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Business R&D in SMEs

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[1] IRMA activities correspond to the implementation of the approach set out in "Investing in research: an action plan for Europe" (COM, 2003) and in further Communications of the Commission: "More Research and Innovation – Investing for Growth and Employment – A common approach", COM (2005) 488 final, "Implementing the Community Lisbon Programme: A policy framework to strengthen EU manufacturing – Towards a more integrated approach for industrial policy", COM (2005) 474 final.

Abstract

This report discusses business R&D in SMEs in the light of a systematic review of publicly available information on industrial R&D, its common trends and related emerging issues.

A number of factors towards better understanding of SME trajectories, specifics in terms of their R&D activities, and the attendant main challenges of SMEs are thus examined along their main boundaries. Company size, the life cycle stage of individual firms, the lack of entrepreneurial spirit in the EU, the lack of access to finance in Europe compared to the US, limited capabilities of SMEs, internationalisation/globalisation effects, intellectual property rights, and the effect of administrative burdens are considered in particular.

In general, achieving a suitable support mix for business R&D in SMEs and embedding it in local, regional, national and European research and innovation systems remains an open but crucial question on the way towards achieving the Lisbon objectives.

JEL Classification: O33

Keywords: business R&D, SMEs

1   Introduction and Methodology

This document emerged from the *Digest of Industrial R&D*[2]*,* whose objective is to provide a review of the recent literature on industrial R&D in a policy-maker friendly format, aiming for a better understanding of industrial[3] R&D investment in Europe[4]. The *Digest* uses systematic information screening, selection and processing activities in order to develop a "bottom-up" picture of the most relevant issues surrounding this subject.

Publicly-available sources, including academic books and papers, documents produced by national governments and international organisations (such as the OECD, the UN and the EU), in-house research at the IPTS and other EC-related working groups, and reports by private organisations were covered in the *Digest* activities.

Four main topics emerged in the first edition of the *Digest*[5]: the impact of business R&D, levels and patterns of business R&D investment, factors that influence those investments, and the internationalisation of business R&D. Following the experience with the first edition, the methodology was improved through incorporating a wider range of sources, in-depth expert discussions for trend identification, and the use of standard templates to structure the information. The most relevant topics have been selected according to the degree of relevance for the following issues:

(a) **Problématique**: the issue at stake and its economic and policy relevance of issues.
(b) **State of the art**: the novelty of literature on this topic.
(c) **Divergence**: the different points of view on the issue, based on existing literature.
(d) **Blind spots**: areas where there is a lack of policy relevant information.

The process was designed to make the exercise as comprehensive, up-to-date and policy-relevant as possible. Given the "bottom-up" character of the process and the quality of the resulting reports, the most interesting reports are published as a self-standing document.

The present report, Business R&D in SMEs, aims to be a useful reference work for policy-making, research and business alike. Comments, feedback and other input are welcome and can be sent by email to: JRC-IPTS-IRI@ec.europa.eu.

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[2]   The Digest was an activity within the Industrial Research and Innovation Monitoring (IRIM) project carried out jointly by the Joint Research Centre (JRC) and the Directorate General Research (DG RTD) of the European Commission. The other IRIM activities are the EU Industrial R&D Investment Scoreboard, the EU Survey on R&D Investment Business Trends, and the Economic and Policy Analysis Report.
[3]   The terms *industrial, corporate, business, and private-sector* R&D are used interchangeably throughout this document.
[4]   IRIM activities are undertaken at the JRC's Institute for Prospective Technological Studies (JRC-IPTS) and are co-funded by DG Research.
[5]   The pilot Digest is available at http://iri.jrc.es/research/docs/annual_digest_ird.pdf

2 Business R&D in SMEs

When discussing business R&D in small and medium-sized enterprises (SMEs) it needs to be recognised that there are many aspects to be taken into account, such as the limited capabilities and resources available to SMEs, the diseconomies of scale they face in R&D activities, and also the stage of the firm's development (e.g. start-up or established niche market producer). Indeed, when considering 'R' & 'D' in SMEs in relation to a company's life cycle, SMEs usually begin with innovation, then moving on to do 'D' in the sense of developing incremental innovations in a given product and/or process and then occasionally they perform some 'R', either in-house or through outsourcing. Accordingly, in the course of this report SMEs' challenges and limits regarding business R&D have to be identified (with reference to the literature), and relevant arguments as well as empirical evidence have to be 'digested'. And all this always needs to be done from different angles (different size classes, firm's life cycle stage, etc.).[6]

Reflecting common trends in R&D expenditures, rapid progress on increasing R&D expenditures in the EU is obviously needed if the EU as a whole wants to stay competitive. The 3% target set in Barcelona should not be seen in isolation, but as a key component in achieving the overarching objective, set in Lisbon, of becoming the most competitive and dynamic knowledge-based economic region in the world. Nevertheless, given the diversity of business environments in the Member States (henceforth, MS), it has to be recognised that a 'one-size fit all' approach will not deliver the increase in R&D spending that the EU needs to see in order to compete effectively in the global marketplace (Gallup Organization, 2006). In fact, if SMEs have an important role to play in reaching the 3% target, the available evidence also shows that the overall performance of European SMEs in R&D activities is a particular matter for concern: while the share of SMEs contribution to total business R&D expenditure rose significantly in the US, for instance, the overall trend in Europe is just moderate.

In this context, a high-ranking SME Expert Group[7] analysing R&D in SMEs in 2004 pointed out that 'the recent situation in European MS can be characterised by the general absence of specific policies that discriminate and exclusively address R&D activities in SMEs.' Indeed, 'most programmes, measures and initiatives in MS's R&D and innovation policies already address SMEs as part of the national business enterprise sector'. In other words, in most MS there is no specific strategy for SMEs because these are often an implicit target group of R&D promotion policies. Public funds are an important source for financing R&D and innovation by SMEs, especially for young entrepreneurs, start-ups, spin-offs and high-tech SMEs (Gallup Organization, 2006; European Commission, 2006a).

This report aims to give an overview of the specifics, strengths and limitations of business R&D in SMEs, outlining the particular challenges in this regard and describing the state of the art with respect to business R&D in SMEs, as defined in the literature.

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[6] The general question whether any public R&D is a complement or substitute for private R&D is not tackled in this report. See David, Hall and Toole (2000) for a review of econometric evidence in this regard or, for example, see Lokshin et al. (2006) for a more recent treatment of the issue.

[7] The *Expert Group on SME*, operating within the framework of the First/Second Cycle of the Open Method of Coordination [OMC] for the implementation of the Action plan "Investing in research: An Action Plan for Europe" (the so-called "3% Action plan"), has undertaken analyses of the situation and the problems SMEs in Europe are facing. The results are outlined in two reports: SME and Research(Gallup Organization, 2006); Design Measures to Promote growth of young research-intensive SMEs and start-ups (OMC-SME Expert Group, 2006). Thus, a series of recommendations addressing SMEs needs has been formulated.

Thus, the term SME here refers to the revised European Commission's definition of a SME[8], adopted by the Commission in 2003 (in effect since 01/01/2005). The revised definition also aims to clarify the typology of enterprises (a distinction is made between three categories: 'linked', 'partner' and 'autonomous' enterprises). It also introduces a method of calculating thresholds referring to the size classes, thus improving legal certainty.

Table 2.1: Thresholds related to SMEs, valid from 1 January 2005

Enterprise category	Headcount (unchanged)	Turnover	or Total Balance Sheet
Medium-sized	< 250	= € 50 million (in 1996: 40 million)	= € 43 million (in 1996: 27 million)
Small	< 50	= € 10 million (in 1996: 7 million)	= € 10 million (in 1996: 5 million)
Micro	< 10	= € 2 million (previously not defined)	= € 2 million (previously not defined)

Source: European Commission, 2006e

3   Why consider SMEs in particular?

There is a long debate tracing back to Schumpeter[9] about the role of small and large firms in technological progress and innovation. While in the eighties the pioneering role of large enterprises with their R&D units was stressed by academics and policy-makers, in the nineties the role and impact of SMEs was rediscovered. The empirical evidence suggests many examples of highly successful innovations stemming from small enterprises, which revolutionised entire industries. Start-up companies, young entrepreneurs, university spin-offs and small, highly innovative firms have often produced major technological breakthroughs and innovations and left behind the R&D efforts and innovation strategies of large global corporations. SMEs serve as important vehicles for knowledge spill-overs; their ideas, competencies, products, strategies, innovations and technologies are often acquired, accessed and commercialised by larger enterprises. They often create new markets and fulfil new consumer demands (European Commission, 2006a). It is a matter of fact that SMEs and entrepreneurship continue to be a key source of dynamism, innovation and flexibility in advanced industrialised countries, as well as in emerging and developing economies. Therefore it is crucial to consider SMEs, and in particular their attitude to both research and development, and common trends (growth patterns, sector composition/trends), and the problems they face, in order to achieve an understanding of the EU economy's positioning in terms of business R&D.

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8   Commission Recommendation 2003/361/EC of 6 May 2003 concerning the definition of micro, small and medium-sized enterprises, OJ L 124, 20.05.2003, p.36. This supersedes the former Commission Recommendation 96/280/EC of 3 April 1996 concerning the definition of SMEs, OJ L 107, 30.04.1996, p.4.

9   Joseph A. Schumpeter, *Capitalism, Socialism, and Democracy* (New York, 1942)

Figure 2.1: Breakdown of main indicators in EU-25's economy by enterprise size class (2001, percentage share of total)

Source: Structural Business Statistics, EUROSTAT.

SMEs account for up to 99% of the total number of enterprises in EU economies (depending on the country), generate about two-thirds of the employment and are the main source of job creation. In the EU-25 economies, 23 million SMEs provide employment for 66% of the private sector. Thus, micro-enterprises (0 to 9 employees) account for 70 - 90% while the category of small firms (0 – 49 employees) accounts for at least 95% of the total jobs in SMEs and, moreover, they generate more than half of the total value added of the EU-25 (OECD, 2005a). This evidence provided the main reason for introducing the general EU principle (initiative) of *think small first* (European Commission, 2006f).

