Institute for Manufacturing

Centre for Technology Management

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No: 2008/01, January 2008

UNIVERSITY OF CAMBRIDGE

Centre for Technology Management Working Paper Series

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ISBN 978-1-902546-63-6

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Erik Stam

Centre for Technology Management
Institute for Manufacturing
University of Cambridge
Mill Lane
Cambridge CB2 1RX
United Kingdom
Tel: 44 (0)1223 338183; 44 (0)1223 765601
Fax: 44(0)1223 766400
fcs28@cam.ac.uk

Erik Stam is an AIM-IPGC Research Fellow in the Department of Engineering, University of Cambridge and Research Fellow at the Max Planck Institute of Economics (Jena-Germany) and at the Netherlands Council for Government Policy (The Hague-The Netherlands)

Abstract

What is meant by entrepreneurship, innovation and economic growth is often not clear or very idiosyncratic. This paper starts with a discussion of the nature of entrepreneurship and its relation to innovation. The second section provides an overview of theory and empirical research on the relation between entrepreneurship, innovation and economic growth. The paper continues with a study on entrepreneurship and innovation in the Netherlands in an international and historical perspective. After these conceptual, theoretical and empirical investigations, we turn to policy issues.

Keywords: entrepreneurship, innovation policy, innovation systems.

1 Entrepreneurship and innovation

Entrepreneurship has been recognized as a micro driver of innovation and economic growth (Wennekers and Thurik 1999; Audretsch and Thurik 2001b; Acs 2006; Audretsch et al. 2006). What is meant by entrepreneurship, innovation and economic growth is often not clear or very idiosyncratic. This paper starts with a discussion of the nature of entrepreneurship and its relation to innovation. The second section provides an overview of theory and empirical research on the relation between entrepreneurship, innovation and economic growth. The paper continues with a study on entrepreneurship and innovation in the Netherlands in an international and historical perspective. After these conceptual, theoretical and empirical investigations, we turn to policy issues.

1.1 Entrepreneurship defined

What is meant with entrepreneurship and how does this relate to innovation? Entrepreneurship and innovation are fuzzy concepts that have been given multiple meanings. Innovation and entrepreneurship are often regarded as overlapping concepts. This can be traced back to probably the most well known definition of entrepreneurship, by Schumpeter (1934: 74), who defines entrepreneurs as individuals that carry out new combinations (i.e. innovations). Schumpeter distinguishes four roles in the process of innovation: the inventor, who invents a new idea; the entrepreneur who commercializes this new idea; the capitalist, who provides the financial resources to the entrepreneur (and bears the risk of the innovation project); the manager, who takes care of the routine day-to-day corporate management. These roles are most often executed by different persons (see for example Kenney 1986). The literature on entrepreneurship recognizes a variety of entrepreneurial roles in economic change, such as:

1. the person who bears uncertainty (Knight 1921);
2. an innovator (Schumpeter 1934);
3. a decision maker (Casson 2003);
4. an industrial leader (Schumpeter 1934);
5. an organizer and coordinator of economic resources (Marshall 1890);
6. an arbitrageur, alert to opportunities (Kirzner 1973; 1997);
7. an allocator of resources among alternative uses (Schultz 1975).

These roles all implicitly carry an economically positive connotation with them. However, if entrepreneurs are defined to be persons who are ingenious and creative in finding ways that add to their own wealth, power, and prestige (Baumol 1990), then it is to be expected that not all of their activities will deliver a productive contribution to society (cf. Murphy et al. 1991). For other reasons, many entrepreneurs do not directly contribute to an increase in for example national income: some entrepreneurship is more adequately

characterized as a non-profit-seeking activity (cf. Benz 2006). Greater independence and self-fulfilment are more often mentioned as important motivations to become self-employed than increasing earning power (EOS Gallup 2004). Empirical studies have even shown that (on average) entry into self-employment has a negative effect on the monetary income of individuals (Hamilton 2000; Parker 2004). Being an entrepreneur may be rewarding because it entails substantial non-monetary benefits, like greater autonomy, broader skill utilization, and the possibility to pursue one's own ideas; i.e. more freedom (cf. Sen 1999). These wide ranging effects of entrepreneurship are reflected in entrepreneurship policy.[1]

There have been dozens of definitions of entrepreneurship (see for example Hebert and Link 1989; Thurik and Van Dijk 1998). There is certainly not one answer to the question of what the phenomenon entrepreneurship truly is. Taking all entrepreneurship definitions together, they broadly reflect two relatively distinct social realities (Davidsson 2004). The first of those is the phenomenon that some people, rather than working for somebody else under an employment contract, strike out on their own and become self-employed.[2] These economic entities involve some element of innovation at start-up, and some degree of innovativeness is needed to survive over time. However, innovation is not central to this phenomenon. It is to the second social reality. This reality involves the development and renewal of any society, economy or organization, which is based on micro-level actors who have the initiative and persistence to make change happen. In this reality, 'entrepreneurship' means the creation of new economic activities and organisations ('Schumpeterian entrepreneurship') as well as the transformation of existing ones ('corporate entrepreneurship').

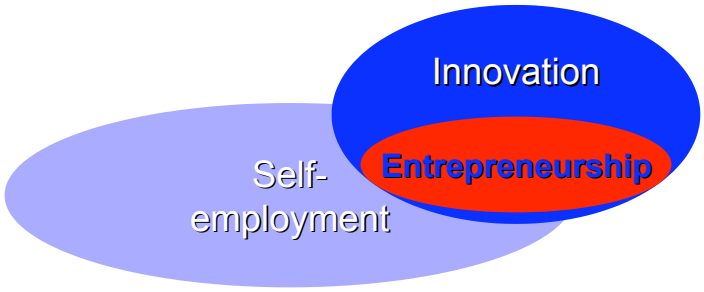
In the context of this paper we are especially interested in this second social reality ('entrepreneurship') and less so in the first. In order to narrow down the discussion we would like to propose a working definition of entrepreneurship as *the introduction of new economic activity by an individual that leads to change in the marketplace* (cf. Sarasvathy 2000; Davidsson 2004). This means that we exclude some other interpretations of entrepreneurship (as non-innovative self-employment) and parts of the innovation phenomenon (see figure 1). For example, we exclude non-market activities such as not-for-profit endeavours, changes in contract (e.g. from employee to self-employed) and internal, organizational innovations. We also exclude mere contemplation over new ideas or introduction of fatally flawed ones that do not change the market (directly or indirectly, via learning mechanisms). We thus do not include novelty and creativity in *any* domain of human behaviour in our concept of entrepreneurship. Inclusion of all this novelty and creativity would make the events of September 11, 2001, an

[1] The aims of entrepreneurship policy in the Netherlands are to increase employment, the flexibility and innovativeness of the economy, individual development, and emancipation and integration (Rekenkamer 2002).

[2] In a similar way, entrepreneurship is often equated with self-employment and SMEs in other EU documents (EOS Gallup Europe 2004; European Commission 2006b)

entrepreneurship masterpiece: “To conceive of a fully fuelled passenger jet as a missile and to combine the idea of hijacking with that of kamikaze attacks is certainly innovative, and in terms of impact – economic and otherwise – it has few parallels. However, regarding these attacks as driving market processes is far-fetched” (Davidsson 2004: 7). This example also shows that innovations can have devastating effects on society.

Figure 1. Entrepreneurship, innovation and self-employment



In line with our definition of entrepreneurship as the introduction of new economic activity by an individual that leads to change in the marketplace, we can formulate several necessary conditions for entrepreneurship (cf. Shane 2004: 6):

1. existence of entrepreneurial opportunities (environmental changes: technological, political/regulatory, social/demographic)
2. difference between people (in their willingness and ability to act upon an opportunity)
3. risk bearing; uncertainty until the entrepreneur pursues the opportunity (does demand exist?; can the entrepreneur compete with others?; can the value chain be created? etc.)
4. organizing (exploiting the opportunity); either creating a firm, or using the market mechanism (for example, licensing)
5. innovation: recombination of resources into a new form that is by implication not a perfect imitation of what has been done before, and thus involves a change in the marketplace.

These are necessary conditions for entrepreneurship. It is however contingent whether the individuals discovering an opportunity are employees or independent individuals, and whether new firms or incumbent firms are used for the exploitation of the opportunity. See figure 2 for a typology of entrepreneurial efforts as a function of the locus of discovery and exploitation

Figure 2. Typology of entrepreneurial efforts (adapted from Shane and Eckhardt 2003: 186)

		Discovery	
		Independent individual	Employee
Exploitation	Independent individual	Independent start-up	Spin-off
	Incumbent firm	Acquisitions	Corporate venturing

1.2 Entrepreneurial opportunities

Because the range of options and the consequences of exploiting new things are unknown, entrepreneurial decisions cannot be made through an optimization process in which mechanical calculations are made in response to a given set of alternatives (Baumol 1993). People must be able to identify new means-ends relationships that are generated by a given change in order to discover entrepreneurial opportunities. Even if a person possesses the prior information necessary to discover an opportunity, he or she may fail to do so because of an inability to see new means-ends relationships. Unfortunately, visualizing these relationships is difficult. History is rife with examples in which inventors failed to see commercial opportunities (new means-ends relationships) that resulted from the invention of important technologies - from the telegraph to the laser.

Every entrepreneur who starts a new business has ideas. The real challenge is to discover an opportunity that is more than just a good idea. These opportunities can have a radical nature (Schumpeterian) or be relatively incremental (Kirznerian). Schumpeterian opportunities originate from changes in the environment (Shane 2003). These can be technological, social / demographic, and political / regulatory changes. First, technological change, often based on progress in the research base of society, is a prime source of entrepreneurial opportunities for new technology-based firms (for example in the ICT and biotech industries). See section 5.2 for the implications of this on economic growth. Second, social and demographic changes can be quantitative changes like an ageing population that offers new opportunities for entrepreneurs. It may also involve more qualitative changes: changing preferences or wants, for example reflected in the rise the creative industries that satisfy new wants (e.g. EndeMol productions), or in the trend toward health and nutrition and the supply of diet and ecological food. In that sense people's necessities are few but their wants are endless. Third, deregulation, privatization, and liberalization have opened up many opportunities for entrepreneurship. [3] An example of deregulation is labour market flexibility policy. Flexibilisation of the labour market has opened up several opportunities for entrepreneurship. One the one hand many employees have become self-employed, partly lured by the lower tax rates in comparison to wage-labour. On the other hand, there have been high-growth start-ups that have used this new trend of labour flexibility to specialize in temporary staffing. Other examples of privatization as sources of entrepreneurial opportunities are the downsizing of municipal services and the privatization of the care market, which have provided opportunities for high-growth start-ups.

