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Innovation papers No 27

Entrepreneurial innovation in Europe

A review of 11 studies of innovation policy and practice in today's Europe

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European Commission

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A review of 11 studies of innovation policy and practice in today's Europe

Directorate-General for Enterprise

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Executive summary

This book summarises 11 recently published reports in the on-going series of Innovation Policy Studies undertaken by the European Commission's Directorate-General for Enterprise. All 11 were commissioned to examine topics of current interest or concern to policy-makers in Europe – to improve understanding of the innovation needs and behaviours of firms, research institutions and investors, to assess the impacts of existing policy measures, and to explore opportunities for further policy intervention. The studies are designed to help regional, national and EU policy-makers to strengthen Europe's innovative capacity and competitiveness through the introduction of effective, well-targeted and mutually reinforcing legislation and support measures.

Chapter 1 reviews two linked studies which together consider innovation policy and activity in the 13 countries that are candidates for membership of the European Union. The studies assess the readiness of these countries' business sectors to compete in the single European market, and their governments' success in planning and implementing effective innovation policies. They highlight a number of common problems. Access to risk capital is poor, research institutions remain better adapted to basic research than to market-oriented innovation, and bureaucracy and corruption still constitute significant barriers to entrepreneurship. Innovative activity is led by large, foreign-owned companies, and its benefits are slow to spread to smaller homegrown enterprises. In these and other areas, policy intervention can have a dramatic effect, and the studies highlight some notable examples of real progress. But in general, across the 13 candidate countries, insufficient government attention and resources are focused on innovation support, and the ministries that share responsibility for it are poorly co-ordinated.

Chapter 2 examines various aspects of the drive to create innovative firms and thereby employment. The first of three studies reviewed here assesses evidence of a correlation between innovation and job creation. It concludes, tentatively, that innovative enterprises, especially small and medium-sized ones, tend to add jobs at the expense of less innovative competitors. But it finds that the net effect is usually mild, and that its intensity varies between regions and sectors. Process innovation, by helping to improve productivity, can have a negative impact on employment. More markedly, innovation causes a skills shift, increasing the proportion of skilled workers in the innovating firm. The second study looks at university-industry co-operation in the creation of new technology-based firms (NTBFs). It notes that the majority of technology-based spin-off firms in Europe are currently generated by industry rather than by public research institutions. It highlights the crucial role of regional networks in supporting the interactions that give rise to spin-off activity. On-going relationships with industry are critical in establishing the culture in which academic researchers develop entrepreneurial attitudes and aspirations. The last study reviewed in the chapter presents an overview of university spin-outs in Europe. It proposes a typology of academic spin-outs, and argues that public as well as private sector resources be focused on those with clearly defined growth strategies.

Chapter 3 summarises four new studies dealing with the financing of innovation. The first analyses the typical growth path of NTBFs in the life science and information technology fields, and examines the role of different sources of finance at each stage of development. It identifies a strong research institution, a public sector pre-seed capital fund and specialised technological incubation capacity as essential features of an entrepreneurial regional climate favourable to the creation of high-growth start-ups. The second study finds that state-backed or mutual loan guarantee schemes are proving to be a very effective means of closing the equity gap. Loan guarantees are often the only way that innovative companies can gain access to early-stage financing, it concludes, and are most effective when offered as part of integrated packages of financial and advisory support. The third study looks at informal investment by business angels as an alternative bridge over the equity gap facing high-growth firms which are not yet mature enough to attract backing from venture capital funds. Business angels, usually entrepreneurs themselves, are far better equipped than banks to assess the risks of investing in young firms whose assets are largely intangible. They also contribute business expertise as well as capital. Business incubators are providing a valuable NTBF-angel matching service. But outside the United Kingdom and, to a lesser extent, Germany and France, informal investment remains under-developed in Europe. The last of the four financing studies examines the training needs of investment analysts. Lack of the necessary competence to assess technology-based investment opportunities, among both banks and venture capital funds, is a major barrier to the financing of innovative firms. The study found that training for analysts in entrepreneurship, technology trends, and the basic principles of technology is patchy or non-existent – but essential and in demand among analysts themselves.