Although there are clearly strong reasons to focus on SMEs, the situation in Europe might appear to be different from that elsewhere in the world: SMEs account for a larger share of business R&D in the EU than in the US and Japan, performing 22% of business R&D in 2002 (see: European Commission, 2005a, p.40).[10] Indeed, European SMEs conduct a growing share of R&D, although they still lag behind large firms in most OECD countries. The higher concentration of R&D expenditure in European SMEs should not be a problem if this supports company expansion. Empirical evidence, however, shows that, while some SMEs (particularly high-tech ones, often labelled 'New Technology-Based Firms' or NTBFs) can grow rapidly and become crucial players in many industry sectors, the typical growth path of such a SME is more likely to be successful in the US than in Europe. For example, only 16% of the EU-15's current largest companies were established more recently than 1980, as opposed to 30% in the US (these companies are taken as examples of very successful start-ups). Out of these large companies created after 1980, only 37% were created from scratch in the EU (the remainder being the result of mergers and acquisitions) compared to 82% in the US (Cohen and Lorenzi, 2000, European Commission, 2005a). It is therefore essential to support the creation and expansion of SMEs, especially in high and medium-high technology intensive sectors and to ensure that the right conditions exist for SMEs to flourish and for Europe, therefore, to achieve its R&D potential.

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[10] Note: Countries that are characterised by a relatively large share of business R&D by SMEs, such as the new MS, Italy, Greece, and Spain, also have low business R&D intensities. Conversely, countries with low concentrations of business R&D in SMEs – e.g. Sweden, France, Germany, Austria, Japan and the US – also have higher business R&D intensities. Countries with low R&D intensities and relatively less developed research systems often lack the minimum scale to host large R&D intensive companies; which in turn explains the predominance of SMEs in their total business R&D expenditure.

4   R&D-performing SMEs in the EU: What do we know?

Despite the importance of SMEs for the European economy, the available information, for instance broken down by company size classes and activities, is somewhat limited. However, some data does exist and Eurostat, the OECD and others recently have undertaken notable efforts to improve the availability data on SMEs. Nevertheless, the databases are rather fragmented and often provide no more than anecdotal evidence, particularly with respect to micro- and small enterprises (which together account for about 50% of the EU-25's value added, see above). Moreover, very little information is available on SMEs' R&D activities.

It is well known that there is a lack of accessible and reliable data on European SMEs' innovation activities. As Fontana *et al.* (2006) explained at the European level, apart from the PACE (Policies, Appropriability and Competitiveness for European Enterprises)[11] questionnaire and the four Community Innovation Surveys (CIS), there are few databases that facilitate analysis of SMEs' innovation activity taking into account the firm, sector and country effects. For instance, the 2000 KNOW survey[12] could be used to analyse and compare the innovation processes in European companies employing from 10 to 999 employees. This questionnaire includes information on seven European countries, including the four largest. However, the range of sectors it covers is limited to just five sectors: food and beverages, chemicals (excluding pharmaceuticals), communications equipment, telecommunications services and computer services (Fontana *et al*., 2003).[13]

As regards data on entrepreneurial activities, there are three resources that the empirical literature has been using during the last few years: the Global Entrepreneurship Monitor (GEM) database, the Eurobarometer survey produced by the European Commission, and the Compendia data set produced by the OECD. The Eurobarometer survey on Entrepreneurship conducted in 15 Member States and the US covered roughly 8500 respondents in 2000 (Grilo and Thurik, 2005 and Grilo and Irigoyen, 2006 are examples of the use of this dataset).[14] The GEM dataset includes various measures of entrepreneurship at different levels across 29 countries (for a detailed explanation of GEM see Stel *et al.*, 2005). And, finally, the Compendia database shows evidence of 23 OECD countries (as an example of this dataset, see Audretsch *et al*., 2002).

In general, comparing SMEs within a certain sector or region, aggregated at MS level, in Europe to SMEs in other countries, such as the US or Japan, implicitly assumes that there are some common patterns for all such firms. However, there is some empirical evidence to suggest that such a comparison may give a biased view, at least as far as frequently applied benchmarks in the US are concerned. First of all, the definition of SMEs in the US is different

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[11]   See Arundel *et al.* (1995) and Arundel and Geuna (2004) for an analysis based on the PACE data, which focused on the large EU R&D intensive firms.

[12]   The goal of the KNOW project (1999 – 2001; Title: *Innovation-related knowledge flows in European industry*: *Extent, mechanisms, implications*) was to empirically appraise the diffusion of knowledge of relevance to the innovative activities of European industry, including both manufacturing and service sectors. The appraisal has focused on questions of interest to regional, national, and pan-European science, technology and innovation policy. Project financed under TSER Programme, contract n°: SOE1-CT98-1118. See final report: http://cordis.europa.eu/improving/socio-economic/area1.htm

[13]   The Know Survey was carried out in 2000. It is based on 70 in-depth interviews covering the listed sectors in Denmark, France, Germany, Greece, Italy, Netherlands and the UK.

[14]   This survey was conducted on behalf of the European Commission's Enterprise Directorate-General, and the key findings are presented in *Attitudes to Entrepreneurship in Europe and the United States – Some results from Flash Eurobarometer 83*. European Commission (2001), available at:
http://europe.eu.int/comm/enterprise/enterprishttp://europe.eu.int/comm/enterprise/enterprise_policy/survey/eurobarometer83.htm

(< 500 employees). But even if it were possible to correct the data for this difference, it is still questionable whether American SMEs are a good benchmark for Europeans, since the US is perhaps the only country in the world where R&D performing companies can be found at significant numbers in any size class of enterprises. Talking about closing a gap and achieving a world leading position in terms of business R&D should therefore also incorporate a discussion about the benchmark in mind. Thus, with rising aggregation level, comparability is more and more difficult to ensure, which limits general considerations of business R&D activities in SMEs. Therefore, it might be useful to consider some exemplary case studies of R&D-performing SMEs in Europe and the US and the problems these companies face.

Some general patterns emerge when comparing SMEs in the EU and the US. As mentioned, SMEs represent a higher share of total business R&D expenditure in the EU than in the US. However, after adjusting for differences in industrial structure between the EU and the US (i.e. correcting for the higher share of SMEs in GDP in the EU than in the US), the average R&D intensity of European SMEs vis-à-vis their American counterparts does not significantly differ from the situation of larger companies. In other words, from a static point of view, there is no *SME-specific* R&D intensity deficit (see European Commission, 2007, p.5). Moreover, EU companies are, sector-by-sector, as R&D intensive as their US counterparts, but they tend to be less involved in some very R&D intensive sectors/sub-sectors (especially the ICTs sector). In other words, the EU/US BERD deficit cannot be attributed to the fact that individual European companies perform less R&D than their US counterparts in the same sectors. The main reason for the deficit is the difference between the structure of European and the American industry (see European Commission, 2007, p.29).

Although it is possible to make very general statements at the aggregate level, it is difficult to filter relevant case studies from anecdotal evidence or extrapolate common patterns from the literature (this equally true for all SMEs). If possible at all, any statement in this regard most likely has to remain rather generic. When attempting to generalise, given the heterogeneity of firms, SMEs are commonly considered per sector or sub-sector, clustered by business model and/or main activities, growth rates, market positioning, export orientation or concentration on domestic market, degree of knowledge and/or technology intensity, etc. Combinations of these criteria are also used, such as classifying SMEs according to their sector alignment, given a certain sector's R&D intensity, such as 'high-tech', 'medium-high-tech', 'medium-low-tech', and 'low-tech' SMEs. For instance, the Observatory of SMEs in 2000 counted about 750,000 SMEs (approximately 4% of the total) as being active in high-tech industries, such as the pharmaceuticals, aeronautics, and telecommunications sectors. In this context, it is interesting to note that the lion's share of R&D activities in the economy is concentrated in these industries. Although the direct impact on the entire economy is limited with respect to employment, the indirect effects as generated by knowledge spill-overs are quite large (European Commission, 2006a), which may justify categorising SMEs in that way. On the other hand, highly technology-intensive companies are not necessarily the fastest-growing firms in any given market (different cluster). Indeed, high-growth-potential SMEs (so-called Gazelles), in principle, can be found in any sector. Accordingly, rapid growth among SMEs is not restricted to companies that are research-intensive and/or engaged in high-tech-industries.[15] Evidently, Gazelles in most cases are not high-tech companies, but innovative and technology-enabled companies. Through the innovative use of technology and/or a new innovative service, these companies are able to offer unique products, outperform their competitors (in terms of price or quality) or invent a completely new niche market that did not previously exist (OMC-SME Expert Group 2006, p. 151 ff).

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[15] For a more detailed analysis, see the following web page: http://www.higrosme.org

Summarising the empirical evidence, small firms tend to be more innovative in knowledge-intensive services such as business services and financial intermediation and less innovative in the relatively large wholesale and retail trade and transport and communications sectors. Whilst productivity growth has accelerated in the US in sectors using ICTs, in the EU productivity has yet to benefit from the boost ICTs can provide. The Federation of Small Businesses is worried that relatively few SMEs are making the most of the potential of ICTs. There is also evidence that SMEs in the computer services sector are as likely to innovate as large firms in that sector (European Commission, 2004). Altogether, R&D activities in SMEs appear mostly to be undertaken with a short-term horizon and are often carried out in an informal way. R&D activities are thus related to the acquisition, adaptation and improvement of existing technologies. Moreover, since research projects are sometimes indivisible and demand certain critical levels of scale, SMEs find it difficult to start R&D projects (European Commission, 2006a). Investment in R&D and innovation is risky and it is often very difficult to predict how successful the results will be. Galbraith (1952) asserted that small firms do not have the time to spend on R&D because it is too costly and risky, whereas by contrast large firms can spread the risk over a large number of R&D projects. He believed that the larger firms were better able than smaller firms to minimise the costs associated with R&D. Large enterprises, with established brands and channels to market, could spread their risk through diversification of their research and innovation activities. This option is not available to SMEs, which may stand or fall based on the success, or failure, of a single product or service.