Some of the examples just given about deregulation as a source of opportunities can also be characterized as Kirznerian. Related to that, the fourth – Kirznerian – source of opportunities can be formulated, namely

[3] See Phillips (1985) for evidence on the positive effects of deregulation on new firm formation in the US and Berkowitz and Holland (2001) on the positive effects of privatization on new firm formation in Russia.

opportunities proven elsewhere that can be pursued in a new context ("filling a gap in the market"). An example of such a Kirznerian opportunity is the imitation of the Italian coffee bar by Starbucks: the founder of Starbucks was alert enough to see that the coffee bar culture in Italy and its social role might translate to the US. These Kirznerian opportunities most often do not involve straightforward replications, as the business idea has to be adapted to the new local context. Thus, although conceptually it is an imitation, the implementation can be seen as an example of (innovative) entrepreneurship.

Finally, customers can themselves be a source of entrepreneurial opportunities, involving so-called user-entrepreneurship.

> The mountain bike industry emerged out of a group of hippies that constructed mountain bikes out of existing bike parts, in order to fulfil their want to ride the bike on off-the-road single track downhills. Gary Fisher – one of those hippies – started to produce these mountain bikes in 1979,[4] and stood at the cradle of what turned out to be a huge industry (Buenstorf 2001). Another example of user-entrepreneurship is the online communication platform Hyves, started out of a personal need to have a computer-mediated social network that connects people. Initially (in 2004) only friends and acquaintances of the founders joined their website; in 2007 Hyves has millions of members, has grown into an enterprise with 30 employees, and has an estimated market value of 50 million euros (Intermediair 2007: 26).

1.3 Entrepreneurship as an organizational product

Figure 2 showed that the discovery of an entrepreneurial opportunity can be made by an employee (i.e. a paid organization member) or an independent individual. The latter situation is reflected in so-called user-entrepreneurship: i.e. a personal need as a consumer is the source of the opportunity. Empirical research has shown that the prior situation occurs much more often, as most founders start a new business in an industry that is similar or related to their prior experience (Klepper 2001). "Producer-entrepreneurship" is thus a much more widespread phenomenon than user-entrepreneurship. In organizational terms the most important question is whether this opportunity is pursued and exploited within or outside the organization of origin: i.e. in the form of a spin-off or of (internal) corporate venturing. Spin-offs involve the exploitation of an opportunity by an employee who leaves an organisation to start a firm of her own that is independent of the parent organisation. Corporate venturing or corporate entrepreneurship has been defined as "the process whereby an individual or a group of individuals in association with an existing organization, create a new organization or instigate renewal or innovation within that organization" (Sharma and Chrisman 1999: 18). Two sub-types of corporate venturing are typically distinguished: 'internal corporate venturing' which focuses on opportunities identified within the company (also called intrapreneurship, sometimes leading to a spin-off firm that commercialises this opportunity outside the mother firm); and 'external corporate venturing' or 'corporate venture capital' which focuses on opportunities external to the company, in the form of investments in

[4] This was the first mountain bike producing firm ever (called MountainBikes). This firm dissolved in 1983, the year in which Fisher founded his better-known company Fisher MountainBikes, which was acquired by Trek in 1993.

independent start-ups. Frequently, corporate venture units pursue some combination of internal and external opportunities. Sometimes a third type – alliances – is also included. Alliances offer the advantage of combining the assets of the larger company (brand strength, market channels, investment capital, and other scale-related advantages) with the more focused and flexible characteristics of the smaller, younger partner.

Why would an opportunity be pursued outside the organization in which it was discovered? When the opportunity depends more on firm specific (e.g. physical or intellectual) assets than on human capital, spin-offs are less common, because entrepreneurs cannot move these proprietary assets with them when they exit a firm. This explains the high number of spin-offs in business services, because the most important asset in this industry is human capital. When innovations are architectural and therefore reconfigure the way in which products are developed, spin-offs will also be more common because established firms have a hard time changing their organization in order to exploit such innovations (Henderson and Clark 1990). Spin-offs are also more likely when established firms are incapable of responding to radical technological changes that upset the established ways of organizing their businesses, i.e. their business model (see Chesbrough and Rosenbloom 2002). High-level managers may be incapable of evaluating the new entrepreneurial opportunities or they choose to focus on their company's core line of business. Likewise, when a new good or service only serves a small market niche, spin-offs are more common because an existing customer base will restrict an incumbent firm from focusing attention on the new niche (Christensen 1997). The risk averseness of the discovering person and the organization in which she is employed will be negatively and positively related to the likelihood of spin-off: risk averse persons will not be eager to leave a secure job, while on the other hand risk averse organizations will not be open to accommodate risky ventures.[5] Taking this latter mechanism into account, an increase in the number of spin-offs (and thus new firms in general) could also be an effect of the increased risk averseness of incumbent organizations.[6]

2 Entrepreneurship, innovation and economic growth

How can we explain the relation between entrepreneurship and economic growth? Several mechanisms may be at work here, which explain why new and small firms in combination with large organisations may drive innovation and ultimately economic growth. These mechanisms are knowledge spillovers, decentralization, experimentation, and competition. We will first discuss these mechanisms. Next, we will provide an overview of empirical

[5] In addition, a risk averse firm is unlikely to offer return options for the entrepreneur if the new venture fails.

[6] This is in line with a study by Wennekers et al. (2007) which shows that uncertainty avoidance is positively correlated with the prevalence of business ownership: a restrictive climate of large organizations in high uncertainty avoidance countries pushes individuals striving for autonomy towards self-employment.

studies that have tested the effect of (different types of) entrepreneurship on (different types of) economic growth.

2.1 Knowledge spillovers

First, as has been mentioned before, new scientific and technological knowledge is an important source of entrepreneurial opportunities. Organisations investing in research or technology development often end up facilitating other agents' innovation efforts, either unintentionally, as when inventions can be imitated, or intentionally as where scientists report on their research. Economists have termed this knowledge spillovers: "any original, valuable knowledge generated somewhere that becomes accessible to external agents, whether it be knowledge fully characterizing an innovation or knowledge of a more intermediate sort. This knowledge is absorbed by an individual or group other than the originator" (Foray 2004: 91). There has been much empirical research showing that firms located near knowledge sources introduce innovations at a faster rate than rival firms located elsewhere (Audretsch et al. 2006). These can be incumbent firms, but more likely involve firms that have been set-up by prior employees of the knowledge producing organisations. They are the Schumpeterian entrepreneurs that commercialise inventions. Many major inventions have been reshaped, speeded, and expanded by (individuals and their) new firms with different objectives, interests, and ideas from those of the original inventor (cf. Shane 2000) or originating organisation. These innovative new firms are started because their innovations would have been turned down or severely delayed in the organizations in which the initial idea was developed.

Several case studies throw some light on how potential entrepreneurs may recognize opportunities that are not recognised as valuable by the knowledge-originating organization. Well-known examples of companies developing resources that they failed to exploit are Bell and Xerox, private companies that incubated emerging technologies.

> During the emergence of the semiconductor industry, the growth of knowledge developed at the Bell Labs and the Bell System provided more opportunities for new semiconductor firms than the Bells could exploit (Holbrooke et al. 2000: 1037; cf. Moore and Davis (2004) for a similar situation at Fairchild Semiconductors). In the early semi-conductor industry, a diversity of new companies were start, based on newly developed knowledge, which ensured that a wide opportunity space presented by the transistor's invention was explored and exploited. The use of semiconductors was appreciably accelerated and broadened as a result of the ready formation of firms (like the multiple generations of spin-offs Shockley Laboratories, Fairchild, and Intel) with different development criteria than Bell's (cf. Rosenberg and Birdzell 1986; Holbrooke et al. 2000). It has also been claimed that roughly half the population of Silicon Valley semiconductor manufacturers can be traced back to the Bell Labs (Rogers and Larsen 1984: 43-45).
>
> Another well-known source of entrepreneurial opportunities was Xerox Corporation. In the 1960s and 70s managers at Xerox who understood the potential of digital electronics and computing set up Xerox PARC near Stanford University. PARC (its employees aided by Pentagon funding) created many of the key technologies of the PC industry, but failed to take advantage of their opportunities (Smith and Alexander, 2003). Xerox' innovations in computing were largely underexploited because its business model was based on developing copier systems

> in-house with proprietary standards. PARC employees were alert to business opportunities neglected by Xerox and chose to leave to found new companies based on novel business models (Chesbrough and Rosenbloom 2002).

Large research organisations are often repositories of unused ideas: big firms have natural diseconomies of scope that a cluster of start-ups does not have (Moore and Davis 2004; cf. Nooteboom 2000), and public research organisations often do not have incentives to commercialise ideas. One of the arguments behind the so-called open innovation strategies of large firms like Philips Electronics is exactly this: the intellectual property developed in these firms could be exploited much more widely by firms outside its organizational boundaries than by divisions from within. Technology transfer and 'valorisation' has also become an important function of public research organisations. University based spin-offs commercialising knowledge have become more common world wide (Shahid and Kaora 2007). These companies explore applications of knowledge beyond the academic remit which established firms find commercially uncertain or which conflict with their current activities. The pioneer in Europe among centres of high tech activity was the University of Cambridge. The first spin-out company from the university was the Cambridge Scientific Instrument Company, founded in 1881 by Horace Darwin, son of Charles Darwin. The current cluster of high tech activities resulted from multi-generational spin out from the university (Garnsey and Heffernan 2005).