Chapter 4 summarises a study of the impact of different industrial relations policies on innovation in firms. The study develops a generic model of 'innovation-friendly' industrial relations policies. It distinguishes between indirect employee participation through trade unions and works councils and direct, face-to-face consultation and delegation. The latter in particular, as practised most widely in Denmark, Finland, Sweden, the United Kingdom and France, are found to aid knowledge dispersion, decentralise decision-making and reduce development times. However, the great majority of firms have not yet implemented even the most basic forms of employee consultation, and public policy has a key role in stimulating debate on innovation-friendly industrial relations policies.

Chapter 5 looks at corporate taxation as a means of incentivising innovation-related expenditure by firms. The study undertakes a detailed examination of experience in France, Germany, Spain, the United Kingdom and the United States, and concludes that well-designed tax incentives, carefully adapted to local circumstances, do encourage additional business investment in R&D. It goes on to examine the potential for strengthening such incentives within the European Union's regulatory framework for state aids, and concludes that the current exemption of tax breaks for research and development should be extended to cover non-R&D innovation activities such as technology transfer, training and industrial design.

Taken as a whole, the 11 reports reviewed here point towards a new European model of 'smart' innovation policy. Many elements of Europe's innovation system still require public policy support. Market dynamics are not enough to create an adequate supply of early-stage risk capital, for example, or to bring about the cultural change in public research institutions that is necessary to stimulate the flow of high-tech spin-offs. On the other hand, centrally planned, top-down initiatives tend to be insufficiently responsive to local circumstances and to rapid technological and market change. Policy-makers must seek out opportunities for interventions with maximum leverage on the innovation activities of economic actors.

Note de synthèse

Ce livre résume onze rapports récemment parus dans la série des Etudes sur la politique de l'innovation que publie la Direction générale entreprises de la Commission européenne. Ces rapports ont été commandés pour examiner certaines questions qui intéressent ou préoccupent actuellement les décideurs en Europe – mieux comprendre les besoins d'innovation et les comportements des entreprises, des institutions de recherche et des investisseurs, évaluer l'impact des mesures existantes et explorer les opportunités d'autres interventions politiques. Les études sont conçues pour aider les décideurs, aux niveaux régional, national ou européen, à développer la capacité d'innovation de l'Union par l'introduction de dispositions légales et de mesures de soutien efficaces, bien ciblées et qui se renforcent mutuellement.

Le 1er chapitre présente deux études qui, ensemble, examinent la politique et l'activité d'innovation dans les 13 pays candidats à l'adhésion à l'Union européenne. Les études cherchent à déterminer dans quelle mesure les milieux d'affaires de ces pays sont prêts à affronter la concurrence sur le marché européen unique, et à évaluer le succès des mesures prises par leurs gouvernements pour planifier et mettre en œuvre des politiques d'innovation efficaces. Elles font ressortir un certain nombre de problèmes communs. L'accès au capital-risque est limité, les institutions de recherche restent mieux adaptées pour la recherche fondamentale que pour l'innovation orientée vers le marché, et la bureaucratie et la corruption constituent encore des obstacles sérieux à l'esprit d'entreprise. L'activité d'innovation est menée par des grandes entreprises sous contrôle étranger, et ses bénéfices tardent à se faire sentir pour les sociétés locales plus petites. Dans ces domaines comme dans d'autres, l'intervention politique peut avoir des effets spectaculaires et les études ont mis en lumière certains exemples notables de réel progrès. Mais d'une manière générale, dans les 13 pays candidats, l'Etat n'accorde pas assez d'attention ni de ressources au soutien à l'innovation, et la coordination entre les ministères compétents en la matière laisse à désirer.

Le chapitre 2 passe en revue divers aspects de la dynamique de création d'entreprises innovantes et donc d'emplois. La première des trois études présentées ici évalue les éléments qui attestent d'une corrélation entre l'innovation et la création d'emplois. Elle conclut, avec certaines réserves, que les sociétés innovantes, et particulièrement les petites et moyennes entreprises, ont tendance à créer des emplois aux dépens de leurs concurrents moins innovants. Mais elle constate que l'effet net est généralement peu marqué et que son intensité varie selon les régions et les secteurs. L'innovation de process, en contribuant à renforcer la productivité, peut avoir un effet négatif sur l'emploi. L'innovation entraîne en tout cas, de façon plus perceptible, un déplacement des compétences, qui augmente la proportion du personnel qualifié dans les entreprises innovantes. La deuxième étude s'intéresse à la coopération universités-industrie pour la création de jeunes entreprises technologiques. Elle note que la majorité des entreprises créées par essaimage en Europe proviennent actuellement de l'industrie plutôt que d'institutions de recherche publiques. L'étude fait ressortir le rôle crucial des réseaux régionaux pour favoriser les interactions qui débouchent sur l'essaimage d'entreprises. La régularité des relations avec l'industrie est essentielle pour créer une culture dans laquelle les chercheurs universitaires sont encouragés à développer un esprit d'entreprise. La dernière étude décrite dans ce chapitre donne un aperçu des essaimages universitaires en Europe. Elle propose une typologie de ces essaimages et recommande de concentrer les ressources des secteurs public et privé sur ceux qui s'appuient sur des stratégies de croissance clairement définies.