But what general causalities between firm size and business R&D can be identified? This question has been investigated by Lee and Sung (2005). Thus, referring to Schumpeter's legacy, the authors stressed that the crucial factor is firms' heterogeneity of technological competences, rather than differences in industry-specific characteristics. According to a formal model of business R&D, the R&D intensity of a profit-maximising firm is determined jointly by firm-specific technological competence and consumer preferences on quality and price. However, the firm's size does not appear to affect its R&D intensity directly, but indirectly through its influence on firm-specific technological competence.[16]

In fact, there are significant barriers to innovation in large companies too, which may explain the ambiguity of the empirical evidence for any positive effects of firm size on innovation. Regarding the size of the firm, Schumpeter (1942) emphasised the positive influence of size on innovation, while a number of theoretical studies claim that larger companies have potentialities such as economies of scale, lower risk, a larger market and greater opportunities for appropriation (Fernández, 1996). However, empirical studies often fail to give such a clear picture. Indeed, whereas some find a positive relationship between size and innovation (Scherer, 1992; Scherer and Ross, 1990; Love *et al*., 1996; Cohen and Klepper, 1996; among others), others cannot confirm a significant (positive) influence (among others Mansfield, 1964; Acs *et al*., 1991, who report that small firms have an innovative advantage in highly innovative industries and in highly competitive markets). The majority of the advantages of larger firms are due to their easier access to finance and infrastructures, whereas in the smaller ones the advantages are centred around their flexibility and ability to adapt to new environments. Thus, the advantages of large-scale companies tend to be physical, whereas for smaller companies they tend to be behavioural.

Taking into account the relevant literature, the available anecdotal evidence, and lessons learnt from case studies concerning SMEs, it is possible to identify a number of challenges that particularly affect European SMEs. Since this apparently determines the trajectories of SMEs in the EU and, therefore, also sets the boundaries for any R&D done by these companies, these challenges will be considered in the following sections in more detail (looked at from the perspective of a SME that is already performing R&D or that is aiming to

do R&D but, however, is prevented from doing so for certain reasons that have yet to be discussed).

5 Challenges for SMEs in Europe: The boundaries of business R&D activities

There is much academic, public and political discussion about what the most important barriers preventing SMEs from innovating or investing in R&D might be. In general, innovation and investment barriers are linked to financial resources, knowledge, human capital and management competences (European Commission, 2003c). These areas are all equally important and the lack of capital is not necessarily the most serious obstacle to investing in R&D. Thus, any relevant challenges as well as measures that address these barriers have to be considered in a nuanced way. In addition, the perceived economic, technical and market-related risks hamper investment in R&D and innovation in SMEs (European Commission, 2004).

Although it is the company's size that is the crucial criterion when distinguishing small and medium-size enterprises from others, in the case of SMEs in particular there are other factors that are also important, such as the business model, market segment, sectoral alignment, etc. Nevertheless, there is one aspect that obviously is more closely linked to the company's size than all the others, namely the 'age' of the company or – more precisely – the stage the firm is at in its life cycle. It makes a difference (also with respect to R&D activities) whether a company is small because it is a very recently established business (i.e. a start-up) or because it has adjusted to the market environment (i.e. a niche player). Taking into account the Lisbon objectives and the obvious need for investments in business R&D and new technologies, it seems to be of enormous importance to emphasise business R&D in start-ups (particularly in NTBF). Hence, although a significant percentage of business R&D of all SMEs might currently be performed by established niche market producers seeking to defend their competitive position in their market (niche) based on technology, quality and/or price leadership (the 'competitive edge'), the discussion of challenges that SMEs usually face may begin with the visualisation of problems according to the firm's stage of life cycle (see Figure 2.2). Thereafter, the main boundaries of business R&D in SMEs will be discussed, such as the lack of entrepreneurship, access to finance, intellectual property rights, etc.

Figure 2.2: Obstacles (coloured squares) faced by R&D intensive (high-tech) start-ups (listed by phase in the life cycle)

	Phase 1: plans		Phase 2: start-up	Phase 3: growth	
	(1a) Formulation of ideas for commercialisation	(1b) From idea to financed b-plan (incl. prototype)	(2) From business plan to first customer and turnover	(3a) From first customer to initial profit	(3b) From initial profit to rapid growth, in 5 years
Entrepreneurial spirit	██	██			
Entrepreneurship		██	██	██	
Financial capital		██	██	██	██

Obtaining patents					

Source: OMC-SME Expert Group, 2006.

Entrepreneurship[17]

One of the most important issues regarding the challenges and boundaries of a given company, in terms of founding and running a company as well as business R&D activities, is entrepreneurial spirit. However, with regard to company creation, according to the literature, the EU economy is – compared to the US, for instance – characterised by a lack of entrepreneurial spirit, something often referred to as the 'entrepreneurial gap'. The Flash Eurobarometer 2005 survey on entrepreneurship pointed out that only 4% of Europeans had been involved in setting up a business in the past three years, yet almost half of Europeans say that they would prefer to be self-employed. However, differences between European countries do exist. For example, the Netherlands and Austria experience relatively low entry and low exit rates in this regard. Concerning the net growth in the overall number of companies, the rate has tended to be positive for many countries, and was 4.3% in the Netherlands, 3.3% in Germany, and 3.1% in the UK in 1999 (the most recent year for which data are available). By contrast, Japan experienced a drop of 2.1% and Belgium a decline of 0.6% in that year (OECD, 2005b).

Admittedly, there may be differences in entrepreneurial spirit between Europe and the US and Asian countries. However, the underlying reasons are manifold and it seems to be too simplistic to consider this the main obstacle or the origin of the gap in business R&D, because SMEs account for a larger share of business R&D in the EU than in the US and Japan (see European Commission, 2005a, p.40). No doubt with respect to the prosperity of the EU it would be more than welcome to stimulate European citizens' entrepreneurial spirit, but enhancing entrepreneurship in Europe seems to be difficult to achieve, particularly from a policy-maker's perspective, as it can only come about, if at all, step-by-step and may take considerable effort (information campaigns, training measures, changing public opinion). Therefore, it will remain a major challenge for a long time to come. A number of corresponding measures have already been implemented or at least scheduled at various institutional levels, such as founder seminars; management training sessions; implementing lectures in entrepreneurship at universities, business schools and colleges; providing contact points, etc. Nevertheless, much remains to be improved, particularly focusing on training company founders. Moreover, since a lot of potential entrepreneurs hesitate to launch their own company due to their lack of managerial skills, along with the anticipated administrative burdens involved in setting up and/or running a company, any efforts that are focused on enhancing the entrepreneurial spirit in Europe could be expected to be more fruitful if they first tackle such concerns (as discussed in the following sections).

It is often argued that the key to economic growth and productivity improvements is entrepreneurial capacity. It is now generally accepted that entrepreneurship contributes to achieving higher levels of economic development. For instance, using recent data from 18 European countries, Audretsch *et al.* (2002, 2006) even conclude that lagging behind in the process of restructuring from larger to small firms comes at an economic cost. Grilo and Irigoyen (2006) have found that the evidence from a sample of the workforce in 15 EU Member States and the US shows that no EU country scores better in any type of entrepreneurial

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[17] For a broad and actual set of articles regarding the new literature about entrepreneurship visit the Discussion Paper on Entrepreneurship, Growth and Public Policy from the Max-Planck Institute of Economics. Downloadable from: http://www.econ.mpg. de/english/research/EGP/discuss.php

capacity (both latent and actual entrepreneurship) than the US, confirming the widespread belief in a more developed entrepreneurial spirit on the other side of the Atlantic.

Access to finance

About 14% of SMEs state that easier access to finance would best assure the company's development (see Flash Eurobarometer 2005: third most frequent category, after more favourable social and fiscal regulations (31%) and better qualified people (16%)). Indeed, Carpenter and Petersen (2002) showed that, for a panel of about 1600 small firms, the growth of most such firms is constrained by their internal finance. Thus, for entrepreneurs seeking to grow their business, external financing is essential. Audretsch and Elston (2002) analysed the relationship between firm size and liquidity constraints. Their results indicate that medium-sized firms appear to be more liquidity constrained in their investment behaviour than either the smallest or largest firms (sample: German firms, different sizes, 1970-1986).[18]

It therefore appears to be relatively difficult to get access to finance in the EU. This is true for SMEs in general (so-called 'equity/finance gap'), but holds true in particular with respect to financing R&D activities because of the uncertainty of the outcomes, lack of company track records, etc.[19] In many cases this results in receiving inadequate finance for SMEs and start-ups, thereby limiting their growth potential.

In general, as the perceived risks increase, it becomes harder to obtain bank finance since it is much more difficult for financiers to assess the risks of innovative, R&D-intensive, fast-growing SMEs, and particularly start-ups, as compared to established companies with a spread of activities, entrepreneurial experience, an established market position and financial strength. For smaller firms, access to finance can obviously be a decisive factor in R&D investment decisions. It therefore plays a crucial role in the creation and expansion of R&D-intensive SMEs since the anticipated research effort is likely to be beyond their financial capacity (European Commission, 2003a).

Furthermore, SMEs have a scale disadvantage when it comes to funding R&D activities. The costs involved in obtaining a small loan can be almost as much as those for a large one (OMC-SME Expert Group, 2006). This means access to borrowing from banks is perceived as being important to the financial well-being of many SMEs (Gallup Organization, 2006). Ease of access to bank loans does in fact appear to vary between companies according to their size. The larger the company (measured by numbers of employees or turnover), the more likely it is that this company will be able to turn to bank loans for financing. By its very nature, bank lending is only suitable for propositions which carry very low risks. A bank has only a comparably low lending margin to cover the costs of appraising and monitoring loans, covering losses arising from bad debts and providing an acceptable return to shareholders (European Commission, 2006a); hence their preference for large borrowers.

Assuming that the cost of borrowing is similar in the US and Europe and given the fact that Business Angel (BA) investments in Europe are estimated to be less than 10% than in the US,

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[18]   The results suggest that the German infrastructure designed to assist small firms has succeeded in alleviating these liquidity constraints. Czarnitzki (2006) investigated access to finance for German SMEs in general and thus showed that West German SMEs are financially constrained in their R&D activities by both internal and external resources and East German SMEs are not sensitive to external constraints, most likely due to the large public R&D subsidies. In fact, R&D in East Germany seems to be driven to a large extent by public subsidies and in this region the usual financial market mechanisms for R&D are dysfunctional. Beside firm size the location of a certain firm apparently also (external environmental conditions) matters in terms of SMEs' access to finance. In this regard, see also Haid and Weigand (2001) who considered general causalities between R&D, Liquidity Constraints, and Corporate Governance.