Regions without larger research organizations (at the scientific or technological frontier), will probably have fewer spin-off firms, both because a lack of technically trained people and a shortage of ideas (Moore and Davis 2004). A mix of large and small knowledge based organisations is thus a better starting point for the exploration and exploitation of new ideas than a concentration of small entrepreneurial firms only (Baumol 2002; Moore and Davis 2004; Rothwell and Dodgson 1994; Nooteboom 1994). The combination of high investments in new knowledge (exploration) and high levels of entrepreneurship exploiting this knowledge is a key driver of growth in advanced capitalist economies (Acs et al. 2005; Audretsch *et al.* 2006). Large firms are not only important as sources of entrepreneurial opportunities. They are also important for more downstream functions. The most useful innovations are likely to produce one or more giant firms, simply because useful often means "widely used" and widely used may well mean "mass-produced" (Rosenberg and Birdzell 1986: 271). See for example the dominance of a few large firms in chemistry, electronics, drugs, and automobiles. Some of these large firms owe their size to an innovation that occurred while the firm was still small, while others had to shift their production and marketing to a new field in order to become large corporations. Large and small firms have dynamic complementarities in technological development (cf. Nooteboom 1994).

> Large corporations invented neither the airplane nor the automobile, but they contributed both technologically and commercially to filling the gap between the horseless carriage and the everyday family car, and between the plane of Kitty Hawk and the commercial airliner. (Rosenberg and Birdzell 1986: 288)

Diversity of enterprise is a necessary condition for economic growth and prosperity. History has shown that long-term economic growth and prosperity depends on a mix of large and especially small enterprises (Rosenberg and Birdzell 1986; Landes 1969). Many types and sizes of enterprise are useful under the right conditions circumstances, but what matters is the diversity of economic organization in economic systems – the variety of the system's organizational repertoire rather than the size of particular enterprises (Rosenberg and Birdzell 1986: 270). The role of diversity of enterprise in economic growth and prosperity has two key elements (Rosenberg and Birdzell 1986: 296-297): experimentation and decentralisation.

2.2 Experimentation

First, experiment is almost always best conducted on the smallest scale necessary to prove or disprove a point. Since experiment is so important in economic change, a great part of the activity in progressive economies will be conducted on a small scale. Economic growth implies change and adaptation, and much of this adaptation takes place through the formation of firms that are, at least initially, small. New firms are useful devices for experimenting with innovation, because they can be established at a small, experimental scale at relatively low cost and therefore in large numbers, and their efforts can be intensively focused on a single innovation. The experimental aspect of new firms is reflected in the facts that they usually start small, their number is large, and as with other kinds of experiment, most of them fail. High rates of firm entry and exit (so-called churning or turbulence) can even be regarded as a necessary price to pay in order to allow "exploration" of new technological and market possibilities: failures at the micro level may be consistent with social benefit at the aggregate level (see March 1991; Saxenian 1994; Dosi and Lovallo 1997). A high level of new variety is needed to produce a few very successful new innovative industry leaders, like Microsoft, Google, and Ebay. The experimental approach to the organization of economic activity is a key mechanism for economic progress. New firms often provide the seedbed for the emergence of new industries.[7] They have been instrumental in the introduction of electricity, the internal-combustion engine, automobiles, aircraft, electronics, aluminium, petroleum, plastic materials, and many other advances (Rosenberg and Birdzell 1986; Baumol 2002; Audretsch 1995).

2.3 Decentralisation

Second, a fundamental characteristic of organization in highly developed economies is decentralisation – a diffusion of authority and responsibility and a limitation of the pyramiding of managerial hierarchies. The resistance to agency costs and the complexities of controlling those costs are not limited to

[7] According to Pasinetti (1993) an economy that does not increase the variety of industries over time will suffer from structural unemployment, and will ultimately stagnate. In this view, the development of new industries in an economy is required to absorb labour that has become redundant in pre-existing industries. This labour has become redundant due to a combination of productivity increases and demand saturation in pre-existing industries, characterizing the product lifecycle dynamics in each sector.

that part of the pyramid that extends from a government board of planning and control down to individual enterprises; they are reflected in the organization of economic activity at all levels. The organizing principle is that the costs and benefits of hierarchy must be balanced out (including the static and dynamic transaction costs; see Nooteboom 1992; Langlois and Robertson 1995).

> That the benefits [of hierarchy] outweigh the costs in comparatively few situations is a fact of social life, as evidenced by the predominance of relatively small hierarchies in Western economies. The strength of the tendency to decentralization in Western economies is chronically underestimated, if one may judge from the many prophecies that capitalism would end in the centralization of Western economies in the hands of a few capitalists – prophecies repeated by now for more than a hundred years and still unfulfilled. (Rosenberg and Birdzell 1986: 297)

Although a large part of economic change is brought about by the expansion and conversion of old firms, innovative change is to a large degree brought about by new firms (see Rosenberg and Birdzell 1986; Acs and Audretsch 2003). That small firms have played a large part in economic growth is not accidental; it can be explained, at least in part, by their smaller agency costs (next to their special suitability to the experimental stage of innovation). Innovation is more likely to occur in a society that is open to the formation of new enterprises than in a society that relies on its existing organizations for innovation (Rosenberg and Birdzell 1986: 258).[8] New, usually small, firms have an important role in bringing about change – a role that may well depend on the degree of inertia accumulated in older bureaucracies.

2.4 Competition

Competition has been the principal source of diversity in enterprise organization: differentiation via the development of unique products, methods of production and distribution, and forms of organization is central to the strategy of competition. Diversity of enterprise is closely related, both as cause and consequence, to diversity of products and services available to customers.[9] See Porter (1980) on the micro-economic, and Helpman (2004) on the macro-economic relevance[10] of product differentiation.

New firms played a direct role in economic growth, with the introduction of new products, but also an important indirect role in triggering old firms to

[8] In comparison to other small economies like Belgium, Denmark and Ireland, the Netherlands has a 'water head': relatively many large dominant firms (the Netherlands had the most Fortune 500 firms per capita in 2006, after Luxembourg and Switzerland), which have a more than proportional influence on public policy, and have received a more than proportional part of government spending. See Banning and Meeus (1998) for the role of Philips in the Netherlands. Studies in the US have shown the negative effect of large firm power on small firm innovation (Christopherson and Clark 2007) and on new firm formation (Choi and Phan 2006). This overrepresentation of large dominant firms is likely to constrain the experimental nature of the Dutch economy. More research is needed to confirm (or reject) this hypothesis.

[9] The very limited variety of products that was available in communist economies seems to confirm this generalization. Wealth can even be defined as the range of choice people have, not just the quantity of supply.

[10] Funke and Ruhwedel (2001) found that a greater degree of product variety is highly correlated to per capita GDP levels and TFP growth in OECD countries.

improve or restructure their activities (or to exit the market if they fail to do so). The easy formation of new firms acts as a disciplinary device for existing firms (cf. Aghion et al. 2006). New innovative firms circumvent bureaucratic rigidity and supply older firms with an incentive – self-preservation – for taking internal measures to avoid the habits and practices that eventually lead to rigidity. This is for example reflected in the rise of corporate venturing, as a means for corporate renewal.

2.5 Empirical evidence on the relationship between entrepreneurship and economic growth

Already at the start of the 20th century the economist Schumpeter made a plea for the entrepreneur as the person who brings new ideas to the market and in that way causes economic renewal and progress. A necessary condition is that these innovations have to offer more (or the same for a lower price) than the pre-existing supply. If this condition is fulfilled there might even be creative destruction: innovations that make the 'old economy' superfluous. A recent example in the Dutch economy is the success of the digital TomTom route planner that has substituted a large part of the production of roadmaps. An indirect effect of the introduction of these innovations by new firms is that incumbents are triggered to upgrade their product offerings in order to remain competitive. How and to what extent does entrepreneurship lead to innovation and economic growth?

Why should entrepreneurs start with an uncertain innovation process at all? A recent study (CBS 2006: 153) shows that entrepreneurs innovate because they want to improve the quality of goods and services (cf. Aghion and Howitt 1992), to offer a broader range of goods and services (cf. Romer 1990), and in the end they want to access new markets or a larger market share. A recent review of empirical studies by Van Praag and Versloot (2007) shows mixed evidence on the assumption of the relatively high innovativeness of small and new firms. They conclude that "entrepreneurs and their counterparts [large incumbent firms] contribute equally importantly to the innovativeness of societies. However, they serve different goals in terms of quality, quantity and efficiency, as well as in terms of producing (and adopting) more radical (and higher cost) innovations" (Van Praag and Versloot 2007: 18). They show that new and small firms have relatively high levels of innovative sales, and are relatively less likely to adopt high cost innovations.

A key question is whether and how entrepreneurship causes economic growth. Before we can answer this question with empirical research, we have to choose empirical indicators for entrepreneurship and economic growth. Traditionally, economic growth has been referred to as the growth of employment or national income, while recently productivity growth is seen as a more relevant indicator. The two dominant empirical definitions of entrepreneurship are the creation of new organisations (a new legal entity; including both independent start-ups and spin-offs) and self-employment (performing work for personal profit rather than for wages paid by others). Some studies also take into account people with a preference for

entrepreneurship ('latent entrepreneurship'), or people that take steps to start a new business ('nascent entrepreneurship'). The latter two indicators can be seen as potential entrepreneurship. Corporate entrepreneurship is not easily identified, and is unfortunately largely an invisible aspect of entrepreneurship in empirical research. In addition to these operational definitions of entrepreneurship, there are several measures of performance, like survival, growth, profitability and realising an initial public offering (IPO) of the business. These performance measures are indicators of entrepreneurship to a lesser or greater degree. Take for example survival: new firms that survive on a long term but remain relatively small often become more conservative (i.e. less innovative) while new firms that grow into substantial corporations often revolutionize the economic structure (cf. Schumpeter 1942: 83). In addition, there are habitual entrepreneurs that 'specialize' in setting up new firms and often leave the newly created firms (either successfully, for example via an IPO, or less successful with a liquidation) to set up other ones.

Empirical research shows an ambiguous relation of entrepreneurship with employment growth: the relation is often positive (Audretsch and Thurik 2001a; Audretsch and Fritsch 2002; Bosma et al. 2006; Acs and Mueller 2007; Acs and Armington 2004; Carree and Thurik 2007; Van Stel and Suddle 2007; Thurik et al. 2008)[11], sometimes non-existing (Audretsch and Fritsch 2002; Acs and Mueller 2007) [12] or even negative (Van Stel and Storey 2004; Mueller et al. 2008). Growth in national income is unambiguously related to high levels of new firm formation and high-growth start-ups (Stam et al. 2006; Wong et al. 2005). Research on the effects of entrepreneurship on productivity growth is less abundant, and only shows an ambiguous positive effect of new firm formation (Callejon and Segarra 1999; Bosma et al. 2006) or no effect of changes in self-employment (Carree and Thurik 2007).