Le chapitre 3 résume quatre nouvelles études portant sur le financement de l'innovation. La première analyse le parcours typique des jeunes entreprises technologiques dans le domaine des sciences de la vie et des technologies de l'information, et examine le rôle de diverses sources de financement à chaque stade de développement. D'après ses conclusions, les aspects essentiels d'un climat régional propice à la création de start-ups à fort potentiel de croissance sont: une institution de recherche très active, un fonds de capital-risque de préamorçage financé par le secteur public et des installations spécialisées d'incubation technologique. La deuxième étude constate que les systèmes de cautionnement mutuel et de garantie de prêt soutenus par l'Etat s'avèrent des moyens très efficaces pour surmonter le problème du déficit de fonds propres. Les emprunts garantis sont souvent la seule façon pour les entreprises innovantes de réunir des fonds pour se lancer et sont plus efficaces quand ils sont proposés dans le cadre de programmes intégrés de soutien financier et de consultance. La troisième étude s'intéresse aux investissements informels des "business angels" comme solution de remplacement pour combler le déficit de fonds propres auquel sont confrontées les jeunes entreprises à fort potentiel de croissance qui n'ont pas encore atteint un stade de maturité suffisant pour être financées par des fonds de capital-risque. Les "business angels", souvent entrepreneurs eux-mêmes, sont mieux équipés que les banques pour évaluer les risques d'un investissement dans de jeunes sociétés dont les actifs sont en grande partie intangibles. En plus des capitaux, ils apportent aussi leur expertise. Les incubateurs rendent de précieux services pour mettre en contact les jeunes entreprises et les “business angels”. Mais en dehors du Royaume-Uni et, dans une moindre mesure, de l’Allemagne et de la France, les investissements informels demeurent insuffisamment développés en Europe. La dernière des quatre études consacrées au financement examine les besoins des experts en investissements en termes de formation. Les banques et les fonds de capital-risque manquent souvent des compétences nécessaires pour évaluer les opportunités d’investissement dans le domaine technologique. C’est là un obstacle important au financement des entreprises innovantes. L’étude a constaté que, malgré leur importance et la demande des analystes eux-mêmes, les programmes de formation sur la création d’entreprises, les tendances technologiques et les principes de base en matière de technologie sont incomplets, voire inexistants.

Le chapitre 4 résume une étude de l’impact de différentes politiques de relations du travail sur l’innovation dans les entreprises. L’étude développe un modèle général des politiques de relations du travail “favorables à l’innovation”. Elle fait une distinction entre la participation indirecte des salariés par l’intermédiaire des syndicats et des comités d’entreprise et les contacts directs dans le cadre d’entretiens personnels et de délégations. Ces derniers, en particulier, tels qu’ils sont pratiqués le plus largement au Danemark, en Finlande, en Suède, au Royaume-Uni et en France, se sont avérés propices à la diffusion des connaissances, à la décentralisation du processus de décision et à la réduction des temps de développement. Toutefois, dans leur grande majorité, les entreprises n’ont encore mis en place aucune forme de consultation du personnel, même la plus élémentaire, et l’Etat a un rôle important à jouer pour stimuler le débat sur des politiques de relation du travail favorables à l’innovation.

Les chapitre 5 porte sur les dispositions relatives à l’impôt des sociétés, comme moyen d’encourager les dépenses d’innovation des entreprises. L’étude procède à un examen détaillé des expériences française, allemande, espagnole, britannique et américaine et constate que des mesures fiscales bien conçues, soigneusement adaptées aux circonstances locales, encouragent effectivement des investissements supplémentaires des entreprises dans la R&D. Elle examine ensuite la possibilité de renforcer ce genre de mesures dans le cadre réglementaire de l’Union européenne applicable aux aides d’Etat et conclut que les exemptions actuelles concernant les abattements fiscaux pour les dépenses de recherche et de développement devraient être étendues pour couvrir les activités d’innovation en dehors de la R&D, comme le transfert technologique, la formation et le design industriel.