[19]   See in this regard e.g. Hall, 2002: The financing of research and development.

there would appear to be a serious and persistent lack of business angels and other seed investors in Europe. On the other hand, the private financial sector has good reason to be reluctant to invest in start-up phases of any firm and/or related business R&D activities, since – as historical data in Europe and the US tend to show – they are generally not sufficiently profitable. According to the literature, the anticipated return on investment (ROI), for example, for high-tech start-ups, is on average less than 3%, which makes such an investment rather unattractive (OMC-SME Expert Group, 2006, p.15). Indeed, according to the European Venture Capital Association, the amount invested in European start-ups came to €2.2 billion in 2004 (compared to €2.0 billion in 2003), which is only about 0.5% of the total venture capital (VC) invested in Europe (OMC-SME Expert Group, 2006, p.51).[20]

Apart from the comparatively low ROI of high-tech SMEs, a mismatch between VC supply and demand can also be observed, due to untapped VC available for young research-intensive SMEs. According to VC and informal investors, this is mainly explained by a lack of good propositions and management competencies. For instance, the OMC-SME Expert Group (2006, p.15), noted that in the case of high-tech start-ups there is an 'equity gap' between supply and demand of somewhere between €100,000 and €2.5 million per financing round. These 'market imperfections' make public measures imperative[21], as an adequate birth rate of these SMEs is vital for Europe's sustained economic growth.[22] In part this objective can be achieved by mobilising private funds, but major public financing by the MS is inevitable since 'friends, family and fools' (companies' own and/or friendly sources of finance) and traditional bank loans obviously are insufficient, which is hindering the establishment or further growth of R&D-intensive SMEs. Support can take different forms:[23] subsidies; guarantee schemes; subordinated loans; equity; etc.[24] According to the OMC Experts Group on SMEs, state aid rules urgently need to be adapted and possibilities for EIB/EIF and national/regional governments should concentrate on co-financing in majority publicly owned VC funds for the seed capital and early stages of young innovative SMEs. This is especially important in the new MS, where a VC sector has yet to develop.

In this regard, Business Angels, for instance, can fill the gap between personal funds and institutional VC funds. In fact, BA support for SMEs is recognised to be a major source of equity for financing innovative SMEs (OECD, 2004). However, given the limited resources the gap cannot be closed entirely, which might be seen again as a reflection of certain market inefficiencies in mobilising financial resources to meet the demand. In essence, the invisibility of potential investors and entrepreneurs and the fragmented marketplace impose high search costs on both parties (see OECD, 2004a and Freear, Sohl and Wetzel, 1994 for more details on Business Angels and access to finance).

In addition to providing finance, BAs contribute their expertise, knowledge and contacts both formally and informally to the businesses they invest in (Thompson and Choi, 2002).

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[20] Fort start-ups, the average deal size was about €730,000 in 2004. The total amount invested in seed capital decreased slightly from about €150 million in 2003 to €148 million in 2004, after the "peak" of almost €1 billion in 2000 (EVCA Barometer, June 2005).

[21] See e.g. Klette, Møen, and Griliches (2000) concerning the question whether "subsidies to commercial R&D may reduce market failures."

[22] See e.g. Hyytinen and Toivanen (2005) who provide empirical evidence that capital-market imperfections hold back innovation and growth, and that public policy can complement capital markets (study concerning the effects of government funding on the behaviour of SMEs in Finland). It has also been shown that government funding disproportionately helps firms from industries that are dependent on external finance.

[23] This implies higher risk taking for this funding but not necessarily a formal subsidy-equivalent, although this is recommendable in the start-up funding phase. The revision of the EU State aid rules on R&D, Innovation and Risk Capital are crucial for this context. "De minimis" can be of help in this respect and preferably with a higher amount than the actual allowed maximum of €100,000 subsidy equivalent. Anyway, public funding has a temporary importance, as in the later stages of financing needs of innovative SMEs the private financial sector has to take over.

[24] See e.g. http://ec.europa.eu/invest-in-research/index_en.htm for an overview of common investment schemes in Europe. For specific measures concerning finance of research-and-technology-intensive SMEs in selected MS see e.g. OMC-SME Expert Group, 2006, pp. 54 – 57.

International co-operation in the BA market, such as the Business Angel Networks (BANs), offers further scope for sharing experience and knowledge as well as expanding investment opportunities (European Commission, 2003b; OECD, 2004a). By providing a channel for communication, BANs have the potential to bring together private investors seeking good investment opportunities and entrepreneurs wishing to raise finance. Supporting the formation of BANs is one of the policy recommendations that can reduce the informational asymmetries between innovative SMEs and potential investors. Governments can support the formation of BANs to bring together private investors with entrepreneurs. Moreover, international co-operation in business angel markets may provide further scope for sharing experience and knowledge as well as expanding investment opportunities (OECD, 2004a).

Apart from the specific details of company size classes and the corresponding access to finance alluded to above, there are also differences among sectors. SMEs operating in high-risk sectors tend to be dependent on sources such as VC funds / BA instead of bank loans (Gallup Organization, 2006). The wide diversity of SMEs entails different financing needs among individual SMEs (European Commission, 2006c). For innovative start-ups, the personal savings of entrepreneurs and funds from 'friends, family and fools', lending substitutes (e.g. leasing, invoice discounting and factoring), and trade credits, are often the most important sources of finance. Obviously, access to finance is very restricted and the sources of financing seem to be very limited and altogether there is considerable scope for improving the situation both for highly innovative SMEs that already perform R&D and those that want to do so.

However, the size of the 'equity/finance gap' differs at different phases of a firm's lifecycle. R&D-intensive companies tend to be particularly risky, with intangible assets and the prospect of negative earnings for several years. In the second phase of survival, as personal funds become depleted, external sources usually tend to become more important. At this stage, investment is still risky with high failure rates, requiring potentially high rates of return. Generally speaking, at this juncture enterprises are not large enough to attract the attention of investors such as venture capitalists. Banks and business angels fill the gap between personal funds and institutional venture capital funds (European Commission, 2006a; OECD, 2004a). Nevertheless, VC should be seen as an important link between innovation and finance, providing capital and market access for small and (mainly) medium-sized innovative firms. Interestingly, the proportion of VC investments targeted on early and expansion stages vary considerably across countries (see e.g. OECD venture capital database, 2003).

For instance, the United States and Canada have been quite successful in channelling investments to early and expansion stages. In other countries, such as Italy, Sweden and the United Kingdom, VC investments have been predominantly targeted on later stages (partly substituted by other sources) which – to some extent – can be explained by differences in both the country's industrial and capital market structures. However, besides differences in terms of company's size and sector affiliation, country specifics also appear to play a significant role. Thus, countries where buyouts offer easier and faster opportunities to achieve higher returns tend to attract the later stages of funding (OECD, 2004a).

Taking into account the general situation of access to finance in Europe, SMEs in the EU seem to be at a significant disadvantage, particularly when compared to SMEs in the US. This needs to be tackled in order to make sure that any promising small company in Europe can at least be given the opportunity to grow and become a medium-sized or large company. Otherwise, the dynamics of the European economy cannot evolve fully and the EU will fail to achieve the Lisbon objectives (European Commission, 2006c).

Limited Capabilities

There are quite a number of dynamic, innovative, and growth-oriented SMEs. These include, in particular, companies that are new technology-based firms offering knowledge-intensive services, which have the capability to renew technologies and make technological breakthroughs, thereby forcing large firms in turn to innovate in order to remain competitive. However, with respect to a significant percentage of SMEs the given capabilities are also one of the major restrictions of the company's development. The lack of qualified people has been mentioned by more SMEs (16%) as crucial for the development of the company as, for example, better access to finance (see Flash Eurobarometer, 2005). Thus, the challenges for European SMEs mentioned have to be seen as linked. For instance, according to the Gallup Organization (2006), and also to Mani and Bartzokas (2002) SMEs that have seen an increase in the number of employees over the past year are significantly more likely to consider opening up or increasing their capital than those companies where the number of employees have remained the same or decreased.

Young R&D-intensive SMEs are often strong on technology, with good innovation capacity. However, innovation greatly depends on the ability to develop and employ their own competences and skills.[25] Accordingly, access to finance is a necessary but – considered in isolation – not entirely a sufficient condition for the success of innovative start-ups and SMEs. Entrepreneurial and management skills are equally important. In particular this is true during a company's start-up phase. Indeed, start-ups often lack entrepreneurial and 'strategic skills', like for example knowledge about markets and competition, intellectual property rights (IPR) and financial matters, since, typically, such firms are founded by scientists who were mainly (or are still) involved in carrying out research, and who have little or no experience in running a business.

In general, (R&D intensive) SMEs tend to under-invest in new and essential competences. This can be explained by a number of hindrances and weaknesses found in the competences market, both on the demand and the supply side, such as lack of capital for investments in competence development (high risk, lack of access to finance); little awareness and recognition of competences as a competitive edge; lack of information and/or knowledge about how to acquire necessary competence and from whom; greater attractiveness of larger companies compared to SMEs for clients/suppliers of competence; and an often poor understanding of suppliers of the actual competence needs of a certain SME (OMC-SME Expert Group, 2006). However, by means of new and/or aligned forms of cooperation[26] and applied support projects for innovative activities these weaknesses and problems could be overcome.

Thus, R&D and innovation performed by SMEs, as well as any competence development and employee training, is somewhat informal in companies of this kind. In SMEs, 'learning by doing', 'learning from others' and 'learning on the job', are more important forms of learning than formal training activities (which dominate in large scale companies). These types of training practices result in tacit competencies and skills, which contribute to the competence base of SMEs and are difficult to imitate by competitors (European Commission, 2006a).

Acquisition and combination of external and internal knowledge is necessary to successfully introduce innovations into markets since the complexity of the relevant environment seems to be steadily increasing. External and internal knowledge sources are therefore highly important

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[25] Considering sources of innovation for high-tech SMEs, according to Barañano *et al.* (2005), internal sources of innovation are more highly rated than external sources for both Canada and Portugal (in contrast to the US).