The review of recent research on entrepreneurship and economic growth reveals that high levels of new growing firms are strongly related with economic growth. There is no consistently positive relation of new firms in general or the level of self-employment with economic growth (see Table 1). The latter outcome is not that remarkable: many new firms are a continuation of the activities that were done as an employee before – so these involve no new economic activities (for example the construction worker who becomes an independent handyman, and the graphic designer who is made redundant with a round of restructurings, but still supplies the same services to her prior employer). The decision to enter self-employment is hardly driven by

[11] Even when controlled for recent macro-economic growth and time lags of the effect on economic growth. Prior economic growth has positive and negative relations with entrepreneurship rates: positive because of growth opportunities ("prosperity-pull"), and negative because unemployed workers are encouraged to become self-employed because the opportunity costs of self-employment has decreased ("recession-push") (see Thurik et al. 2008).

[12] In what they call "revolving door" regimes: inefficient entrants, which exit soon after entry because they cannot make a valuable contribution to the economy.

innovation, and relatively often by lifestyle reasons, like the combination of labour and care tasks and a focus on a particular craft (Dirks et al. 2003).[13]

Table 1. Entrepreneurship and economic growth (in OECD countries)*

	Employment	Income	Productivity
Self-employed	+ / 0	+	0
New firm formation	+ / 0 / -	+	+ / 0
High-growth start-ups	+ / 0	+	x

* + = statistically significant positive relation; 0 = no statistically significant relation; - statistically significant negative relation; x = no empirical research

A critical interpretation of the overview of empirical research could be that entrepreneurship as measured in these studies does not have much to do with innovation at all: productivity growth is probably the best output indicator of innovation, and the studies reviewed showed that entrepreneurship has hardly an effect on this. The positive effects on income and employment do not have to be explained with innovation: consider the situation in which increased labour market participation via self-employed is registered both as an increase in new firm formation and in self-employment, this is like to lead to an increase in employment and income, as members of society that not were not involved in paid labour, now both add to total employment and to total income. In this situation both employment and income are growing, but innovation is not a necessary ingredient of this.

Next to economic growth, a more relevant indicator may be welfare (Layard 2005). Unfortunately, the relation between entrepreneurship and welfare has not been researched to a large extent. However, there are several indications that entrepreneurs are on average more satisfied with their occupation than employees are (Blanchflower and Oswald 1998; Benz and Frey 2003; Frey and Benz 2003).

3 Entrepreneurship in the Netherlands

A record number of new firms has been started in the Netherlands in 2006: 85,000. The number of new firms has almost been tripled since the end of the 1980s. On the basis of these numbers one tends to say that the Netherlands has become more entrepreneurial in the last decennia. If ones assumes that these new firms also supply something that is sufficiently new and different from the existing supply of goods and services, and even make a profit, than it is not such a strange idea to regard new firms as the driving force of an innovative economy (see Coalitieakkoord 2007, especially “pijler II”).

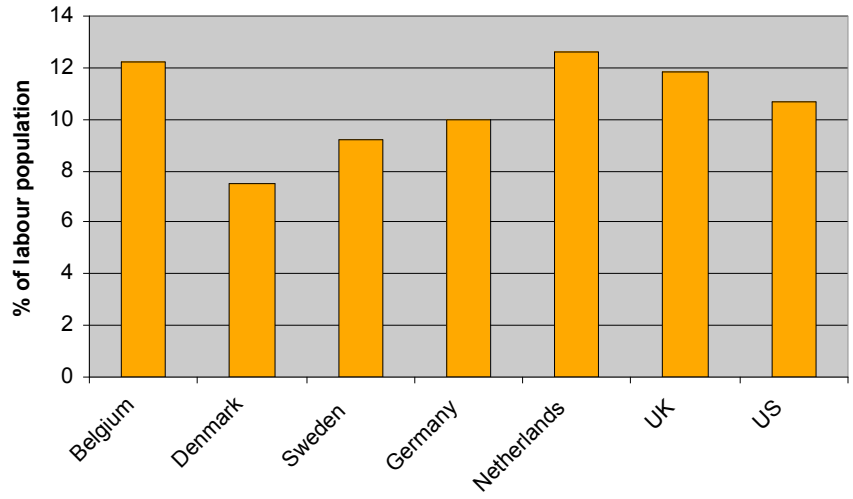
[13] The Global Entrepreneurship Monitor makes a distinction between “necessity entrepreneurship,” which is having to become an entrepreneur (often “self-employed”) because you have no better option, and “opportunity entrepreneurship,” which is an active choice to start a new enterprise based on the perception that an unexploited or underexploited business opportunity exists. Analyzing data in 11 countries, Acs and Varga (2005) found that effects on economic growth and development of necessity and opportunity entrepreneurship vary greatly: necessity entrepreneurship has no effect on economic development while opportunity entrepreneurship has a positive and significant effect. They also found that the ratio of opportunity to necessity entrepreneurship in a country is positively related to GDP per capita.

In spite of this record number of new firms, there is still a common opinion that there is a shortage of entrepreneurship in the Netherlands, especially in comparison with Anglo-Saxon economies like the UK, Ireland and the US. In order to understand whether there is 'sufficient' entrepreneurship in a particular economy or innovation system, one should compare systems in time or over space. Only such a comparison makes it possible to identify a 'problem'. We will attempt to get a better insight into the relative position of entrepreneurship in the Netherlands internationally (in comparison to other relevant 'benchmark' countries) and over time.

3.1 International comparison

We start with an international comparison of three key indicators of entrepreneurship: self-employment, new firms, and ambitious entrepreneurs. With respect to the percentage of self-employed in the labour force – the most static measure for entrepreneurship – the Netherlands is in front of all benchmark countries (see figure 3). When we look at more dynamic measures of entrepreneurship,[14] the picture looks a bit less rosy: the Netherlands is now behind almost all benchmark countries, and is – just like all other European countries – miles behind the US (see figure 4). Especially with regard to ambitious entrepreneurship – one of the most important types of entrepreneurship for economic growth – the Netherlands is at the back of the peleton (see also Hoffmann 2007).[15]

Figure 3 International comparison of self-employment (2004)

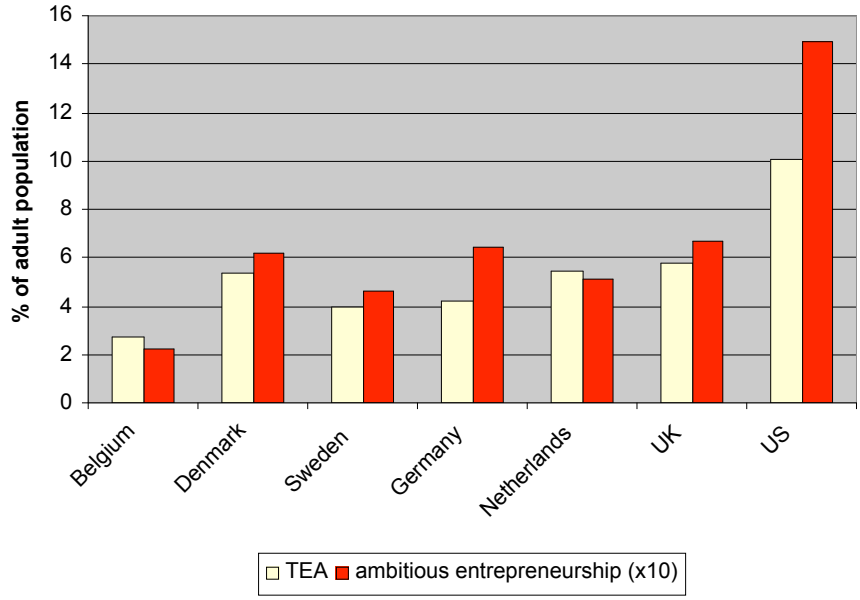


[14] "TEA" reflects the percentage of the adult population that is actively involved in setting up a business or owns a young (<42 months) firm; "% ambitious entrepreneurs" reflects the percentage of the adult population that is actively involved in or owns a young firm and have the ambition to expand to a size of more than 20 employees (Autio 2007).

[15] This might be less worse for the economy if this is caused by new forms of governance, like network organisations: entrepreneurs may have low ambitions for employment growth, but high ambitions in sales growth and growth in value added, realised as a self-employed in a network organisation. However, it is far from clear that this phenomenon is over represented in the Netherlands, and that this causes the relatively low number of entrepreneurs with employment growth ambitions in the Netherlands.

Source: CBS

Figure 4 International comparison of TEA and ambitious entrepreneurship (2006)

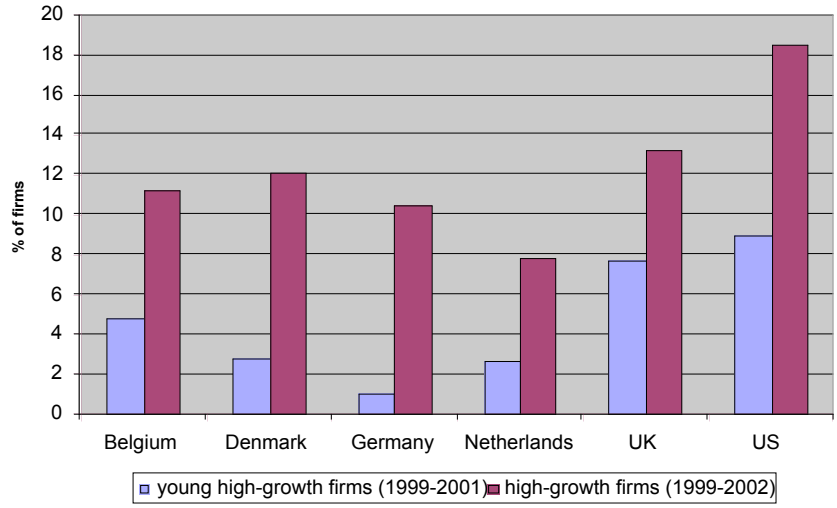


Source: GEM

In spite of the record number of new firms in the Netherlands and the high percentage of self-employed, [16] the Netherlands can still not be seen as a leading entrepreneurial economy. Especially with respect to ambitious entrepreneurship, the Netherlands is behind other relevant countries. This is confirmed in international comparisons on the share of high-growth firms (see figure 5). This form of entrepreneurship is very important for economic growth. The Netherlands is thus a country with many self-employed but with few ambitious entrepreneurs and high-growth firms.