Dans leur ensemble, les 11 rapports présentés ici plaident en faveur d’un nouveau modèle européen de politique de l’innovation “intelligente”. De nombreux éléments du système d’innovation en Europe requièrent encore un soutien politique public. Les dynamiques du marché ne suffisent pas à créer une offre adéquate de capital-risque pour les premiers stades de développement des entreprises, par exemple, ou pour faire naître le changement culturel nécessaire dans les institutions de recherche publiques pour stimuler l’essaimage d’entreprises high-tech. D’un autre côté, les initiatives centralisées, venues d’en haut, accusent souvent un certain décalage par rapport aux circonstances locales et aux changements rapides dans les technologies ou sur le marché. Les décideurs doivent rechercher les opportunités d’intervention qui auront le plus d’effet sur les activités d’innovation des acteurs économiques.

Überblick

Dieses Buch enthält Zusammenfassungen von 11 kürzlich veröffentlichten innovationspolitischen Studien der Generaldirektion Unternehmen der Europäischen Kommission. Die Studien wurden in Auftrag gegeben, um aktuelle Themen zu untersuchen, die für politische Entscheidungsträger in ganz Europa von Belang sind. Dabei ging es vor allem darum, die Innovationsbedürfnisse und das Innovationsverhalten von Unternehmen, Forschungseinrichtungen und Investoren besser zu begreifen, die Auswirkungen bestehender politischer Maßnahmen zu beurteilen und Möglichkeiten für künftige politische Massnahmen zu prüfen. Die Studien sollen Politikern auf regionaler, nationaler und EU-Ebene helfen, Europas Innovations- und Wettbewerbsfähigkeit durch die Einführung wirksamer und gezielter Gesetze und Fördermaßnahmen zu stärken.

Kapitel 1 befasst sich mit zwei Studien, die die Innovationspolitik und die Innovationsaktivitäten in den 13 Ländern, die sich um eine Mitgliedschaft in der Europäischen Union bewerben, unter die Lupe nehmen. Die Studien bewerten die Wettbewerbsfähigkeit der Wirtschaftssektoren dieser Länder im europäischen Binnenmarkt und den Erfolg ihrer Regierungen bei der Planung und Umsetzung effizienter Innovationspolitiken. Sie stellen eine Reihe gängiger Probleme heraus: Der Zugang zu Risikokapital ist völlig unzulänglich, die Forschungseinrichtungen sind noch immer viel mehr auf Grundlagenforschung als auf marktorientierte Innovation eingestellt, und das Unternehmertum wird durch Bürokratie und Korruption weiterhin stark behindert. Die Innovationstätigkeit geht von großen ausländischen Unternehmen aus, und ihre Ergebnisse finden nur nach und nach den Weg zu kleineren einheimischen Firmen. In diesen wie auch anderen Bereichen können politische Interventionen enorme Wirkung erzielen; die Studien enthalten einige bemerkenswerte Beispiele für echten Fortschritt. Im Allgemeinen ist jedoch festzustellen, dass die Regierungen der Innovationsförderung zu wenig Gewicht beimessen und die zuständigen Ministerien schlecht koordiniert sind.

Kapitel 2 beleuchtet verschiedene Aspekte der Tendenz, innovative Firmen und damit Arbeitsplätze zu schaffen. Die erste der drei hier beschriebenen Studien beurteilt, inwieweit sich ein Zusammenhang zwischen Innovation und der Schaffung von Arbeitsplätzen nachweisen lässt. Sie gelangt – vorläufig – zu dem Schluss, dass innovative Unternehmen, vor allem kleine und mittlere, neue Jobs meist auf Kosten ihrer weniger innovativen Konkurrenten hervorbringen, dass der Nettoeffekt daher in der Regel geringfügig ist und seine Intensität zwischen einzelnen Regionen und Sektoren variiert. Verfahrensinnovation, die auf Produktivitätssteigerungen abzielt, kann sich negativ auf die Beschäftigung auswirken. Noch deutlicher ist zu erkennen, dass Innovation dazu führt, dass sich Fähigkeiten verlagern und der Anteil qualifizierter Arbeitnehmer in dem innovativen Unternehmen steigt. Die zweite Studie beschäftigt sich mit der Zusammenarbeit zwischen Hochschulen und Industrie bei der Gründung neuer technologiebasierter Firmen (NTBF). Sie stellt fest, dass die Mehrheit technologiebasierter Spin-off-Firmen in Europa gewöhnlich von der Industrie und nicht von öffentlichen Forschungseinrichtungen geschaffen wird, und unterstreicht die maßgebliche Rolle regionaler Netzwerke bei der Unterstützung der Wechselwirkungen, durch die Spin-off-Aktivitäten ausgelöst werden. Laufende Kontakte mit der Industrie sind entscheidend für die Entstehung einer Kultur, in der Hochschulforscher unternehmerische Haltungen und Visionen entwickeln. Die letzte in diesem Kapitel beschriebene Studie gibt einen Überblick über Ausgründungen aus Universitäten in Europa. Sie erstellt eine Typologie von Hochschul-Spin-offs und empfiehlt, öffentliche und private Mittel auf Ausgründungen mit klar definierten Wachstumsstrategien zu konzentrieren.