[26] See for example Belderbos et al. (2004) concerning heterogeneity in R&D cooperation strategies.

and have to be managed, and this requires a specific amount of absorptive capacity (European Commission, 2006a). In this regard, the common understanding in the literature is about to change, shifting from considering external-knowledge as being of prime importance for SMEs towards the opinion that what is crucial for companies' development is inter-organisational knowledge transfer, in particularly for SMEs (Chen *et al.*, 2006; Desouza and Awazu, 2006). Indeed, a major weakness of the European Innovation System is the lack of interaction between the key actors. This problem is especially apparent in relation to the links between SMEs and Higher Education Institutes (HEI). Thus, the quality of science and higher education is regarded as excellent, but the actors seem to be unable to commercialise the results of these efforts (the so-called 'European paradox'). Innovation-driven economic growth, however, requires optimal co-operation, and studies suggest that there is plenty of scope for improvement.[27] According to the OMC-SME Expert group, by creating more jobs and well-being, this knowledge transfer process will improve the competitiveness of young research-intensive SMEs and also the competitiveness and attractiveness of nations. Research-intensive SMEs, in particular, can gain a lot by working together in collaborative networks with research institutes and other, mostly bigger, companies.

However, besides research-intensive SMEs, collaborative networks are also valuable for other types of innovative firms; SMEs as well as large scale firms.[28] There is in fact a growing use of networks by firms of all kinds, although once a primary competitive advantage of (relatively flexible) SMEs. These developments have created both opportunities and threats for SMEs. On the one hand, large firms have increasingly sought out SMEs as they have developed their use of external networks.[29] By doing so, larger firms are now more and more able to avail themselves of the flexibility long-enjoyed by SMEs. Although SMEs continue to have the advantages of flexibility and rapid response, their traditional disadvantages due to size limitations may have worsened due to increased competition and the demand for multiple technological competences (see Narula, 2004). In policy design, it will be important to segment SMEs appropriately, and adapt the ways of linking these SMEs to the knowledge world accordingly.[30] However, some segments look likely to need to build their capacity for knowledge absorption as a prerequisite for collaboration.

On the other hand, European Universities currently lack incentives to cooperate with SMEs that address their research needs. By changing the legal framework in which universities operate, for example by gearing their third mission towards societal needs in general, and the needs of industry in particular, the research needs of SMEs could be better addressed. In this regard, it is also recommended to foster the setting up of professional Technology Transfer Offices at universities (OMC-SME Expert Group, 2006).

Finally, providing highly professional coaching facilities to develop management skills and/or specific support measures for the commercialisation of SMEs' products, particularly in the early stages of the life cycle of a company, can trigger start-ups and/or increase SMEs' survival rates and, therefore, promote the growth of (research-intensive) SMEs.[31] However,

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[27] See OMC-SME Expert Group, 2006, pp. 17, 93ff for country-case studies on links between SMEs and HEIs.

[28] See Ritter and Gemünden (2004). These authors have developed a basic framework for the successful implementation of a technology-oriented business strategy, consisting of four elements: business strategy, network competence, technological competence and innovation success. The model has been empirically tested using a database of 308 German companies. Accordingly, both network competence and technological competence have a significant positive impact on a company's innovation success and a company's technological (implicitly also R&D) strategy supports the development of both network and technological competencies.

[29] See e.g. Miles, Preece and Baetz (1999) concerning the impact of strategic alliance use by small technology-based firms.

[30] See OMC-SME Expert Group, 2006, pp. 17ff for an overview of common (present) practices / policies & instruments concerning the link between SME and HEI, as applied in MS, problems that occur in general / with respect to some countries (with respect to the latter see OMC -SME Expert Group 2006, chapter 3).

[31] The OMC-SME Expert Group proposed investigating the opportunity of a European Academy for Entrepreneurship, aimed at "training the trainers" so as to train entrepreneurs to world-class level. See OMC-SME Expert Group (2006) also for an overview of MS initiatives addressing management skills.

most intangible resources, like skills and competences, cannot bought on the open market, but must be developed and maintained internally in the firm, which limits the effect of any political initiative in this regard.[32] Referring to impact analyses of MS initiatives that address managerial skills, the OMC-SME Expert Group has called for an 'integrated approach' on both financing and coaching of management skills. In this regard it has been proposed (see pp. 3ff), in most cases, that financing should be made conditional, only to be provided when the start-up accepts adequate coaching, resulting in its learning a whole range of management skills. Accordingly, the development of an innovative start-up has to pass well-defined milestones (subject to evaluation of pre-identified project targets). An integrated approach therefore implies both the need for adequate coordination of policy levels and the need to streamline the supply of competent advice and coaching services.

Internationalisation/Globalisation

SMEs are, in general, under-represented in global trade, although there is increasing evidence of their internationalisation. But, for many SMEs (especially those with high growth potential), gaining access to international markets is a strategic instrument for sustaining their competitiveness and company growth (OECD, 2006).[33]

However, going international is always a challenge, particularly for small companies that do not have sufficient capacities in-house to deal with foreign legal frameworks, tax systems, languages, etc. Indeed, enterprise size appears to influence the possibilities and/or choice to internationalise. According to the OECD (2006), internationalisation was found to have a significantly greater effect on the competitiveness of medium-sized enterprises than it did on either micro or small enterprises. The literature also shows that internationally active SMEs tend to be larger than SMEs on average (and vice-versa, *ceteris paribus*).

A number of factors can positively influence SMEs' internationalisation efforts, such as adaptation of standard ICTs, increasing managerial awareness and education; growing internationalisation of large firms and service providers; and participation in clusters and networks. A small domestic market can also be a driver for SME internationalisation. Indeed, SMEs in smaller countries tend to depend much more on international markets than those which have an ample domestic market.[34] Moreover, access to know-how and technology, to capital and labour and the opportunity to obtain access to new and larger markets for products and services are some of the motives that can be identified among the diverse range of approaches to SME internationalisation (OECD 2004, 2006). In general, an internationalised SME has better possibilities of meeting partners for technological cooperation (e.g. for R&D activities), and/or entering new value chains.[35] Foreign direct investment (FDI) is a vehicle for SME internationalisation, although in most countries relatively few foreign subsidiaries have been established.[36]

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[32]   See OMC-SME Expert Group (2006) for policy recommendations (national level p. 91ff; EU level p. 92).

[33]   It should also be noted that the literature also talks about "globally born enterprises"; companies that operate on international markets right from their start-up stage and can be, therefore, considered as specific cases (compared to total number of start-ups they are relatively rare even if the numbers are rising). See e.g. Knight and Cavusgil (2004). Moen and Servais (2002) consider SMEs and discuss the question "born global or gradual global"? Almor and Hashai (2004) discuss the competitive advantage and strategic configuration of knowledge-intensive small and medium sized multinationals.

[34]   Domestic market, in this context, refers to the company's country/region of origin and not to the common market of the EU. Therefore, in comparison to the size of domestic market in the US, the market size argument indeed matters (although empirical evidence suggests that the existence of corresponding clusters and sector-specific components might be even more important for SMEs' perception of going international).

[35]   See e.g. Narula and Duysters (2004) concerning trends in international R&D alliances.

[36]   No more than 1 to 4% of the SMEs belonging to EU15, Norway, Iceland, Liechtenstein and Switzerland.

Alongside the evident advantages that motivate SMEs to internationalise their businesses there are also some obstacles. The most frequently cited barrier can be seen in the high costs of internationalising a SME, given its financial constraints. These costs include those associated with doing market analysis abroad, purchasing legal consulting services, translation of documents, adaptation of products to foreign markets (including licensing, certifying, etc.), travelling expenses, in addition to the higher business and financial risk incurred, etc. Moreover, existing laws and regulations; product standards; intellectual property rights protection; lack of capital or finance; lack of support and/or advice; cultural and language differences; and lack of information often prevent SMEs from going international. Referring to this long list of challenges for SMEs that want to internationalise their business, the Istanbul Ministerial Declaration of the OECD highlighted the need to reduce barriers and provide access to global markets as key points. Policies need to aim to encourage the smooth, cross-border growth of SMEs including in some instances through the promotion of business linkages between large enterprises and SMEs by means of reducing the administrative and legal burdens.

Intellectual Property Rights (IPR)

In relation to business R&D by SMEs, another key issue is the protection of the company's competence. Protecting relevant knowledge and the competence base from imitation by competitors is crucial for all companies. SMEs's options for protecting their tacit knowledge include secrecy or Intellectual Property Rights (patents, confidentially agreements with customers, etc.). However the evidence suggests that SMEs have a disadvantage *vis-à-vis* larger firms in terms of their ability to protect Intellectual Property (IP). The 2004 Community Innovation Survey reveals considerable differences in the use of IP protection by firms of different sizes (see, for example, Figure 2.3, below, for companies operating in the service sector vs. total industry per size class related to the average company size). Clearly, SMEs are considerably less likely to employ each of the various forms of IP protection than larger firms (both in services and manufacturing). It is therefore not very surprising that small firms[37] are even less inclined to use IP protection (European Commission, 2006a; OECD, 2006).

Figure 2.3: Use of Intellectual Property Protection by firm size
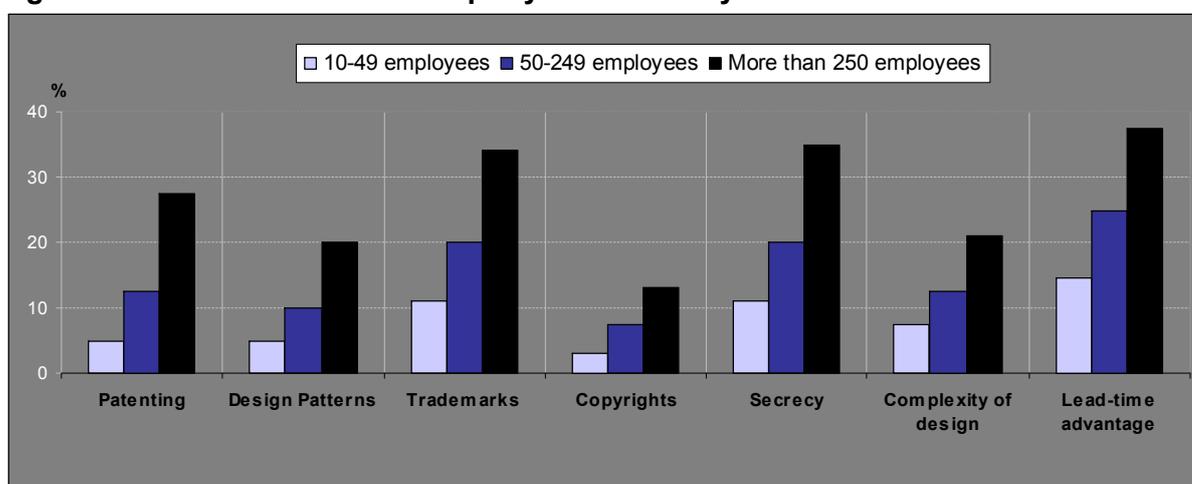
Source: OECD (2005b) based on Eurostat, CIS Survey 2004.


