zone of limited resource generation is seldom comfortable. The firm has few reserves and even minor instability in supplies or demand can set off shortages or gluts that exhaust its resources. Inevitable fluctuations in fortunes follow and entail at best uncertainty, at worst a continual struggle for existence. Rather than remain in the ranks of the 'living dead', the founders may decide to sell up or attempt growth. Occasionally a new opportunity is seized, stimulating growth after a plateau period. Thus the early plateau phase may be a prelude to growth (sometimes delayed), to merger, decline or failure (Figure 2, see p. 550).

Growth Reinforcement

Unusual firms achieve resource mobilization rapidly and succeed in generating revenue early, often aided internally by incubation or externally by growth markets. For these firms, impetus may be built up which leads from early resource generation on to growth reinforcement, as illustrated by the dashed line in Figure 1. In rapid growth cases there is limited appeal in a low-growth 'comfort zone', attractive to founders whose company struggled in early life. Successful growth and further investment are mutually reinforcing. Once a firm has demonstrated its viability, it can shift from raising early risk capital to seeking further development capital. It is seldom admissible to raise funds on the stock market before a firm has a trading record—though this requirement may be waived for firms with long-term prospects perceived to be very promising, as for biotechnology firms.

Even for firms that do not achieve rapid early growth, once prior planning and initial productive activity have been accomplished, resources are released which may be used to promote growth (Packard, 1995, pp. 46–47). With routines in place, the early effort demanded to set up production is no longer called for. Staff taken on to ease early shortages may be underemployed as resource generation is organized more effectively. Partially underused capacity provides further incentive to realize what Penrose termed the 'economies of

growth'. The need to provide challenge and promotion opportunities to retain able staff may make growth options attractive. Penrose pointed out that many of the resources required for expansion are only available in multiples that do not match up, as where new equipment creates excess capacity. This creates incentives to exploit unused resources through further growth (Penrose, 1959, p. 58). Thus, once growth is underway, internal pressures are exerted for further growth, in the amplifying mode of positive feedback in dynamic systems (Arthur, 1990).

In addition to the internal pressures for growth identified by Penrose, key relationships established in earlier phases play an important part in promoting growth. The firm is inevitably operating within a structure of interdependence with outside agents on whom it relies for resources and revenue. Internal pressures are reinforced by external pressures as funders attempt to realize their investment and insist that managers aim for growth. Customers whose demand provided for initial growth may be pressing for more products or demanding further services faster than these can be made available under current arrangements. Distributors may threaten to turn to competitor products unless their demands are met. Pressures of this kind may prevent stability from being an option. Key relations of interdependence, initially a source of support, may now narrow options, preventing the pursuit of a strategy of steady-paced growth conducive to resource synchronization. Among firms in an innovative industry, growth may be a requirement for survival (Kirchhoff, 1994, p. 184). But shareholder pressure for short-term profit growth can be oppressive, leading some entrepreneurs to buy back shares to regain control.

As the firm grows, founders must delegate to professional recruits more of the running of the company. Entrepreneurs who excel at providing ideas, contacts and enthusiasm often lack professional management skills and the taste for overseeing the details of production. This often results in conflict and continues to be a frequent source of strain in entrepreneurial companies (Fleck and Garnsey, 1988). The very qualities of commitment and involvement that make an entrepreneur an inspiring leader may make delegation a difficult task. But delegation is essential if the combined demands of current production and the pressures for further growth are to be met. To secure the future, decision makers must increasingly take on a strategic role which limits the time for overseeing the details of current resource generation. The firm's members are building their own distinctive competences and can use these to form trading partnerships and strategic alliances. There are incentives to enter alliances with other organizations, to access complementary assets and to reach new markets. Key relationships can be organized on a deliberate strategic basis, rather than

being the product of uncontrolled developments. The management of such alliances is time-consuming and it is necessary for top decision-makers to spend increasing amounts of time on interface work with the outside world. Founding entrepreneurs who do not create an effective executive team to manage the growing company become an increasing liability.