Kapitel 3 fasst vier neue Studien über Innovationsfinanzierung zusammen. Die erste dieser Studien analysiert den typischen Wachstumspfad von NTBF in den Bereichen Biowissenschaften und Informationstechnologie sowie die Rolle verschiedener Finanzierungsquellen in den einzelnen Wachstumsstadien. Sie gelangt zu dem Ergebnis, dass eine starke Forschungseinrichtung, ein öffentlicher Startkapitalfonds und spezialisierte technologische Gründerzentren entscheidende Voraussetzungen für ein regionales unternehmerisches Klima darstellen, das die Gründung von Start-ups mit hohem Wachstumspotenzial fördert. Die zweite Studie stellt fest, dass staatliche Garantiesysteme oder Kreditgarantiegemeinschaften sich als äußerst wirksames Mittel zur Überbrückung der Kapitallücke erweisen. Für innovative Unternehmen sind Kreditgarantien oftmals der einzige Weg, Zugang zu Frühphasenfinanzierung zu finden, so die Studie weiter – und ihre Wirkung ist optimal, wenn sie im Rahmen eines integrierten Pakets von Finanz- und Beratungsunterstützung angeboten werden. Die dritte Studie befasst sich mit informellen Investitionen von Business Angels als Alternative zur Überbrückung der Kapitallücke, mit der Wachstumsfirmen konfrontiert sind, die für Risikokapitalfonds noch nicht interessant sind. Business Angels, in der Regel selbst Unternehmer, können die

Risiken einer Investition in Jungunternehmen mit überwiegend immateriellen Vermögenswerten viel besser beurteilen als Banken. Neben Kapital bringen sie auch ihr geschäftliches Fachwissen ein. Gründerzentren helfen mit, NTBF mit dem richtigen „Engel" zusammenzubringen. Aber außerhalb des Vereinigten Königreichs und, in geringerem Umfang, Deutschlands und Frankreichs sind informelle Investitionen in Europa noch immer zu wenig entwickelt. Die letzte der vier Studien zum Thema Finanzierung untersucht den Ausbildungsbedarf von Investment-Analysten. Die Finanzierung innovativer Firmen wird durch mangelnde Kompetenzen zur Bewertung technologiebasierter Investitionsgelegenheiten (sowohl bei Banken als auch bei Risikokapitalfonds) erheblich behindert. Die Studie stellt fest, dass Ausbildungsmöglichkeiten für Analysten in Bereichen wie Unternehmertum, Technologietrends und den Grundprinzipien der Technologie nur sehr vereinzelt oder gar nicht bestehen – dabei wäre eine derartige Ausbildung ungeheuer wichtig, und unter den Analysten selbst besteht durchaus eine entsprechende Nachfrage.

Kapitel 4 befasst sich mit einer Studie über die Auswirkungen verschiedener politischer Maßnahmen im Bereich der Arbeitsbeziehungen auf Innovation in Unternehmen. Die Studie entwickelt ein allgemeines Modell „innovationsfreundlicher" politischer Maßnahmen im Bereich der Arbeitsbeziehungen. Sie unterscheidet zwischen indirekter Arbeitnehmerpartizipation über Gewerkschaften und Betriebsräte und direkter persönlicher Anhörung und Delegierung. Insbesondere das letztere Modell, das in Dänemark, Finnland, Schweden, dem Vereinigten Königreich und Frankreich am weitesten verbreitet ist, trägt laut der Studie zur Weiterleitung von Wissen bei, dezentralisiert die Entscheidungsfindung und verkürzt Entwicklungszeiten. Allerdings haben die meisten Unternehmen bislang nicht einmal die grundlegendsten Formen einer Arbeitnehmerkonsultation eingeführt; hier ist die öffentliche Politik gefordert, eine Debatte über innovationsfreundliche politische Maßnahmen im Bereich der Arbeitsbeziehungen anzustoßen.