[37] Firms with 10 to 49 employees

Admittedly, the recent discussion of the European Patent has been an important step towards the harmonisation of IPR legislation. The effect of having a single IPR system would be positive for the commercial exploitation of new ideas (Botazzi, 2006). However, IPR is likely to remain one of the main challenges for SMEs wanting to ensure the innovations they produce are protected. Thus, the relevance of IPR is rising with the amount of business R&D performed and, moreover, it is negatively related to the company size; i.e. the smaller (younger, in the case of start-ups) the company, the less likely that it has sufficient capabilities to deal with IPR properly. This is particularly important in terms of highly innovative and recently founded NTBFs.

In general, the empirical evidence suggests that Europe lags behind the US in the generation of knowledge. But, improving the knowledge base and protecting the related IP (particularly with respect to new emerging markets), realising 'first mover' advantages by entering a market early and/or binding customers by offering complementary services all are very important issues for investing more in research and innovation (European Commission, 2006b). This holds for any kind of company, but is certainly more difficult to achieve for SMEs than for larger companies.

Administrative burdens

Regulatory and administrative burdens can dampen entrepreneurial activity and hold back SMEs' development. Excessively stringent regulations affecting product and labour markets have a negative impact on both firm entry and productivity as they hinder firms from shifting resources to new and productive uses, to innovate and to adopt new technologies (Scarpetta *et al.*, 2002). Since any administrative burdens, by their very nature, result in costs and require efforts to be devoted to them, SMEs are particularly sensitive to them because they lack the capacity to handle all the legislation. The proportionate costs for a small company to comply with regulations are nearly six times higher than for a medium-sized or a large company. Given the limited financial resources, capabilities, managerial experience, etc. (as mentioned above), administrative burdens shorten the possibilities for a certain SME to perform business R&D. Accordingly, reducing administrative burdens and freeing Europe's entrepreneurs from unnecessary red tape is a prime concern. And, as is evident from Figure 2.4, the existing regulations and administrative burdens involved in launching a company still can be simplified a lot in many EU Member States.

Figure 2.4: Number of days to start a business, 2004
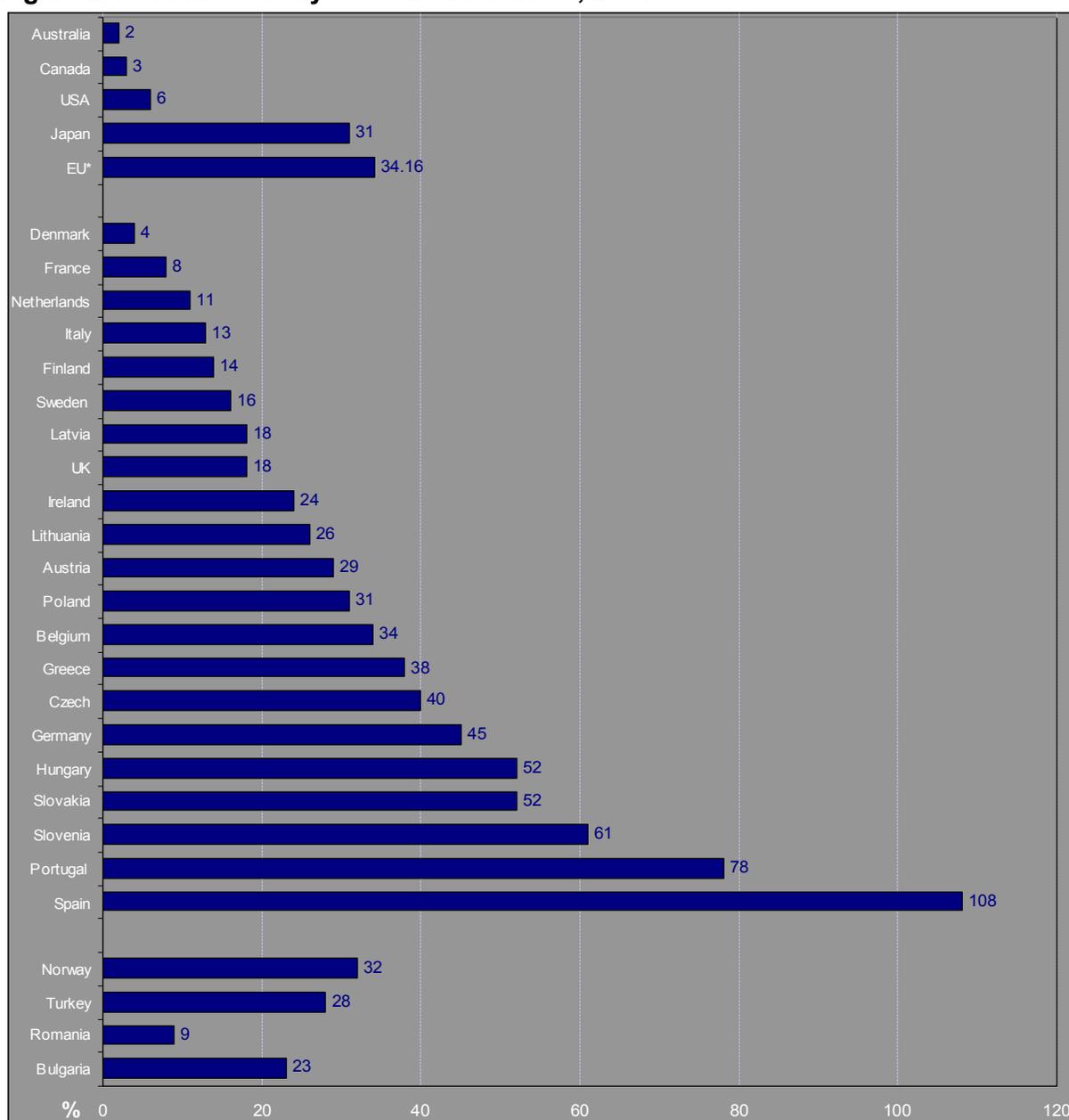
Note: * weighted average of EU-25 (countries for which data are available)
Source: Word Bank, 2004

In the context of the renewed Lisbon strategy, which refocused on growth and jobs, the Commission released a Communication entitled *Better Regulation for Growth and Jobs in the European Union*.[38] The Communication proposes three key action lines. The first is focused on promoting the design and application of better regulation tools at EU level, particularly insofar as impact assessments and simplification are concerned. The second highlights working more closely with Member States in order to ensure that better regulation principles are applied consistently throughout the EU by all regulators. Finally, the last action line focuses on reinforcing constructive dialogue between all regulators at the EU and national levels and with stakeholders (UNICE, 2005).

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[38]   The communication was released on March 16th 2005. The initiative builds on the Commission's 2002 initiative for better regulation.

6 Providing public support to SMEs - The controversial issue of how to shift the existing boundaries of R&D

In view of the overarching importance that SMEs play for the development of the entire EU economy there are a number of policy initiatives and institutional measures that focus on giving support to SMEs in general and performing R&D and innovation activities in particular. The EU provides assistance to SMEs in various ways, for instance with respect to SMEs' access to finance, grants, loans and, in some cases, guarantees. Support is available either directly or through the Structural Funds, managed at national level. SMEs can also benefit from a series of non-financial assistance measures in the form of programmes and business support services (see e.g. European Commission, 2005b). In principle, all MS support the development of small research-intensive firms.

Altogether this leads to a situation in which the assistance provided is often research-related, instead of being innovation-focused, driven by push rather than pull factors and often triggered in response to developments in emerging markets. Moreover, support often ends at national borders and is not available to help companies find technology partners or to address larger niche markets. But, as already discussed, Europe does not lack inventiveness; what it lacks is innovation and entrepreneurship (OMC-SME Expert Group, 2006), and in this sense the assistance provided is still insufficient.

How to provide suitable support to SMEs is a very controversial issue. In principle, giving a company support to help itself most likely is the best way of providing any assistance since only this ensures tailored activities focusing on the real needs of a given SME, triggered by demand from the business side rather than being pushed by any initiative from the public side. However, even if this is widely accepted in the relevant literature, in practice it appears somewhat difficult to achieve as any measure applied is supposed to have side effects that may cause the call also to be tackled from a policy point of view, which complicates any programme's implication. Moreover, arbitrage effects and biased market solutions may also appear, public measures may cause a crowding out of private efforts and thereby defeat the intentions of the initiative. The list of examples in this regard is long, in the EU and elsewhere.[39]

Nevertheless, there are numerous programmes and measures, initiated by a wide variety of actors, aiming to support SMEs in some way or another. Table 2.2 (Annex) aims to give a (non-exhaustive) overview of the variety of measures applied that directly or indirectly focus on providing support to (European) SMEs in terms of business R&D. Given the large number of existing support initiatives provided by both public and private institutions (e.g. associations, government bodies, NGOs), each of them is likely to have a different motivation for its activities and a specific focus. Therefore, it is not surprising that these initiatives are often characterised by substantial overlaps, fragmentation and competition among managing agencies, potentially diminishing the impact of the support available.

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[39] For example, Wallsten (2000) found evidence that government-industry commercial R&D grants crowd-out firm financed R&D spending dollar for dollar, based on a dataset of companies that participated in the Small Business Innovation Research (SBIR) program. Almus and Czarnitzki (2003) analysed the effects of public R&D policy schemes on the innovation activities of firms in Eastern Germany and whether public funds stimulate R&D activities or crowd out privately financed R&D. According to this study, on average, firms increased their innovation activities by about 4 % compared to the case in which no public financial means were provided.