[16] The high percentage of self-employed in the Netherlands can partly be explained by the relatively high survival rates of new firms in the Netherlands, in comparison with for example the US (Bartelsman et al. 2005).

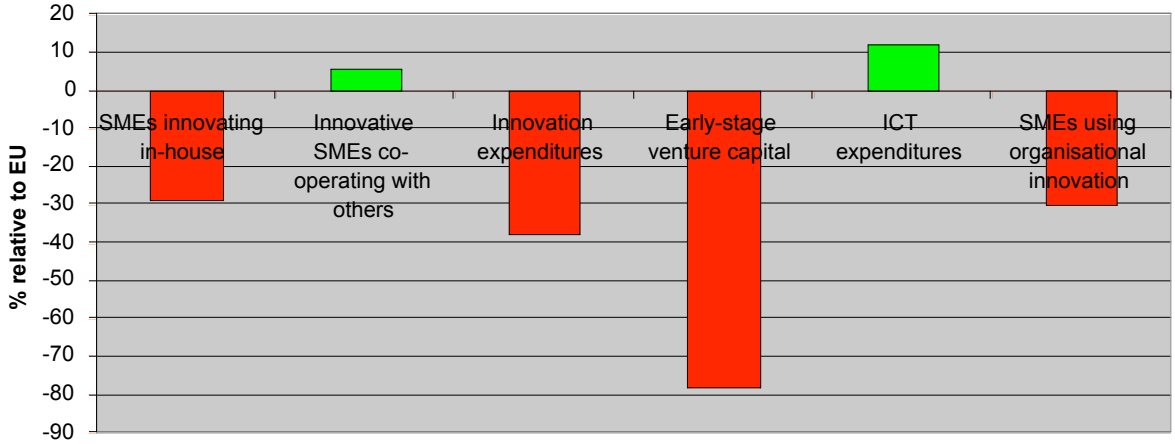
Figure 5 International comparisons of high-growth firms



Sources: Hoffmann and Junge 2006; EIM 2006

The European Trend Chart on Innovation (European Commission 2006a) includes one set of indicators reflecting innovation and entrepreneurship (based on the Community Innovation Survey and Eurostat data), which measure the efforts towards innovation at firm level. The six indicators are " SMEs innovating in-house (% of all SMEs)", "Innovative SMEs co-operating with others (% of all SMEs)", "Innovation expenditures (% of total turnover)", "Early-stage venture capital (% of GDP)", "ICT expenditures (% of GDP)", and "SMEs using organisational innovation (% of all SMEs)". The Netherlands performs particularly well with respect to ICT expenditures, but performs particularly bad with respect to innovation expenditures, cooperating with others for innovation, and innovating in-house. Taken together, the Netherlands performs less than average on the innovation and entrepreneurship indicators in the European context (see figure 6).

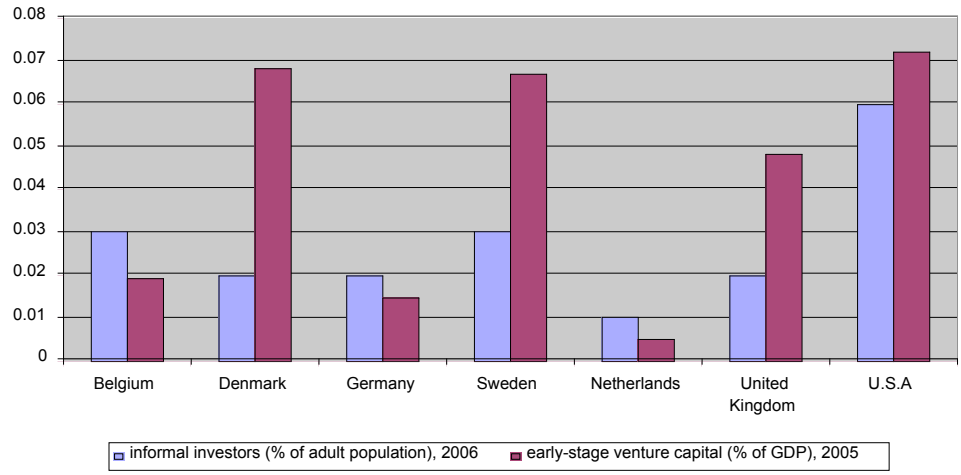
Figure 6 Innovation and entrepreneurship indicators, NL relative to the EU 2003



Source: European Commission 2006.

What drives entrepreneurship? The literature on entrepreneurship has shown that two of the necessary conditions of entrepreneurship are the (perceived) skills and knowledge to start a business and the (perceived) opportunities to start a business. With respect to entrepreneurial skills, the Netherlands adult population is rather average within Europe (Bosma and Schutjens 2008), while with respect to opportunities, the Netherlands seems to be relatively abundant (Bosma and Schutjens 2008). Another aspect of national culture that is often seen as a major constraint to entrepreneurship in Europe in comparison to the US, is the so-called fear of failure. The Netherlands has the lowest percentage in the EU of people that would not start a business because they have a fear of failure (Bosma and Schutjens 2008), and has a lower percentage of people that regard the possibility of going bankrupt as an important risk attached to start-ups than the EU average (EOS Gallup Europe 2004). Even though it still lags behind the US, its position within the EU is quite good. For high growth (new) firms, the supply of venture capital is highly relevant. The overall supply of venture capital is very good in the Netherlands (see Porter et al. 2007). However, the supply of informal investors and early-stage venture capital, which is more relevant for successful entrepreneurship, lags behind considerably to other benchmark countries (see figures 6 and 7).

Figure 7 International comparison of informal investors and early-stage venture capital



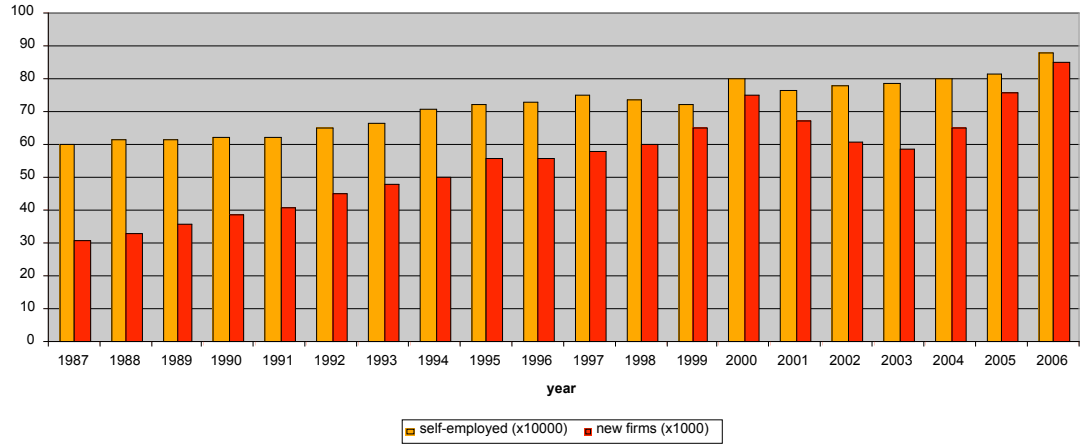
We now have a 'worrisome' picture of the Netherlands, in comparison with other benchmark countries. How has the Netherlands come into this position, i.e. has it been better in former times, or has it even been worse, and is the Netherlands 'catching up'?

3.2 Entrepreneurship in the Netherlands over time

How has entrepreneurship developed in the Netherlands in the last two decennia? If we look at the annual number of new firms, there is a huge increase, with only a hesitation after the technology-bubble at the early 2000s

(see figure 8). A similar, but more moderate, trend can be observed if we look at the number of self-employed over time (see figure 8).

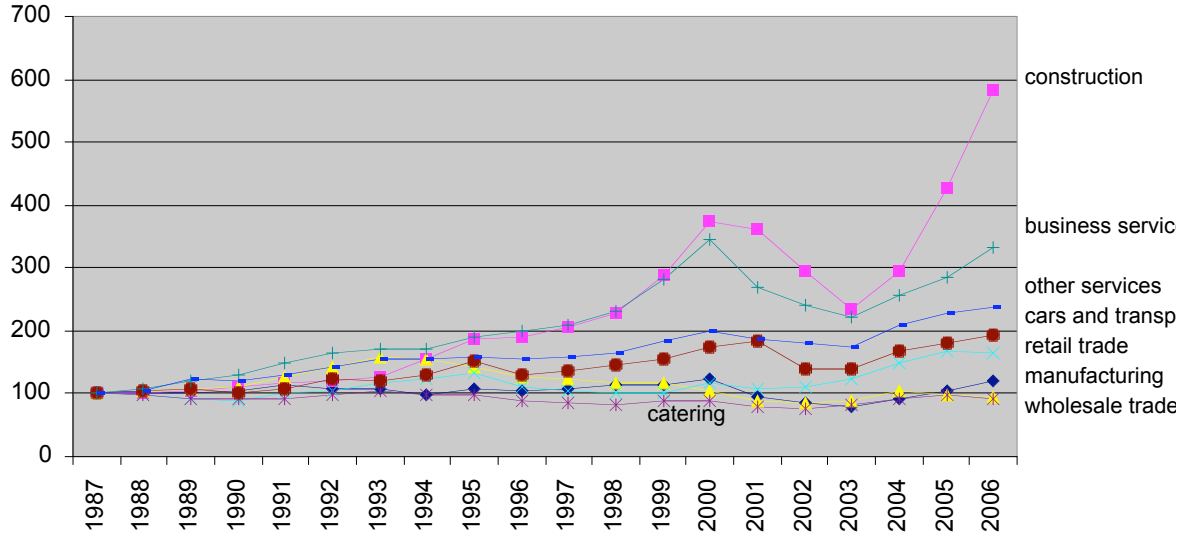
Figure 8 Total number of new firms and self-employed in the Netherlands, 1987-2006



Source: CBS

Can we trace back the rise in the number of new firms to particular sectors, are have all sectors contributed evenly to the increase of new firm formation? Figure 9 shows that the construction and (business and personal) service sectors have grown disproportionately. These two sectors are certainly not a marginal group as they also include more than half the population of new firms in 2006. Two increasingly important contributing groups of entrepreneurs are female and foreign entrepreneurs. Female entrepreneurs are over represented in personal services, and relatively often starting a part-time business, while – especially Eastern European – foreign entrepreneurs have provided a substantial impetus to the growth of new construction firms (Braaksma and Meijaard 2007).