Growth Reversal

Factors restraining growth are at work all along and prevent many firms from ever getting off the ground. Many other firms reach a plateau, and are unable to expand further. However, a perverse effect of growth, and especially rapid growth, is that it can amplify growth-restraining factors, and beyond a certain point these may operate in such a way as to offset the growth process. Decision-making problems accompany the need to delegate. As complexity increases, these are often a source of limits to growth and can lead to growth reversal. Limits to growth operate in many spheres of life, and are analysed as outcomes of feedback effects in systems dynamics (Senge, 1990, p. 379). Synchronization problems can lead to unexpected resource shortages and new sets of problems can arise quite suddenly, as where the struggle to gear up for growth has suddenly to be replaced by problems of running down excess stocks when a shortfall in demand arises. Oscillations in performance can become full-scale crises, as illustrated by the case of General Motors. In 1910, William Durant was promoting growth at General Motors:

In carrying out expansion . . . he never prepared for nor hardly even considered possible a temporary decline in demand and so failed to build up his cash reserves. He made no attempt to collect information about output and demand in order to make adjustments in production that might prove necessary. Nor was he interested in building an organizational structure to give him information about and control over his operations or to help him achieve potential economies. . . . As a result . . . when sales dropped below scheduled production he lacked funds to pay his suppliers and work force. (Chandler, 1962)

A very similar crisis arose at Acorn Computers, UK, in 1985. The new venture encountered greater demand for their product than they could initially meet, and so geared up to expand production. Instead demand slumped, leading to a build-up of stocks. There was intense media exposure, partly because of the publicity connected with the recent flotation, and

creditors demanded immediate payment (Fleck and Garnsey, 1988). Again, the founding entrepreneurs had failed to invest power in professional managers. In both cases, amplification processes moved into reverse: by virtue of their shortage, resources became increasingly unavailable. In both cases, the crisis was exacerbated by the absence of professional procedures enabling managers to keep track of their resource and market position. Recognition of these deficiencies at General Motors had significant consequences, providing the rationale for Sloan to pioneer the development of modern managerial procedures at the company (Chandler, 1962).

New firms are hampered by their need to make search processes a prelude to every new problem they encounter. As learning occurs, benefits can be obtained from the introduction of a repertoire of problem-solving procedures. In terms of March and Simon's model, eliminating open search from the problem-solving response greatly reduces the labour and time required to address recurrent problems (March and Simon, 1958). But procedures can also create new problems where they are applied inappropriately (Argyris 1992). This is particularly so when founding entrepreneurs have dominated early problem solving.

Sometimes problems build up steadily and visibly—as a niche market becomes saturated, for example, the order book ceases to grow and no new sources of custom emerge. But threshold effects in complex systems can create sudden discontinuities. When rapid growth is underway, feedback effects may go undetected and reversals can occur unexpectedly as an essential resource is exhausted. The knock-on effects of fluctuations are always hard to accommodate, but when growth has removed slack from the system, reserves are depleted as a result of prior pressures. All aspects of growth are interconnected, hence these difficulties may multiply before they are addressed. They call for a shift of strategy where opportunities and resources no longer match as expected. A succinct account of resource shortages precipitating crisis during a period of growth is given by Audrey Wood, a founder of Oxford Instruments, in her unpublished history of the company:

With so many difficult technical problems solved, a growing reputation, lots of orders and ample space, too many people assumed that the business side, which held little interest for them, would be alright. But overheads were higher in the new building and the turnover was growing fast. The need for more working capital for development and for more materials and staff was masked at first by an increased overdraft facility. . . . Accounting procedures were not adequate for the more complicated operation . . . and so the financial situation deteriorated, insidiously at first. The years between 1966 and 1970 were dogged by

financial crises and twice we came close to being taken over. In the earlier years we were making a profit but we were undercapitalised and needed cash for expansion faster than we could generate or borrow it.

A timely injection of private funds and management expertise enabled Oxford Instruments to recover from this crisis and to grow to become an industry leader.