According to the OECD, the possibility of incorporating new objectives into existing programmes should be considered before establishing new ones. Moreover, these programmes should have monitoring and evaluation mechanisms embedded in their frameworks. In particular, they need to have a sunset clause to allow for the termination of the programme once the corresponding conditions in the private sector improve and/or the initial objective becomes either obsolete or has been largely achieved (OECD 2003; 2004). Many existing programmes, however, lack this. Furthermore, with respect to the public support measures UNICE (2005) claims that its crucial that EU policy-makers and Member States recognise that decisions taken at the EU level have major consequences for European entrepreneurs and SMEs: they affect the attractiveness of starting a business, the way in which a business operates (innovative strategies, international competitiveness and human capital resources) and even the way a business can be wound up.

In general, 'digesting' the pros and cons of support measures concerning business R&D in European SMEs, it seems that the problem should not be seen in the amount of assistance but rather in the way this assistance actually is provided and how it affects the market and the behaviour of the market participants. Already the sheer number of unlinked measures causes problems. Many SMEs are unable to inform themselves about all the available measures and/or cannot deal with the complicated and time consuming procedures to apply for them. This may lead to the absurd situation that a more innovative SME may fall behind a competitor in terms of internally available financial resources simply because it might have been concentrated on performing research instead of applying for support to do it.

In view of the challenges that European SMEs face –as highlighted by the Lisbon objectives– sophisticated assistance is obviously needed. On the other hand, empirical evidence suggests that the current situation of supporting SMEs is somewhat inefficient. In this regard, and apart from the mentioned programmes and initiatives, recently, Public Technology Procurement[40] (PTP) has been mentioned more and more often as a suitable measure for supporting SMEs, in particular with respect to promoting R&D-intensive and high-technology start-ups. Indeed, technology procurement is important for all innovative companies, but especially for research intensive SMEs. Therefore, PTP should go beyond the stage of giving opportunities to established technologies. For research-intensive SMEs this would not only offer a financial opportunity that is more attractive than a classical subsidy scheme. It would also position public bodies as early adopters demonstrating new solutions in real conditions and thus opening the door to new markets. But, as this involves risk-taking, a clear political commitment is necessary (OMC-SME Expert Group, 2006).[41] Indeed, several MSs are already actively developing PTP schemes taking into account the importance for R&D intensive businesses as stated in European Commission, 2006d.[42] However, the current practice in this regard indicates the bottlenecks hindering the successful implementation of PTP schemes. These are not so much related to the technology, the ideas or getting SMEs involved, but European legislation. This is mainly related to the uncertainty surrounding the public procurement directive (Dir 2004 / 18 / EC). The most relevant questions in this regard are about the status of contracts falling under the R&D exception and to which degree the possibilities for innovative SMEs are addressed.

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[40] By means of Public Technology Procurement, a government will cover the costs for R&D performed (by the SME) under the heading of procurement. Besides grants and loans, PTP can be a powerful instrument to stimulate innovation. According to a report on the functioning of public procurement markets in the EU "*Benefits from the application of EU directives and challenges for the future*" ((4), 03/02/2004), Public Procurement in the EU is worth approximately 16% of GDP.

[41] In several MS, attractive and realistic schemes for Technology Procurement are actively being developed. Some are at the pilot phase and one is actually operational (the SBRI-scheme in the UK). A lot of analysis has also been done on this issue at European Commission level. Networking and mutual learning, for example, by means of a dedicated OMC-Net, are highly recommendable.

[42] The report considers measures and actions to assist in the development of procurement practices favourable to private investment in R&D and innovation. The expert group has identified PTP as the most powerful instrument in the arsenal of policy instruments to achieve the 3% Barcelona target for R&D as a proportion of GDP by 2010.

7   Conclusions

The literature reviewed in this report has shed light on the current debate regarding business R&D in SMEs and identified further issues to be explored as well as actions to be taken.
A main aspect in terms of research on business R&D in SMEs lies in the question of how to actively support SMEs performing R&D. Given the importance of SMEs for the EU's economy and the challenges that these companies are facing, support measures focusing on SMEs in particular seem to be necessary to achieve the Lisbon objectives. However, it is far from easy to implement sophisticated support measures in an appropriate way. In this regard a lot of research still needs to be done with respect to (1) learning from the existing 'best practice' and understanding the underlying mechanisms, and (2) conceptualising suitable support accordingly. As a precondition of both, the determinants of a company's development and the crucial external environmental conditions of its life cycle have to be investigated in order to understand what makes some start-ups/SMEs grow into larger companies and what prevents others from doing so. Thus, the enormous heterogeneity of SMEs has to be taken into account. In general, the problem lies in the translation of existing knowledge concerning individual needs of each company and corresponding bottlenecks into generalised and commonly applied support measures. Any measure put in place in order to support one SME could have a negative impact on others. In this sense, there is a lot of room for further research on specific target groups for policy measures.

Within this context, the European Research Advisory Board (EURAB) recognises the pivotal role that small businesses could play in meeting the EU's 3% target. It points out that, in the US, the average small business has an R&D budget many times higher than in the EU[43] and that, if that gap was closed, the EU would get quite close to its overall target of achieving 3% spending for R&D. According to EURAB, further targeting the EU's funding programmes towards SMEs would be highly beneficial in this regard.

In a more general context, following the recommendations above, policy making faces the challenge to ensure that SMEs obtain support according to their needs in an environment that genuinely enables them to flourish.

Besides being a pure research activity, this 'digest' of business R&D in SMEs also allows to sketch other possible activities. In general, without implementing any new support programmes there are many ways to help SMEs, such as cutting red tape. In fact, considering the challenges mentioned above, there are a number of possible improvements that could be initiated politically, at European, Member State or regional level, for instance with respect to policies to boost the availability of venture capital for innovative SMEs with a particular focus on early stage financing. In this regard, public sector funds could be used to leverage private sector financing in order to reduce the financing and equity gap. Wherever the responsible authorities believe that such support is warranted, they could draw on the experience of several countries with small business investment companies implementing the best-practice approach. In this case, proximity between suppliers of funds and those who require finance, particularly for small-scale investment, becomes highly important. Evidence suggests that regional and local equity initiatives (e.g. regional funds) are very appropriate for this type of investment. According to the OECD (2004a), such programmes should be created in parallel with the development and support of regional and local business angel networks as well as

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[43]   See EURAB 04.028-FINAL: Report and Recommendations on: "SMEs and ERA".

business incubators (in order to name just a few further avenues for initiating promising support measures).

In total, achieving a suitable form of assistance (support-mix) for business R&D in SMEs which is integrated with local, regional, national and European research and innovation systems remains an open but crucial question that will have to be solved on the way towards achieving the Lisbon objectives.

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Annex: Who is doing what in relation to SMEs?

A non-comprehensive overview about measures supporting R&D in SMEs

Organisation / Association	Objectives / Focus initiatives & related remarks	Relevant activities strands of activities, experiences, …
BusinessEurope formerly Union of Industrial Employers' Confederations of Europe **[UNICE]**	*Confederation of European Businesses*: SMEs voice vis-à-vis EU institutions > 20 mill. SME in 32 Countries	Activities: ensuring that the common interests of SMEs are heard, understood, and taken into account…
CEI [Central European Initiative]	*Objective*: assisting transition countries from Central Europe in approaching the EU → CEI Working group on SME	Establishment of a business advisory services (in coop. with EBRD); Initiation of a multilateral cooperation of chambers of commerce focussing e.g. on cutting red tape, access of SME to research programmes, providing business support, etc.
EBRD [European Bank for Reconstruction and Development]		*Financing SMEs*: special credit lines for SME, microfinance banks, equity funds, leasing, and technical assistance for institutional development; *Skills*: *Turn Around Management* (TAM) → fully funded assistance to SMEs in transition countries;
EIB group **EIB** [European Investment Bank] **EIF** [European Investment Fund] **ECB** [European Central Bank]	*Objective*: EU's financing institutions [complementary] → programmes concerning certain SME needs *Available data bases*: Statistics related to financing of SME (regularly basis, quarterly, starting in 2003, online available via www.ecb.int)	*Financing SMEs*: programmes concerning access to finance, equity, venture capital & guarantees. *Innovation 2010 Initiative* (fostering knowledge & innovation based economy → €20 billion lending envelope for 2003 – 2006), thereafter: midterm review + fine tuning initiatives priorities and instruments up to 2010 (measures: equity participation, counter-guarantees designed to stimulate start-ups and development of SME, providing venture capital, access to bank credit) *Assisting start-up*: *European-Technology-Facility-Start-up* [ETF] designed to support innovative SME; Working group of EIF with *European Venture Capital Association* regarding legal issues for venture capital / private equity investors (particular focus on SME);
EUROCHAMBERS [Association of European Chambers of Commerce]	Implicit SME focus: 80% of Chamber members (14.5 mill) are SME *Available data bases*: data on request → turned into (calls for) actions;	*Assisting start-up*: info-centre, services, training; *Market access*: Organisation of trade fairs

| European Commission

DG ENTER
DG RTD
DG REGIO
DG ECFIN
…

ESTAT (see above)
EPO
… | *Focus*: **Think Small First principle** to ensure EU policy making & legislations will be SME friendly at all stages

Framework Programmes for Research and Technological Development
▪ FP 6 ~ 2.2 bill Euro spent on SMEs
▪ FP 6 allocates over 15% of its total budget to support R&D for SMEs
▪ FP 7 → further increase in budget

Specific measures (FP 6):
▪ Integrated projects [IP's]
▪ Network of Excellence [NoE]
▪ Specific Targeted Research Projects [STREP's]
▪ Specific Support Actions [SSA]
▪ Horizontal Research Activities (cooperative + collective R&D)
▪ Marie Curie Transfer of Knowledge [TOK]
▪ SME National Contact Points [NCPs]
Databases (apart from surveys):
▪ new Cronos (ESTAT), structural business statistics by employment size classes;
▪ BACH21 (harmonized annual accounts statistics for selected European countries, Japan and US) | ***Financing SMEs***: e.g. SME Guarantee Facility, Seed Capital Action [SCA], Joint European Venture Programme [JEV], Risk Capital Action Plan (1998), see also EIB / EIF;
Assisting start-up: *cut the red tape* programmes; training activities and development of human resources, promoting entrepreneurship [e.g. European Social Fund], etc…
Skills: European Entrepreneurship Curricula; Exploratory research on *Management Capacity Building* (including regular benchmarking); EU Agenda for Entrepreneurship (Action Plan); etc.
Other activities / projects:
▪ Gate2Growth (support to innovative entrepreneurs)
▪ Business Angel Network
▪ Benchmarking of incubators
▪ Innovation and Technology Equity Capital Pilot Project ([I-TEC] → encourage high-quality early stage investments in technologically innovative European SME) + I-TecNet (pan European Network of early stage technology venture capital investors, launched 2002);
▪ Innovation Relay Centre [IRC] Network (specialised business support services primarily targeted at technology-oriented SME);
▪ ERA: e.g. TTI, ProTon Europe, PAXIS, Europe INNOVA (Innovation Watch), European Innovation Portal, Observatory of European SME, European Charter for SME, ... |