Kapitel 5 widmet sich der Unternehmensbesteuerung als Mittel, Anreize zu Investitionen in Innovation zu schaffen. Die Studie untersucht im Detail einschlägige Erfahrungen in Frankreich, Deutschland, Spanien, dem Vereinigten Königreich und den Vereinigten Staaten und gelangt zu dem Schluss, dass vernünftig konzipierte und sorgfältig auf das lokale Umfeld abgestimmte Steueranreize tatsächlich zu höheren F&E-Aufwendungen der Wirtschaft führen. Sie geht außerdem auf das Potenzial zur Verstärkung derartiger Anreize im EU-Rechtsrahmen für staatliche Beihilfen ein und kommt zu dem Ergebnis, dass die derzeitige Ausnahmeregelung, die Steuererleichterungen für Forschung und Entwicklung vorsieht, auch für Nicht-F&E-Aktivitäten wie etwa Technologietransfer, Ausbildung und Industriedesign gelten sollte.

Im Ganzen gesehen zeichnen die 11 hier beschriebenen Berichte die Umrisse eines neuen europäischen Modells einer „cleveren" Innovationspolitik. Viele Elemente des europäischen Innovationssystems sind immer noch auf die Unterstützung der öffentlichen Politik angewiesen. Die Dynamik des Marktes allein kann kein angemessenes Angebot an Frühphasen-Risikokapital verfügbar machen oder den kulturellen Wandel in öffentlichen Forschungseinrichtungen herbeiführen, der notwendig ist, um die Gründung von Hightech-Spin-offs voranzutreiben. Andererseits gehen zentral geplante Top-down-Initiativen meist nur unzureichend auf lokale Gegebenheiten und auf technologische und Marktveränderungen ein. Die politischen Entscheidungsträger müssen versuchen, möglichst dort anzusetzen, wo ihre Interventionen eine maximale Hebelwirkung auf die Innovationstätigkeit der Wirtschaftsakteure haben.

Introduction

The innovation value chain

Eleven new policy studies reveal substantial progress towards the establishment of a Europe-wide policy framework that favours innovation. Policy-makers are becoming smarter at identifying and valuing innovation. The challenge now is to apply these lessons in market-oriented measures that appropriately support and incentivise innovators – not just within the EU-15, but also in acceding and candidate countries.

The Lisbon European Council of March 2000 defined an ambitious ten-year strategy to turn the European Union into "the most competitive and dynamic knowledge-based economy in the world" by the end of the decade. The Council identified innovation – the successful production, assimilation and exploitation of novelty in the economic and social spheres – as the principal engine of sustainable economic growth.

In its report on implementation of the Lisbon strategy, submitted to the European Council in Barcelona in March 2002, the European Commission asks the Council to "endorse action to strengthen the European area of research and innovation by setting a target of 3% of GDP for the overall level of public and private spending on research and development by the end of the decade. Within that total, the amount funded by business should rise to around two thirds against 55% today."

In today's global market economy, the innovation performance of a European region or country, and of the European Union as a whole, primarily depends on decisions made by economic actors rather than by policy-makers. Ultimately, it is the choices made by individual entrepreneurs, company managers and investors – based on their perceptions of costs, benefits and risks – that determine levels of innovative activity.

Nevertheless, by removing barriers, balancing incentives, supporting experimentation and ensuring the free flow of information, policy-makers play a crucial enabling and catalytic role. The European Commission's communication *Innovation in a knowledge-driven economy*,(1) adopted in September 2000, translated the Lisbon summit's goals into priorities and practical steps for Member States in the area of innovation policy.