A period of growth reversal often results from leadership and human resource difficulties (cf. Kotter and Sathe, 1978). Informal entrepreneurial leadership is no longer appropriate and difficulties often arise in making a transition to new leadership patterns. Crises occur as unaddressed problems build up until they demand solution, as Greiner's model emphasizes (1974). A new entrepreneurial firm often lacks people who know how to institute efficient procedures to relieve pressure on resources. The introduction of professional managers from big business often results in new problems because they do not have the kinds of competence needed in young, growing firms. Where members of the founding team have relevant business experience, this improves prospects (cf. Storey, 1994).

Attempts to introduce corrective management routines can have perverse effects. Productivity should improve as procedures are installed, but routines can remove scope for spontaneity and initiative, the basis for effective teamwork in the new entrepreneurial firm (Slatter, 1992). In the early days, the unmistakable impact of individual effort is highly motivating. As the organization becomes increasingly complex, individuals feel they have decreasing influence over outcomes. Disillusionment can follow as routine sets in and early challenges are replaced by repetitive grind. When the excitement of the early growth period fades and new procedures are experienced as constraints, motivation and commitment decline.

Vital knowledge and experience can be lost when people leave. As firms become more established they seek to reduce their dependence on individuals by creating job descriptions and roles. But reducing dependence on individuals can also have untoward effects. Staff may no longer feel the sense of personal responsibility or enjoy the recognition that comes from being indispensable. As long as success continues to deliver rewards, these difficulties can be overcome and procedures made acceptable. But the problems of maintaining motivation as the firm grows are greatly increased by growth setbacks. Overworked staff may suffer burn-out. When crisis occurs, loyalty is tested to the limit. As a manager at Apple Computers put it to the new professional CEO: 'We can't push people any harder. They are going to break. We are just going to burn people out' (Sculley, 1987, p. 391). He recalled that 'A near-warlike mentality prevailed. Mention was always made of people who

were leaving and casualty lists were created. We had our own war heroes. And war dead' (Sculley, 1987, p. 391).

Lay-offs may be unavoidable during growth reversal, and stimulate further departures. Morale problems have a serious braking effect on growth. Departures are often accompanied by spin-out of a new venture by former employees who set up a firm which is complementary to, or in competition with, their former employer. New firm foundation through spin-outs is the primary mode of expansion of the population of firms in many innovative locations. Thus firms' internal growth experience, including internal conflict, collectively shapes the local economy and industrial structure, influencing the density of activity of interest to population ecologists.

The limits on the capacity of decision-makers to assimilate knowledge, coordinate and plan cannot be remedied, even through the use of consultants and associates. Ultimately, inside experience is needed for firm-specific competence and the authority to execute decisions. This factor was identified by Penrose as the major internal constraint on growth. Complexity greatly increases the knowledge those in charge have to assimilate, slowing the rate at which they can take considered decisions. Coordination and planning require intensive participation by a select group of people—founders or leading managers who have the authority to take decisions for the firm.

If limits on the capacity of internal decision-makers to assimilate knowledge, plan, coordinate and supervise are a central constraint on growth (the 'Penrose constraint'), they are also a major obstacle to recovery from growth reversal, since the same people have to be both planning for the future and remedying current crises. Plans for the future have to be shelved when 'fire fighting' is required, and new opportunities have to be foregone. Crises are particularly difficult to overcome where the basic assumptions on which members of the firm have been proceeding have to be reconsidered (cf. Argyris and Schon, 1978). This involves a major cognitive and practical upheaval, and often the departures of key figures, including founders. This may be necessary where new forms of leadership are called for. In rare cases where founders are able to adapt to changing circumstances, their firms benefit from the continuity and commitment they can provide, as the example of Oxford Instruments and Hewlett Packard reveal.

Shortages of key inputs revive mobilization problems like those that featured earlier in the firm's life. The relationships with funders and suppliers that were vital during the mobilization phase assume renewed importance. Crises often result in a serious breakdown in these relationships. By the same token, input of funds and skills by knowledgeable funders and board members can help overcome problems, as illustrated by some of the rapid

growth Silicon Valley firms which have had access to major venture capital funding.¹⁷ Those firms that have turned to the stock market for funding face further difficulties as their share prices plunge when performance figures suffer after early promise of success.