Organisation / Association	Objectives / Focus initiatives & related remarks	Relevant activities strands of activities, experiences, …
Further relevant programmes & projects of the… **European Commission**	▪ **EUROSTARS** (proposed 2007)	▪ Joint Programme with 27 EUREKA countries to finance (international) R&D partnerships of research performing SMEs
	▪ **Environmental Compliance Assistance Programme (ECAP)** (announced 2007)	▪ Support to SMEs coping with increasingly burdensome environmental legislation & to take advantage of economic benefits offered by improved environmental management
	▪ **EUREKA** – A network for market oriented R&D	▪ Pan-European network for market-oriented, industrial R&D organisations
	▪ **eContent*plus*** (2005-2008)	▪ Development of multilingual content for innovative, on-line services across EU; tackling market gaps through investment support
	▪ **eTEN.** Its main aim is 'an information society for all'	▪ Support to telecommunication network based services (e-services) with a trans-EU dimension
	▪ **CORDIS** (Community Research & Development Information Service)	▪ Web portal for Europe's innovators (ca. 30.000 web pages on EU R&D and innovation policy)
	▪ **Innovation Relay Centres Network**	▪ Providing local help to promote technology partnerships and transfer
INSME [International Network for SME] coordinated by Italian Institute for Industrial Promotion [**IPI**: www.ipi.it], Rome	*Objective*: fostering trans-national cooperation and public and private partnership in the field of innovation and technology transfer to SME; *Focus*: Networking… exchange know how & expertise in innovation and technology transfer (international forum); benchmarking of existing measures and programmes at regional and global level > 80 members, 30 countries (in 2005)	*Financing SMEs*: working group on innovation in finance and venture capital, public-private partnerships, and on how to strengthen venture industries; survey on *Business incubation & VC*; *Assisting start-ups*: special assistance & training in *Management of Innovation and Technology Transfer for SME*; *Training*: programme on the *Role of IPR for Innovation in SME*; *Other activities*: Working groups on: ▪ *SME competitiveness* [INSME Think Tank] ▪ *Innovation Angels*: transforming the technology transfer process from 'on demand' to 'on offer', enhancing the matchmaking between demand and supply of technology; ▪ *Development of Industrial Cluster dynamics*: ways and means to foster interoperability between SME (through adoption of ICT); ▪ *Innovative methods for innovation*: Creativity techniques in terms of breakthrough problems & approaching radical innovation;
OECD **CFE** [Centre for Entrepreneurship, SME & Local Development] created in 2004 out of: **LEED** [Local Economic and Employment Development] Programme + SME & Entrepreneurship division	CFE work is directed by **WPSME** [Working Party on SME & Entrepreneurship] → empirical analyses, international comparison, policy focus on SME; Projects: ▪ Methods to measure, compare and benchmark administrative burdens (further extension of ongoing activities scheduled) ▪ creating a handbook on Evaluation of SME & Entrepreneurship Policies and Programmes Data: Structural Business Statistics [SBS], increasingly harmonized compared to ESTAT	*Financing SMEs* (see e.g. conference: Better Financing for Entrepreneurship & SME growth, 03/2006, Brazil; 2nd OECD Ministerial Conference on SME → Tools for SME innovation / Panel1: Financing for SME: Innovative Solutions; *Assisting start-ups*: Promoting *Smart Tape* instead of *Red Tape* → recommendations based on surveys / analyses concerning quality & capacity of countries' regulatory frameworks (data 1998,2000); *Access to markets*: 'Removing barriers to SME access to international markets' (APEC); *Innovation*: monitoring the implementation of the Bologna Charter on SME Policies (carried out by WPSME). Activity: 'OECD Policy Agenda for Growth: The Regional Dimension' → focus on the link between regional innovation strategies and growth, including policies for SME and clusters;

Organisation / Association	Objectives / Focus initiatives & related remarks	Relevant activities strands of activities, experiences, ...
UEAPME [European Association of craft small and medium-sized enterprises]	SME umbrella organisation: > 11 mill enterprises, nearly 50 mill employees *Objectives*: - Monitoring EU policy & legislative process; keeping members informed on all relevant matters of EU policy - Representing & promoting interests, needs and opinions of its member organisations to the EU institutions and other international organisations - Supporting its members academically, technically and legally on all areas of EU policy - Supporting the idea of European integration and contributing to European co-operation	*Projects*: *Responsible Entrepreneurship in SMEs* (support intermediary business organisations, train-the-trainer sessions, handbooks, …) - European Forum *Local Governance and Sectorial Social Dialogue* [LOGOSSD] *Euronaver*: database made to promote SMEs' transnational projects, providing best-practise examples, guidelines, check-lists, … *Business opportunities and services for small-micro companies* (BOSS) Project - Integrated programme to encourage social dialogue in the new member states *Business Support Programme II* (→ focussing on CEEC countries) …
UN **UNECE** [Economic Commission for Europe]	economic and policy analyses, development of conventions, standards, and technical assistance;	**CEI** [Central European Initiative]: networking and match-making contacts concerning *financing of SME activities*; Studies on *good governance for SME*, Report on SMEs in transition countries, recommendations concerning *Integral management systems* for industrial & service enterprises (incl. SME)
UN **ILO** [International Labour Organization]	*Focus*: - foster competitive and economically viable small firms and cooperatives; - encourage management practices to establish / maintain job quality; - improve access to business development & training services for micro, small & cooperative firms; - strengthen association building, worker's cooperatives, indigenous peoples, and self-organisations to generate employment	***Financing SMEs***: Guarantee funds, guarantee funds management manual, training courses; ***Assisting start-ups***: Assessing influence of business environment on SMEs (→ a guide / survey kit how to measure institutional regulations' influence on employment in SME); training course for policy making (strategies for SME development: how to design programmes in order to improve the enabling environments for SMEs?); ***Skills***: management training activities in more than 80 countries (Start your business, SYB)
UN **UNDP** [UN Development Programme]	*Objective*: guidance & technical assistance to SME provided e.g. by UNDP's **SURF's** [Sub-Regional Resource Facilities] and by the *Division for Business Partnerships* of the *Bureau for Resources and Strategic Partnerships*	Activities: technical support, business consultancy, microfinance, training of management skills (see also SYB: start your business activities of ILO); developing business incubators; coordination of a global knowledge network on SME and Micro-finance **UNCDF** [UN Capital Development Fund] → main focus on developing countries…
UN **UNIDO** [UN Industrial Development Organisation]	*Objective*: technical cooperation agency, platform for cooperation, analyses, support (business → policy); *Focus*: mainly on developing countries and countries in transition (the latter in particular concerning SME)	***Financing SMEs***: access to finance & equity → providing assistance in business planning, training, links to banks & lenders, etc.; ***Assisting start-ups***: monitoring needs of SME & impacts of policies; development of coherent and harmonized frameworks of industrial and SME policies; promoting private sector participation in policy formulation, implementation and evaluation; Assisting SME in getting access to markets: support to marketing, product development & design e.g. in terms of standards, certification, testing laboratories; platform for export consortia; ***Other activities***: Incubator services (capacity building for SME + providing local institutions, particularly concerning ICT/e-commerce, etc.; providing / adjusting SME relevant info bases;

Organisation / Association	Objectives / Focus initiatives & related remarks	Relevant activities strands of activities, experiences, ...
UN **WORLDBANK**	*SME Department* of the World Bank combines the market perspectives of the IFC [International Finance Corporation] with the policy expertise of the WB, inter alia to promote local SME growth (mainly in developing countries)	***Financing SMEs***: IFC → facilitating leasing, crediting, secured lending, bank downscaling, microfinance, etc.; ***Access to markets***: linkage programmes in order to facilitate entering markets (e.g. wood, IT); **Skills**: Various training programmes e.g. concerning innovation activity: *SME Toolkitprogram* (online resource for SME);
UN **WIPO** [World Intellectual Property Organization]	Arbitration & Mediation Centre: esp. important for SMEs *Focus*: settling commercial disputes involving IPR, particularly patents and software licences, patent infringement, agreements on trademark, coexistence, pharmaceutical products, R&D, etc.	***Training***: measures concerning innovation and IPR for entrepreneurs, SME, business consultants and SME' supporting institutions; ***Other activities***: issuing policy papers /guidelines; compilation of case studies & *best practice*; WIPO Trophy for innovative enterprises; patent searches via WIPO Patent Information Service (WPIS)

Source: Own elaboration
Note: This table does not pretend to be exhaustive. The authors would like to apologise for any outdated information or if relevant information were missing in this sheet.

The mission of the JRC-IPTS is to provide customer-driven support to the EU policy-making process by developing science-based responses to policy challenges that have both a socio-economic as well as a scientific/technological dimension.

Abstract
This report discusses business R&D in SMEs in the light of a systematic review of publicly available information on industrial R&D, its common trends and related emerging issues.
A number of factors towards better understanding of SME trajectories, specifics in terms of their R&D activities, and the attendant main challenges of SMEs are thus examined along their main boundaries. Company size, the life cycle stage of individual firms, the lack of entrepreneurial spirit in the EU, the lack of access to finance in Europe compared to the US, limited capabilities of SMEs, internationalisation/globalisation effects, intellectual property rights, and the effect of administrative burdens are considered in particular.
In general, achieving a suitable support mix for business R&D in SMEs and embedding it in local, regional, national and European research and innovation systems remains an open but crucial question on the way towards achieving the Lisbon objectives.

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