Figure 9 New independent start-ups per sector, 1987-2006 (index 1987 = 100)



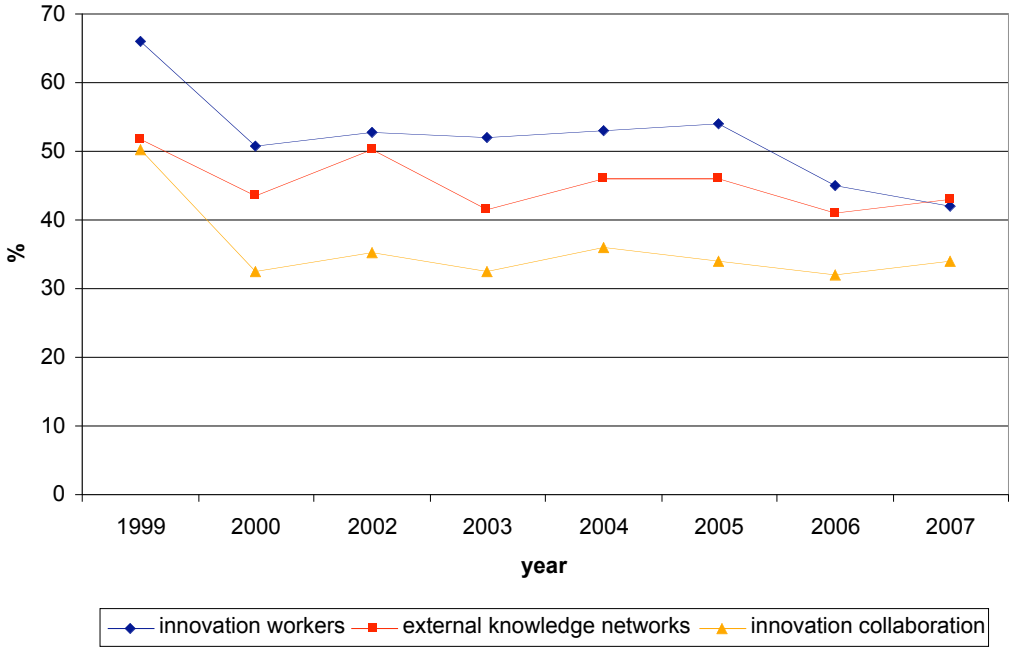
Source: EIM, based on data from the Dutch Chambers of Commerce (KVK)

The number of subsidiaries has increased even stronger than the number of independent start-ups. In the 1980s the number of firms and employment share of subsidiaries was respectively about 15% and 30% of the total number of new firms and employment, while in the 2000s the employment share of subsidiaries has risen to about 40% of the employment (and about 30% of the number of new firms). These subsidiaries are started out of 'offensive' and 'defensive' motives. Offensive motives lead to distributing different business activities in separate profit centres, and (thus) stimulating 'intrapreneurship'. An important defensive motive is reducing risk for corporations by creating financially independent subsidiaries.[17]

The number of techno start-ups, a relatively important category for technological innovation, has also increased over the last decade, however less strongly so than for the general population of new firms (Braaksma and Meijaard 2007). The share of start-ups with R&D has increased to a considerable degree from 10.4% in 1994 to 19.2% in 2003 (Braaksma and Meijaard 2007). This is in contrast to the innovativeness of SMEs in general, which has decreased substantially over the last eight years (see figures 10 and 11).[18] The latter trend resembles the general decline in innovative output of the Dutch business population (with more than 19 employees) over the last decade (CBS 2007).[19]

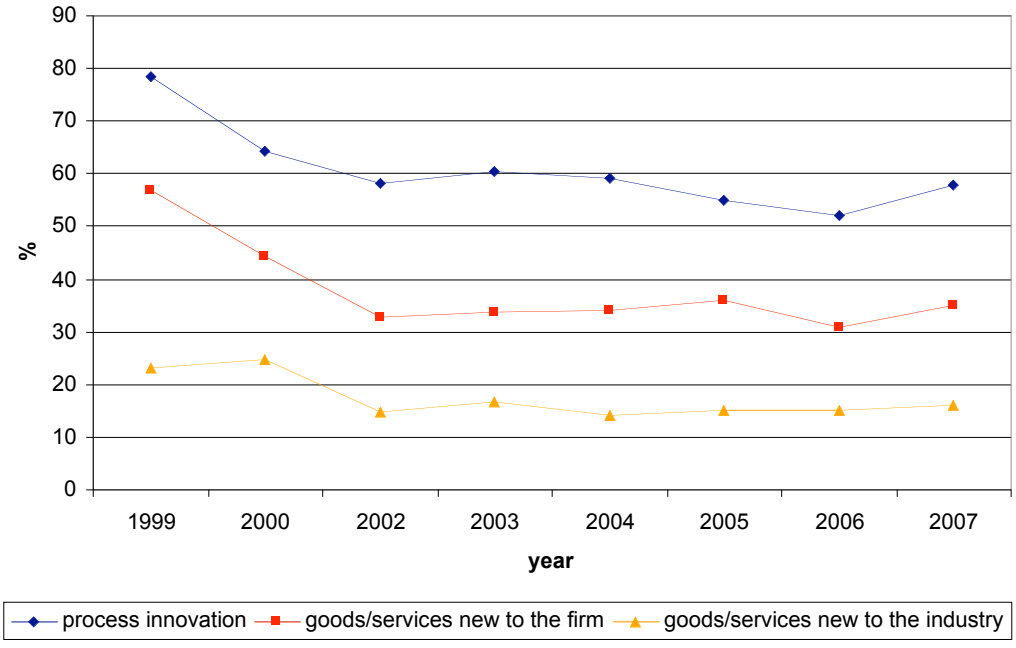
[17] A low performing subsidiary may eventually go bankrupt without dragging along the corporation as a whole.
[18] Unfortunately the data for 2001 was not available for figures 10 and 11.
[19] A business cycle explanation of these dynamics does not seem to match the data, as there had already been a strong downward trend before the post-2000 recession started. In

Figure 10 Innovation inputs of SMEs in the Netherlands, 1999-2007



Source: De Jong and Jansen 2007

Figure 11 Innovation outputs of SMEs in the Netherlands, 1999-2007



Source: De Jong and Jansen 2007

addition, research has shown that in general innovation behaviour is pro-cyclical, but that innovation behaviour of SMEs is countercyclical (Heger 2004). This latter phenomenon is explained by the lack of access to qualified labour for SMEs in boom periods.

3.3 Entrepreneurship and innovation in the Netherlands: summary
If we summarize the findings on entrepreneurship and innovation in the Netherlands in an international perspective and over time there is 'good' and 'bad' news. The good news is that the annual number of new firms has almost tripled over the period 1987-2006. This spectacular increase is to a large part traceable to the increase in the number of branches that have been set up annually. This can be done for offensive reasons, for example as corporate venturing, or for defensive reasons, for example to allocate risky activities to separate legal entities. The growth of techno start-ups has also been considerable, though less spectacular than the growth of new firms in general. The share and number of new firms with R&D activities has also increased in the last decade (1994-2003), indicating an increasing number of innovative start-ups. In addition, young SMEs seem to be more innovative than older SMEs, implying that an increase of start-ups will probably lead to a more innovative business population.

However, there is also some bad news for innovation. First, a large part of the new firms seem to be self-employed that continue with the same activities (mainly in the construction and services sectors), which had been executed as employee before. This is not likely to improve the (product) innovativeness of the economy at all. At most this means a more flexible economy, and an improved allocation of resources (static efficiency), and in the end a higher productivity.[20] Second, on average SMEs have become less and not more innovative in the last decade (1999-2007), and the percentage of innovative SMEs is much lower than the EU average. Most SMEs are not innovative at all (see also Parker 2001). Third, the Netherlands is lagging behind internationally with respect to ambitious entrepreneurship. This is not a recent phenomenon, but seems to be consistent in the last decade, in spite of several policy measures that have been taken to improve these numbers.

4 Entrepreneurship and innovation policy

The objective of innovation policy is to encourage and facilitate the generation, application and diffusion of new ideas, in particular innovation systems. The systemic nature of innovation means that we should not base our insights and recommendations on a linear view of innovation. Entrepreneurship plays a role in different phases of the cycle of discovery (Nooteboom 2000). We know that entrepreneurship fulfils an important function in the innovation system (cf. Hekkert et al. 2007), but this does not mean that more entrepreneurship is always better for the functioning of the innovation system. Two disclaimers apply: an empirical and a systemic. The empirical disclaimer is that not all that is counted as entrepreneurship necessarily involves innovation (not all new and small firms are innovative) and not all entrepreneurship is counted (corporate entrepreneurship is hard to

[20] More research is needed to disentangle different types of self-employed and their direct and indirect effects on innovation and economic growth. An interesting question in the Dutch context is whether the institutions that have fostered flexibility and modest wage increases have improved self-employment (static efficiency) but not innovation (dynamic efficiency) (cf. Engelen 2002).

trace with empirical research). Aiming at higher numbers of new firms, small firms, or self-employed will thus not automatically imply an increase in innovation. The systemic disclaimer has two aspects. First, the elements of an innovation system should be aligned in some way in order to function properly: the elements should be sufficiently present and well connected to the other elements. This means for example that if the number of innovative new firms increases, but without sufficient venture capital supply or advanced customers, this will not lead to higher levels of economic growth because the newly introduced products are not commercialised to a large extent due to a lack of investment means or a too small market base. Second, not every system needs the same level of entrepreneurship. Mowery and Rosenberg (1993: 29) showed that new firms in the US have played a significant role in the commercialisation of new technologies; a role which the new small firm does not necessarily play in the innovation system of other countries (e.g. Japan and Sweden).[21] Several configurations could explain this. First, internal corporate venturing could act as a substitute of new firm formation. This means that if large firms in a country are relatively less inert and bureaucratic (and risk averse) than in other countries – for example due to different formal and informal institutions – there is less need for employees to start a new firm in order to exploit a new idea. Second, organizational innovations, for example in the form of new forms of network organisations, could also enable the recombination of resources without installing new legal entities. Third, certain – especially large scale, and incremental (Winter 1984) – innovations are better realized in large firms than in small firms.