Moreover, enough time has elapsed since start-up for major changes to occur in the industrial environment in which the firm is operating, as occurred in the case of the early microcomputer firms when IBM entered the market. The configuration of suppliers, customers, distributors and competitors may have shifted in such a way as to dislodge the firm's market position, on which resource generation and the prospects for growth depend. Alliances which earlier secured the firm's position have had time to break down. If the firm has been expanding its sales in a new growth market, there is often a failure to prepare for impending discontinuities in consumer preferences and to differentiate by market segment. A loss of external focus is the more likely when the firm has been caught up in internally generated growth problems.

External pressures may intensify where competition increases in parallel with internal expansion. While new firms are struggling to obtain funding and to generate further resources, imitator firms will copy a successful product unless some means has been found of protecting the intellectual property it embodies. Patents may be hard to protect, licences may provide limited revenues and, in the absence of operational capability, originators may fail to appropriate the further revenues from innovation which accrue as the market assimilates the new products (Teece, 1986). Competitors can erode the once-growing firm's margins, and typically do so as concentration in the industry develops (cf. Peteraf, 1993). Firms that grew rapidly within a niche may encounter market saturation. The firms that continue to grow often succeed by linking-in their products and services to those of complementary providers in an expanding business ecosystem.

Where market conditions are continually changing, it may be necessary early on to undertake upgrading, product renewal or extension of the product range. In maturing markets, complementary assets may be required—extended production or marketing capability, for example (Teece, 1986). Both vertical integration and differentiation pose new problems. Moving into mass production may secure the gains from innovation, but entails intensive competition. Alliances can supply complementary assets, but the success of alliance relationships is always problematic.

¹⁷ Funding may be a necessary condition for overcoming growth crises, and the absence of funding on a sufficient scale may be one reason for the failure of most European ventures to overcome their growth difficulties. However, generous funding is not a sufficient condition of success, as the experience of the hand-held computer firm GO, for example, reveals (Kaplan, 1995).

The firm that experienced crisis after early success may, if it escapes failure, join the ranks of the low-growth companies, remaining on a plateau and avoiding the risks entailed by new opportunities. Relatively few firms overcome these problems to achieve sustained growth.

These are among the conditions which make the sale of the company an attractive course of action to entrepreneurs. Owners are aware of their firm's vulnerability and may decide to sell even where they had earlier aimed at sustained independence (Oakey, 1995). Alternatively, acquisition may have been planned as the exit strategy to enable founders and funders to realize their investment. The growth of the acquired enterprise is now bound up with that of the parent company. Entrepreneurs who sell out may use their gains to found a new venture, repeating the start-up cycle, or become providers of venture capital, increasing opportunities for others. In the aggregate, this behaviour can alter the business environment, stimulating growth of innovative local industry.

Accumulation of Resources

The comparatively few firms that continue to grow on an independent basis benefit from further amplification effects, extending their markets through alliances and acquisitions that make available further resources (Penrose, 1960). Often the firms that function as system integrators for the industry emerge as industry leaders, as high-profile firms like Intel and Microsoft have demonstrated in recent years.

The accumulation of reserves ensures that a firm is better placed to deal with vicissitudes that would overwhelm a less secure enterprise. Small firms usually have to operate on a *minimum of reserves* because the opportunity cost of holding reserves is high when the scale of operations is small.¹⁸ Accumulation often takes place through the purchase of other enterprises, which may provide a whole new product range and market position. Acquisition shapes the experience of the acquired, removing them from the ranks of independent firms. By this time, through changes in ownership, scale and activity, the early identity of the firm has been transformed (Penrose, 1959). But even through this process of *metamorphosis*, certain *continuities* which reveal the influence of earlier experience are in evidence (Slatter, 1992, p. 120).

3. *Maturity*

Our model does not extend to mature phases, but reflections on later

¹⁸ Japanese writers on innovation have pointed to the importance of unused resources as reserves, for sustained innovation (Nonaka and Takeuchi, 1995).

development point to opportunities for new firms. The early growth phases reflect processes required if firms are to take off at all and usually take place within the first 7 years of life, though they may be conflated or extended. Beyond these, a great variety of problems arise specific to firms' circumstances. Some early experiences are repeated later on, as illustrated in Penrose's study of the interaction between the resources and markets of the mature firm in her study of expansion through diversification of a company active in the early plastics industry (Penrose, 1960, p. 18). In cases of this kind, unused resources create new opportunities, but problems continue to emerge in reaction to past solutions, in path-dependent mode. Even for a larger firm which has been able to accumulate capital, untoward circumstances will tax the firm's resources. Major or sudden changes in the trading environment can make the firms' established competence inappropriate to new conditions.

Rigidities set in over time in the firms' routines and members' outlook; mental maps may not be revised for new terrain. It may be difficult for the participants to acquire new skills and competence, or even to perceive changing conditions (Argyris and Schon, 1978; Senge, 1990). Powerful members of the firm with most to lose may have most difficulty in understanding a new set of problems and in accepting the need to alter the firm's ways. Where vested interests have built up, a shift in power relations is needed to precipitate change, with board involvement.¹⁹

Where larger corporations address the problems raised by change by decentralizing, downsizing and outsourcing certain activities, these trends also provide scope for new companies, by opening up new positions as established firms withdraw or shift their activities. New firms often take up these positions initially by entering niche markets. They may remain in what Penrose called 'the interstices' between large corporations, pursuing neglected opportunities. When the large corporation avoids risks, develops rigid routines and fails to move into emerging markets, it creates opportunities for newer, more flexible firms to extend their activities and grow.

4. Growth Phases and Development Paths: Summary

Because theories of the firm focus on firms already in operation, early growth processes have been neglected in the theoretical literature. Growth phases are symptoms of the dominant problems to which growth processes give rise,

¹⁹ Power relations, neglected in the economic literature, are central in systems of activity where there is asymmetrical control over valued resources. The extent to which knowledge is inseparable from power relations has long been a concern in work influenced by Michel Foucault (1969).

consequently phases vary in duration and extent of overlap. It is the early growth processes that are universal, not their phase manifestations. Opportunities must be identified and input resources accessed and mobilized in order to generate further resources if a firm is to become a sustained system of activity through market exchange. Growth may become self-reinforcing if sufficient impetus is achieved, but consequent synchronization problems can bring about reversals. The relatively few firms that achieve sustained growth use their problem-solving capacity, or competence, to achieve leverage in accessing further resources and markets. 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.

Based on the composite account of growth here provided, alternative branching paths of firms following diverse growth patterns can be shown schematically, as in Figure 2, which illustrates possible trajectories in the first years of life of a cohort of firms founded in year 1. They are subject to common conjunctures in the wider economy, which provide more or less propitious conditions, affecting aggregate firm performance.

If the firms in Figure 2 are assumed to compete in a limited market, the success of the dominant will be at the expense of competing firms. But even if they are assumed to operate in different markets, the growth model suggests that only a very small proportion of the cohort of firms will show sustained growth of assets, and still fewer will reach massive revenues. The growth line in Figure 2 represents the path of the few firms that sustain steady independent growth. Many other firms founded at the same time will cease to trade within a few years of birth. Others achieve sustainability but move onto a plateau. Still others merge or are acquired.

Approaches to Industrial Opportunity and Industrial Renewal

In the economic literature, the 'internal' approach to firm behaviour is associated with the resource-based view of the firm, and the 'external' approach is associated with industrial economics and the strategic analysis of competition. A criticism mounted against the resource-based view of the firm is that it has been introspective and has failed to emphasize that resources are only valuable in so far as they 'allow firms to perform activities that create advantages in particular markets' (Porter, 1991, p. 108).²⁰ A neglect of this

²⁰ Porter (1991) describes the firm as 'collection of discrete but interrelated activities'. Penrose's approach had more in common with Porter's than may at first appear; thus her conception of the particular 'combinations of productive services' characterizing a firm bears a resemblance to Porter's notion of the firm as a collection of activities (Porter, 1991).