Does all this mean that nothing remains to be said about entrepreneurship in innovation policy? No, but first we should be careful not to start with sweeping statements about the supposed backwardness of the Netherlands and to take the US as the role model entrepreneurial economy. Entrepreneurship policy in the Netherlands can get inspiration from top-performing countries in this respect, but the initiatives have to be tailored to the Netherlands' context. Second, we should use indicators of entrepreneurship that are as close as possible to innovation, including both exploration and exploitation. This means that for example spin-offs and new technology based firms are probably better indicators of exploitation of unused ideas than the general population of new firms. High-growth start-ups are even stronger indicators of successful exploitation on a relatively large scale. However, we should not neglect exploration. Exploration could be involved in many 'experimental' new firms that just try out new ideas, and which might act as a source of learning for the firms in related activities, even

[21] This means that it is unlikely that there will be institution-free descriptions of best practices in entrepreneurship and innovation policy (cf. Chesbrough 1999, 2003). Sweden, for example, is renowned for the economic dominance of large firms and is often cited in comparative entrepreneurship studies as a country whose institutional environment discourages entrepreneurship (see also figures 3 and 4 in this paper), however, it is a leader with respect to innovative entrepreneurship indicators (European Commission 2006a; Parker 2006).

if these start-ups fail on the short run.[22] In this sense, it is important to let "thousand flowers bloom". An entrepreneurial climate – with a low stigma on failure – is likely to facilitate these experimental firms. With these remarks in mind, the next subsections deal with how institutions might be changed in order to stimulate new firm formation in general, and techno start-ups, spin-offs and corporate venturing, and finally high growth start-ups in particular.

4.1 New firm formation

The total supply of entrepreneurs varies among societies due to different prevailing values and beliefs related to entrepreneurship, i.e. its entrepreneurial culture. Economists generally share the opinion that it is not the role of government to change the attitude of its people, perhaps even leading to 'social engineering' (Storey 2002), or that public policy cannot change the culture of a country in order to stimulate the supply of entrepreneurship, on the short term (Baumol 1990). Some economists have argued that entrepreneurship is an omnipresent aspect of human action, and that for economic development to take place, certain institutions must be present in order for the entrepreneurial aspect of human action to flourish (Boettke and Coyne 2003). This omnipresence also means entrepreneurship cannot be the "cause" of economic development: it is caused by proper institutions that channel entrepreneurship in a direction that spurs economic growth (cf. Baumol 1990). Entrepreneurship policy in the Netherlands also includes integrating entrepreneurship in the education system in order to develop entrepreneurial skills and promote an entrepreneurship culture on the long run. The latter aspect is a clear example of the convergence of entrepreneurship and innovation policy, in that a strong entrepreneurial culture is an enabling context for the emergence of innovations.

The other more direct role for public policy involves changing the formal institutions in order to stimulate productive entrepreneurship. Examples of these formal institutions relevant for entrepreneurship are taxation rules, bankruptcy regulations, social security rules, and immigration laws. Enough has been said and done about the first three of these. The latter is less straightforward.

Innovation systems are not closed systems: exploration taking place in one country, might lead to exploitation in another country, and the other way around. This also means transnational entrepreneurs might function as important linking pins between different national innovation systems. This legitimises accelerating changes in the immigration system in order to attract in (potential) entrepreneurs from elsewhere (cf. Saxenian 2006) as part of – person-level – entrepreneurship policy, and innovation policy. This could also involve targeting ambitious expatriates to relocate back to the

[22] In addition to this, empirical research has shown that entrepreneurs that have started multiple firms ('habitual entrepreneurs') are more often innovative than one-off entrepreneurs (Ucbasaran et al. 2007).

Netherlands (or to become transnational; with firms registered in the Netherlands and elsewhere) and start an internationally oriented new firm.[23]

4.2 Techno start-ups

Techno start-ups are a particular kind of new firms, which are very important for the diffusion of new technologies, possibly in new applications. The stimulation of new technology based firms is an example of the convergence of innovation and entrepreneurship policy, as this improves both the creation and diffusion of new technologies and the levels of entrepreneurship (cf. Garnsey 2001).[24] Indirectly, public R&D spending (as part of innovation policy) could increase opportunities for new firms (part of entrepreneurship policy).

As a form of economic organization, new technology based firms are ideally suited to minimizing the social risk of experiment in developing applications of new technologies. They have every incentive to find such applications, but at the same time the cost of the inevitable failed experiments is not multiplied by the bureaucrat's temptation to pour good money after bad rather than admit failure (Rosenberg and Birdzell 1986: 312).

There has been much debate in economics whether R&D divisions of large firms provide better incentives for innovation than entrepreneurial firms. A study by Kortum and Lerner (2000) showed that the ratio of venture capital (invested in young technology based firms) to corporate R&D investments in manufacturing is about 3%, while venture capital accounts for about 15% of industrial innovations (measured by patents). The apparently greater efficiency of venture funding in spurring innovation raises questions about whether industrial R&D spending has been optimally directed or exploited. Jensen (1993) has argued that agency problems have hampered the effective management of major corporate industrial research facilities. Indeed, it appears that many major corporate research facilities are today in the process of being restructured. One striking change is an emphasis by many large firms on adopting (open innovation) programs, such as joint ventures with smaller firms and strategic investment programs, whose structures resemble that of venture capital investment (for an overview, see Rosenbloom and Spencer 1996).

One of the key market failure arguments for innovation policy is that the private return of a developing and commercializing a new technology is below the social rate of return. This situation might be explained if (new technology-based) firms are unable to fully appropriate the rents on their

[23] More research is needed to gain insight into the effects of migration of highly skilled labour - and the subsequent transnational entrepreneurship - on innovation and economic growth.

[24] New technology based firms are more likely to be innovative (due to the technologically dynamic nature of the industries in which they are active), and are likely to involve viable businesses due to the high-opportunity costs of the founders (leaving behind secure well paid jobs).

innovations. In such a situation entrepreneurial activities could be lower than socially optimal. Three key problems in this respect are:

1. problems of appropriating the rents of the innovation (spillovers)
2. financial constraints to invest in the development of new technology (asymmetric information between potential investors and the entrepreneur)
3. uncertainty about demand for the new technology/product in the market place

Government interventions to tackle these problems are:[25]

1. securing intellectual property rights
2. stimulating seed capital and early stage capital (with subsidies, tax reductions, or favourable interest rates)
3. government as leading customer (or setting standards/certifications)

Intellectual property right policy has become more of a European policy issue (European Patent Office) than a strictly national one. Examples of the second type of interventions are the Small Business Investment Company (SBIC) Program in the US (providing long-term funds with favourable interest rates to private companies that invest in small firms), the Carbon Trust in the UK (co-investor in the low carbon technology field), and the Technopartner program in the Netherlands.[26] The goal of Technopartner is to realise an increase in and improvement of the quality of techno start-ups by mobilising the risk capital market for techno start-ups through the Seed Facility (comparable to the SBIC Program in the US). This facility accommodates loans to private investment funds. Technopartner also offers direct support and financial scope to new technology based firms and stimulates knowledge institutions to professionalize their patent policy through the Subsidy programme Knowledge Exploitations (SKE).

An example of the third type of interventions is Small Business Innovation Research (SBIR) program in the US.

> The US Congress enacted the SBIR program in the early 1980s as a response to the loss of American competitiveness in global markets, especially in face of the "Japanese threat". The US regulation underpinning the SBIR programme requires that 2.5% of all federal government agencies' external R&D budgets are distributed to innovative small firms. Each year the SBIR program makes over 4,000 awards to US small firms, amounting to over $2 billion in value (Connell 2006). The SBIR consists of three phases. Phase I is oriented towards determining the scientific and technical merit (technological creativity) along with the feasibility (economic creativity) of a proposed research idea. A Phase I award (typically around $100 k)

[25] These are very general policy implications: they do not indicate how large the subsidies should be or within which specific area one should intervene, and they also do not say which policy instruments should be given priority. Unfortunately, the systems of innovation approach does not do better than the market failure theory in providing specific policy implications (see Edquist 2001).

[26] See Boot and Schmeits (2004) for a useful review of imperfections in the capital market for innovative firms, and public policy in the Netherlands.

provides an opportunity for a small business to establish the feasibility and technical merit of a proposed innovation. This is a venture capital segment – seed capital – that is generally ignored by private venture capital. Phase II awards are more selectively aimed at developing new technologies and products, which involves about 50% of the phase I award winners, and delivers up to $750 k. Phase III awards are funded from mainstream (i.e. non SBIR budgets), and add probably again as much as Phase I and II in total to overall R&D expenditure on SBIR projects (Connell 2006). These Phase III projects also bring small firms the opportunity to win valuable sole supplier contracts with federal agencies. Some of the most innovative American companies, like Genzyme, Amgen, Genentech, and Qualcomm received early stage SBIR finance. Lerner (1999) showed that SBIR funded firms enjoyed substantially greater employment and sales growth than other similar firms. It is not just the size of the subsidy that is important for the recipients: these awards also play an important certification function, increasing the trustworthiness of the recipients.

Programs like the SBIR are highly valuable in making governments lead users/customers for innovative new and small firms in 'public sectors'. There are indications that the Netherlands is lagging behind with respect to these kind of government procurement of advanced technological products (Porter et al. 2007).