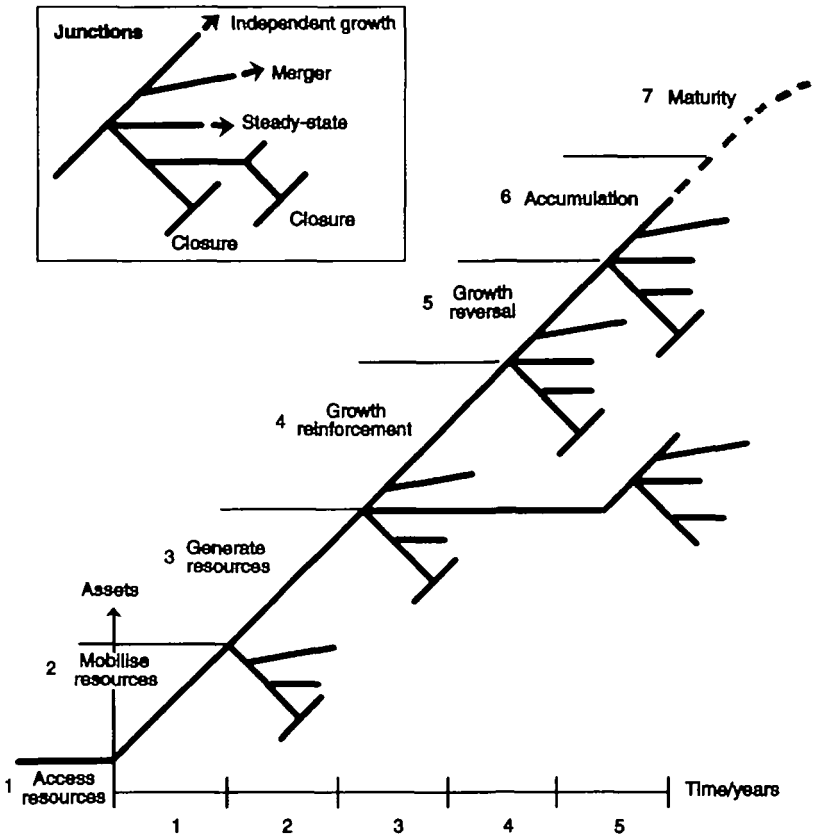


FIGURE 2. Diverse trajectories of a cohort of firms.

issue is to be found in some recent work, but Penrose herself focused on the firm's capacity to create advantages in particular markets, notably in her study of the interplay between the technology and knowledge base of an innovating firm and its take-up of market opportunities (Penrose, 1960). Industrial economists using aggregate data have not been concerned with evidence on the internal dimensions of firm start-up and early growth, which have been left to entrepreneurial studies outside the mainstream.²¹ An early behavioural approach did attempt to decompose the effects of industrial sector growth on the one hand and individual firm factors on the other (Ijiri and Simon 1967). However, Simon, like Penrose, was little concerned with

²¹ Among the most useful have been those concerned with the economic role of entrepreneurs as agents of change (Casson, 1990).

start-up and focused on subsequent growth processes in firms. Currently, recognition is mounting of the importance of both internal and external factors (Porter, 1991; Audretsch, 1994; Teece and Pisano, 1994). But theoretical frameworks in industrial and organizational economics have not facilitated the integrated analysis of internal and external factors.

Recent sociological approaches examining the emergence of organizational populations are more supply-side dominated than those of Simon and the early behaviourists.²² However, the concern in the population ecology literature with the influence of initial conditions on later prospects for organizations (cf. Stinchcombe, 1965) is shared in the present analysis.

Chance and Path Dependence

The role of chance factors in business success is unmistakable, and has been recognized among others by behavioural theories of the firm (Ijiri and Simon, 1967) and by population ecologists (Hannan and Carroll, 1992). In stochastic theories of firm size distribution, random firm growth rate differences are assumed. Nelson and Winter have pointed out that:

A weakness of this genre of models, even Simon's, is that the models' grounding in a theory of firm behavior tends to be rather superficial and the specification of the competitive environment is left implicit. (Nelson and Winter, 1978, p. 527)

Penrose was clear about the influence of chance on the prospects for any particular firm and was concerned with the principles of growth, not with prediction in specific instances. She saw 'enterprising management as the one identifiable condition without which continued growth is precluded', but this was a necessary and not a sufficient condition for success (Penrose, 1959, p. 8). She dismissed the problem of prediction with characteristic simplicity in the introduction to *The Theory of the Growth of the Firm*.

The problem (of predicting firm growth in a particular instance) is not unlike the problem of diagnosing the prospects for the growth of, say, a tree. Upon examination, one can say that the tree will not grow . . . unless certain environmental conditions are satisfied—but one can never certify in advance whether the tree will or will not survive all possible vicissitudes and how they will affect its growth—the next winter may

²² Adherents of the population ecology approach present findings on higher mortality rates among organizations founded at a time of density of similar activity (Freeman *et al.*, 1983). Higher mortality rates of firms founded at a time of intense competition may be related to the effect on opportunities for later entrants of industrial shake-out and concentration (Teece, 1986; Utterback, 1994).

be severe, the spring rains may fail, or blight may set in. (Penrose, 1959, p. 8)

The concept of path dependence can be used to provide conceptual grounding for Penrose's common-sense approach to chance. In a path-dependent system, prior experience sets the firm on a route in which subsequent developments are determined by what has gone before, yet chance and initiative have a major impact on development (Arthur, 1990). The genesis of a system such as a firm is highly sensitive to initial conditions and early resource availability, on which competence is built. But in complex systems, 'small "random" events can accumulate and become magnified by positive feedbacks so as to determine eventual outcomes' (Arthur, 1990). Firms, like people, are continually subject to random events and only certain of these have further consequences; what aspects of chance prove significant depend on the nature of the system in question. We extend Arthur's analysis by recognizing that chance has expansionary effects through the very mechanisms of action and reaction that shape the system's growth. Thus to understand the effects of chance, an aggregate methodology is insufficient; we must understand the nature of the firm as a complex system.

Luck is often treated as an exogenous factor. Aggregate data have been interpreted as revealing the prevalence of 'random shocks leading to some fast-growth firms, but without any consistent factors "explaining" their growth.' (Storey, 1994, p. 119). Random factors are thus viewed as a residual explanatory category, essentially anomalous and at variance with 'consistent' causal factors. Yet chance events occur continuously and only certain among these turn out to be significant for firm growth. Chance events must be such as to be reinforced by cumulative processes if they are to have a lasting impact. Chance occurrences have a significant impact on a firm when they bring about *a change in perceptions that affects the ability to address and solve key problems*. This can be the basis for developing competence, as where early crisis at General Motors led to the pioneering of new managerial skills. Chance events are significant when they *make available or close off resources and perceived opportunities*, as where the founders of Oxford Instruments heard at a conference about a new superconductive technology which they determined to master. These effects are often brought about by chance events that *initiate or alter key relationships*, as where an opening for Microsoft to become a key supplier to IBM was created by a rival firm declining to develop an operating system for the new PC. For chance occurrences to set off reinforcing effects in the firm, a chain of internal responses must take place.

Aggregate Effects of New Firm Growth

For Penrose, it is 'the constantly changing and cumulative process involved in the interaction between the resources and markets of a firm' that explains growth opportunities and their realization (Penrose, 1960). As a result, industrial structure itself alters under the impact of activity by innovative firms, as where microcomputer firms significantly altered competitive forces in the computer industry. It is important to understand the microprocesses of growth, through which the activities of new firms continually alter the industrial environment.

At any point in time, entering firms have a very small proportion of industry market share, and the new firms have a high mortality rate, as many as half of them dying before their tenth birthday (Baldwin, 1995, p. 381). But although becoming an industry leader is an improbable event, overall new firms can grow in sufficient numbers to ensure industrial renewal. Those firms that survive early uncertainties are more likely to survive and grow in emerging growth industries, though massive revenues are readily available to predatory innovators in some mature industries (Harrison and Taylor, 1996). Short-term employment effects of new firms now appear less dramatic than was earlier believed (Hart and Oulton, 1996). But a focus on profit and employment attributes of new firms in the short term fails to capture their impact. Moreover, 'The conventional industrial-economics literature—with its focus on large-firm shares and concentration ratios—all too easily gives the impression of minimal change and, therefore, of static markets' (Baldwin, 1995, p. 29). Baldwin's study of cohorts of new firms in North America shows that 'Efficiency changes are related to rapid shifts in the technological environment that produce new leaders and that gradually shift market share to these firms' (Baldwin, 1995, p. 393).²³ Baldwin was able to show from North American manufacturing census data for the 1970s and 1980s that 'over a decade, the effects of entry builds up until the new entrant cohorts account for a quarter of all manufacturing establishments' (Baldwin, 1995, p. 384). Over a generation, industries can be completely transformed by entries and exits, despite the longevity of certain established firms. The pattern of growth of new firms has dynamic consequences: 'Entry serves to increase productivity. It boosts efficiency. It is part of the dynamic process that serves to renew industries and facilitate technical progress and innovation' (Baldwin, 1995, p. 390).