4.3 Spin-offs and corporate venturing

We discussed the conditions under which spin-offs are more likely than corporate venturing as a means of exploitation. Both types of entrepreneurial effort involve an entrepreneurial opportunity that is based on the existing knowledge base of the parent firm. Spin-offs and corporate venturing are thus likely to be the vehicles of innovation, and sources of so-called related variety: exploring new options based on existing capabilities. In addition spin-offs provide new nodes in an inter-organisational network. There has been much public policy and media attention for university spin-offs, while corporate spin-offs and corporate venturing have largely been neglected. Corporate spin-offs are both more numerous and more likely to be successful (due to better capabilities and market orientation: exploration based on exploitation), while corporate venturing has a direct positive effect on the innovativeness of large firms, which is likely to lead to an increase in macro economic growth. Should public policy pay more attention to spin-offs and corporate venturing; if yes, how?[27]

There are several problematic issues in the practice of corporate venturing, which explain why corporate venturing units often fail (Birkinshaw and Hill 2005). For example, it has been argued that mixing both corporate trained people and people from the venture capital world is one of the key factors behind corporate venturing (Birkinshaw and Hill 2005; Ernst et al. 2005); however, many companies are not willing to have venture capitalist as 'intruders' in their business. This might constrain the development of high-potential new businesses. Another delicate issue is the appropriation of the

[27] For example, the UK government has introduced a tax relief for corporate venturing in 1999. However, one could doubt the effectiveness of such a measure, given the low additionality of it: i.e. if corporate venturing is important to (especially large) firms, they will do it anyway, and only the accountant will notice the advantage of this tax relief.

rents from innovation: how are these distributed over the top-management, corporate venturing unit staff, and the employees that started the initiative? In addition, how and when will the new venture be integrated into the incubating organization? If the venture is integrated too early, the innovation might die because of the parent's bureaucracy, while if it is integrated too late, the venture has developed an identity and routines of its own, which constrains re-integration.

> Corporate venturing is never easy, but it is beginning to be recognised as something that far-sighted companies cannot do without (Birkinshaw et al 2002: 43)

Stimulating an entrepreneurial culture is not only a mission of the government: large firms also play a role here, for example with their corporate venturing practices. Corporate venturing could lower the risk averseness in large firms, but this should also include the alignment of incentives and the attitude towards failure. Large firms' corporate venturing practices will only create value on the long term if the whole organization has been made more 'entrepreneurial'. In addition, corporate venturing is a means to stimulate the investment behaviour and in the end innovativeness of large firms. This should not be a one-off action, but should be a structural element of corporate strategy ('serial corporate ventures', like Intel (external VC) and 3M (internal VC)). Corporate venturing can also create a platform where entrepreneurs, managers and investors can find each other. Entrepreneurs may acquire (technical and commercial) expertise of large firms, and financial means of (corporate or private) venture capitalists.

Stimulating entrepreneurship in existing firms (corporate entrepreneurship) is probably the best policy to start with: stimulating entrepreneurial initiatives that have access to a large range of resources within or via the mother firm. However, some characteristics of large firms (inertia, incentive structures) make this an unlikely success. That is why stimulating spin-offs might be a second best policy option. To some extent this is also easier to affect by government policy as it is very much related to labour market and competition regulation. One important entry barrier especially for growth-oriented spin-offs is anti-competition clauses . Government regulation might reduce the use of these clauses. However, this might have negative effects on investments of firms in their employees and of venture capitalists in their portfolio firms, as the (potential) entrepreneur can leave to competitors or set-up another firm with knowledge of the proprietary organization (cf. Fallick et al. 2006).

Corporate venturing might be connected to universities in order to tap their knowledge and look for commercial applications. A related trend can be identified in the UK where university incubators have become private organizations (like ISIS Oxford, Imperial Innovations; see Library House 2007). This privatization of university incubators both provides these organizations with more competent staff, and 'purifies' the university as producers of public knowledge (cf. Lester and Piore 2004).

4.4 High growth start-ups[28]

High growth start-ups are the economic entities that are successful in commercializing new ideas on a large scale in a short term. These firms are serious candidates for industrial leadership of tomorrow. However, the contradiction for public policy is that policy makers grant themselves an important role in stimulating these (potentially) successful firms (Smallbone et al. 2002; MinEZ 2006), but that these firms themselves regard government intervention as a very marginal influence on their success (see Fischer and Reuber 2003; Perren and Jennings 2005; Te Peele and Brummelkamp 2007). This brings us back to the discussion of picking the winners or backing the challengers.[29] Challengers are ambitious new firms that have already revealed some of their potential to become leaders in their (sector or geographically unique) niche.[30] Leadership in a sector unique niche involves the creation of a new technology or product that might be diffused globally (e.g. the development of new ERP software by BAAN, or digital route planners by TomTom), while leadership in a geographically unique niche (i.e. the Netherlands as a whole or a specific region initially) is likely to involve the application or adoption of technology or product that has been developed in another country (e.g. the early leaders in the Dutch Internet Service Providers industry: XS4All and Planet Internet). The latter type of leadership is not based on pushing the technological frontier (technology push), but on advanced users that spur the development and diffusion of new applications.
One measure to stimulate high risk and potentially high-growth start-ups is to lower the barriers to incorporation. Incorporation provides a means to safeguard ambitious entrepreneurs from the high risks of growing a new business, by making the incorporated firm and not the entrepreneur responsible for the eventual financial losses. Lowering the barriers to incorporation is likely to stimulate firm growth (Storey 1997), but also leads to higher bankruptcy rates (Harhoff et al. 1998). The net effect of these two outcomes – increase of the number of high-growth start ups and of the number of bankruptcies – on the societal level is still unknown.
Research has shown that probably the best entrepreneurship policy could do for young high growth firms is to stimulate communities of practice of entrepreneurs leading (potentially) high growth firms (Smallbone et al. 2002; Fischer and Reuber 2003). Such peer-networks have already been initiated in many ways, and are also facilitated by the Dutch Ministry of Economic Affairs (see Waasdorp and Bakkenes 2006).

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[28] See Stam et al. (2007) for an overview of the literature on the economic importance of high growth entrepreneurs, and the rationales for public policy.

[29] The so-called "uitdagerskrediet" (challengers credit) partly covers this field. It is a public credit facility for financing challenging innovation projects of SMEs, in which new goods, processes or services will be developed, that will lead to fast and substantial growth of the firm.

[30] Focus on post-entry policies minimises the risk of waste and the possible substitution effect of government subsidies. A possible deadweight effect should be avoided by the identification of those firms that are good enough to survive but not strong enough to grow (i.e. that do not have the financial means to invest substantially) (cf. Santarelli and Vivarelli 2007).

5 Summary

This paper has provided insights into the nature of entrepreneurship and its role in innovation and economic growth. We have defined entrepreneurship as the introduction of new economic activity by an individual that leads to change in the marketplace. Innovation is a necessary condition of entrepreneurship, just like the existence of entrepreneurial opportunities and heterogeneous risk taking individuals that organize the exploitation of these opportunities. Entrepreneurial opportunities can emerge from major scientific breakthroughs, but also from more mundane applications of existing solutions in new contexts. The particular characteristics of the opportunities, the organizations in which they were discovered and the persons that perceived them affect the trade-off between exploiting these opportunities in the incumbent firm (corporate venturing) or in a spin-off firm. What matters for macro economic growth is the performance of these entrepreneurial efforts. Both new firm formation in general and high-growth start-ups in particular play their role in economic growth. New firms are useful devices for exploring the viability of innovations. They start small, with relatively low costs and in large numbers. The provision of requisite variety comes at a cost, because most of these new firms fail. However, without these large numbers of experiments, breakthrough innovations and new industries and industry leaders are less likely to emerge. Still, if this pool of experiments does not lead to a sufficient number of high-growth start-ups, they are less likely to lead to economic growth. They might have other indirect effects on economic growth by providing knowledge about 'failed experiments' to incumbent firms, and acting as a potential threat to incumbents that will spur corporate renewal. Investments in the knowledge base of existing organizations also provide a source of entrepreneurial opportunities, to be commercialised by knowledge-based new firms. In this perspective new firms provide the missing link between investments in science and technology and economic growth.

We have zoomed in on the development and presence of diverse forms of entrepreneurship in the Netherlands. Even though the annual number of new firms has increased spectacularly (almost tripled) over the period 1987-2006, there are more weaknesses than strengths with regards to entrepreneurship in the Netherlands. First, a large part of the population of new firms seems to be self-employed that continue with the same activities (mainly in the construction and services sectors), which had been executed as employee before. This is not likely to improve the (product) innovativeness of the economy at all. Second, on average SMEs have become less and not more innovative in the last decade, and the percentage of innovative SMEs is much lower than the EU average. Third, the Netherlands is lagging behind internationally with respect to ambitious entrepreneurship. This is not a recent phenomenon, but seems to be consistent in the last decade, in spite of several policy measures that have been taken to improve these numbers. The Netherlands seems to have become a good place for self-employed with low ambitions, but this has not been accompanied by a rise in innovativeness and high-growth firms. Especially the low number of ambitious entrepreneurship seems to be worrisome, as this is a strong driver of national economic growth.

What is the role of entrepreneurship in innovation policy? We have stated two important disclaimers concerning the measurement (not everything that is counted as entrepreneurship concerns innovation) and systemic effects (more entrepreneurship does not always mean more economic growth) of entrepreneurship. A small set of specific types of entrepreneurship – techno start-ups, spin-offs and corporate venturing, and high growth start-ups – seems to be more relevant for innovation than other types. The capital provision for techno start-ups is already stimulated by a set of policy measures within the Technopartner program in the Netherlands. Implementation of a SBIR-like program would probably lower the uncertainty about demand for new technologies and further stimulate the emergence and growth of new technology based firms. Corporate venturing is a highly important means to stimulate the innovativeness of incumbent firms, but unfortunately corporate venturing strategies seem to be less often successful than is needed for a dynamic innovation system. A second best solution in this respect involves – university and especially corporate – spin-offs. The last but not least important type of entrepreneurship that is discussed in the context of innovation policy is the high-growth start-up. These firms probably need the least government support, but policy could play a role here in facilitating communities of (high-growth) practice that stimulate peer-to-peer learning of the entrepreneurs involved.

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