²³ At the industry level, firms grow within a market by increasing their product's market share or through vertical integration. Access to further markets can be achieved through differentiation, by offering new or substitute output (Pavitt, 1984). By innovating, firms increase the prospect of finding new markets rather than entering into head-on competition with existing firms.

5. Conclusion

Our reflections on the dynamics of early firm growth make it understandable that very new firms are subject to high infant mortality and their survival chances increase as they age, while for a whole cohort of firms, the proportion continuing to grow falls over time as events take their course. Theory and evidence suggest that no more than half of a cohort of new firms will grow to the point of achieving self-sufficiency, at most a quarter will expand beyond the plateau stage, and among these, few will be unable to sustain their growth performance or recover from reversal following early expansion.²⁴ It is to be expected that under five per cent of the cohort will experience the sustained growth amplification effects required if they are to become major players in their industry (Storey, 1994). Nevertheless, surviving firms may grow sufficiently to capture increasing market share (Baldwin, 1995).

The statistical evidence on the attributes of successful firms can be interpreted in the light of an understanding of the internal dynamics of growth. Prospects are enhanced by early resource endowments, tangible and intangible, sufficient to meet new opportunities. These are more likely to be supplied by a team than by an individual, and by founders with qualifications and experience of the area of business (Kirchoff, 1994; Storey, 1994). Incubation has a role to play in the attainment of resource generation, sometimes before the firm is incorporated. These attributes increase the networking capacity of founders and their ability to match opportunities and resources. The evidence also shows that partnerships and alliances allow growth firms to secure complementary assets and achieve market repositioning. In these ways they increase exposure to favourable demand and investment conditions. Different types of market structure shape the context within which firm growth can occur, but there is scope for firms to position themselves in a variety of ways within dynamic markets. They can use the knowledge built up in the firm as a basis for new productive services. Existing resources can provide leverage, making it possible to acquire further competence in markets with good prospects as new opportunities are perceived.

But emerging firms which fail after a period of early promise may have earlier possessed the characteristics of successful firms. The identification of success characteristics does not therefore guarantee the picking of winners. Rapid-growth firms that fail and those that succeed resemble each other more than either group resembles low-growth firms (Storey, 1994). The nature of growth-reversal processes explains this unresolved issue in the literature on

²⁴ Simon analysis of regression to the mean growth rate for the industry (Ijiri and Simon, 1967) implies a pattern of growth reversal for many firms earlier experiencing higher than average growth.

small firm research. The drive to growth can have perverse effects as it creates resource shortages and synchronization problems (Harrison and Taylor, 1996, p. 38). Moreover, chance comes into play, setting off unpredictable feedback effects.

Nevertheless, the overall likelihood of success can be improved by policies that limit the premature culling of innovative firms in their vulnerable early years, and make available key resources at a formative period. Access to specialist market information and expertise can help these firms to target markets where demand conditions are favourable. At critical junctures, even small inputs of key resources can transform a firm's fortunes. In incubation centres, close monitoring of ventures by experienced mentors increases survival rates.

Penrose sought to uncover basic incentives for and constraints on growth in established firms. In extending her analysis, we can make use of the concept of the firm as an open system interacting with others in its environment. No firm is an island, and to understand its growth it is essential to understand the webs of interaction which make up its environment. Further work is needed on the way in which firms coevolve in production networks which create and respond to demand as they emerge and grow. This could allow progression from aggregate statistical associations and a theory of individual firm growth to a grounded understanding of the ecology of industrial renewal.

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