At the same time as establishing strategic objectives for the European Union, the Lisbon Council introduced a new method for the Member States to achieve these objectives jointly. It described the method of 'open co-ordination' as "the means of spreading best practice and achieving greater convergence towards the main EU goals". The method involves:

- specific timetables for achieving short-, medium- and long-term goals
- international benchmarking, using quantitative and qualitative indicators, as a means of comparing best practice
- national and regional policy targets and measures
- mutual learning through periodic monitoring, evaluation and peer review

In the area of innovation, the main mechanism the Commission deploys to support open co-ordination is the European Trend Chart on Innovation. This transnational learning tool comprises the Innovation Scoreboard, which provides an annual snapshot of innovation performance in each Member State, a database of innovation policy measures that identifies and describes nearly 700 European innovation support schemes, and a series of policy benchmarking workshops through which policy-makers and practitioners from around Europe proactively address specific topics of policy design or practical implementation.

Policy studies

To provide additional support for open co-ordination in the area of innovation policy, the Innovation Directorate of the Commission's Directorate-General for Enterprise undertakes a series of specific Innovation Policy Studies. These examine in detail issues of particular interest or concern to policy-makers – especially topics relevant to the policy framework established by the 2000 communication on innovation. Their aim is to improve understanding of the innovation needs and behaviour of economic actors, the impacts of policy instruments already in place, and the options for further policy intervention.

Innovation policy in Europe is evolving rapidly in response to the challenges of globalisation and the knowledge economy, and thanks to the greater priority accorded to it by EU, national and regional authorities. Since 2000, new policy concerns and approaches have started to emerge, and the Commission has recently published a new communication(2) addressing in particular questions of 'entrepreneurial innovation' and innovation that is not directly inspired by research.

(1) COM(2000) 567. The full text can be downloaded from http://www.cordis.lu/innovation-smes/communication2000/home.html
(2) Commission Communication Innovation policy: Updating the Union's approach in the context of the Lisbon strategy*, COM(2003) 112, 11 March 2003. The text can be downloaded from http://europa.eu.int/comm/enterprise/innovation/communication.htm*

Traditional innovation policy-making in Europe has tended to focus on its technological aspects, but today a more entrepreneurial, or market-oriented, approach is required. In the future, innovation policy will have to take into account not only the suppliers and immediate users of new knowledge but also its indirect contributors and beneficiaries. These include end-users in business and consumer markets, and the many intermediary organisations, agencies and professions which link these actors together into a cohesive and dynamic innovation 'value chain'. The challenge for policy-makers will be to maximise the efficiency and productivity of this value chain.

The diversity of innovation practice and performance across the Union is already both a challenge and an opportunity. A two-speed innovation system cannot deliver maximum economic and societal benefits, and the gap between the leaders and the rest must not be allowed to widen. On the other hand, the spectacular success of some countries in particular policy fields makes it possible for those with weaknesses to advance rapidly, by benefiting from the transfer of policy know-how, tools and schemes. The challenge and the opportunity will both be magnified by the imminent enlargement of the Union, making the process of open co-ordination even more necessary.

The benchmarking of national performance against specific indicators, the regular collection and dissemination of information about current policy schemes, and mutual learning effected through peer reviews, have already done much to improve the inclusiveness and transparency of innovation governance in Europe. But the speed and spread of innovation in Europe depends on its acceptability to citizens, organisations and administrations, as well as on effective policy-making. In the coming years, it will be more important than ever to give regional, sectoral and social stakeholders better access to the process of policy design, implementation and evaluation.

This publication

This book reviews and summarises 11 of the most recent Innovation Policy Studies. As in the earlier Innovation Policy Study compendium *Building an innovative economy in Europe*,(3) each summary outlines the most significant findings of the study, and is intended to add value to those around it. Full publication details are given for each report.

(3) Building an innovative economy in Europe *can be browsed or downloaded at http://www.cordis.lu/innovation-policy/studies/2001/*

Chapter 1 **Enlargement and innovation**

1.

Chapter 1 reviews two linked studies which together consider innovation policy and activity in the 13 countries that are acceding to or are candidates for membership of the European Union. They highlight a number of common problems. Access to risk capital is poor, research institutions remain better adapted to basic research than to market-oriented innovation, and bureaucracy still constitutes a significant barrier to entrepreneurship. Innovative activity is led by large, foreign-owned companies, and its benefits are slow to spread to smaller homegrown enterprises.

1.1

Innovation policy issues in six candidate countries:* The challenges

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Innovation papers No 16, 189 pp
Free, from the Innovation Helpdesk (see back cover) or downloadable from http://www.cordis.lu/innovation-policy/studies/geo_study1.htm
Study team led by: Aide à la Décision Economique SA - ADE (Belgium)

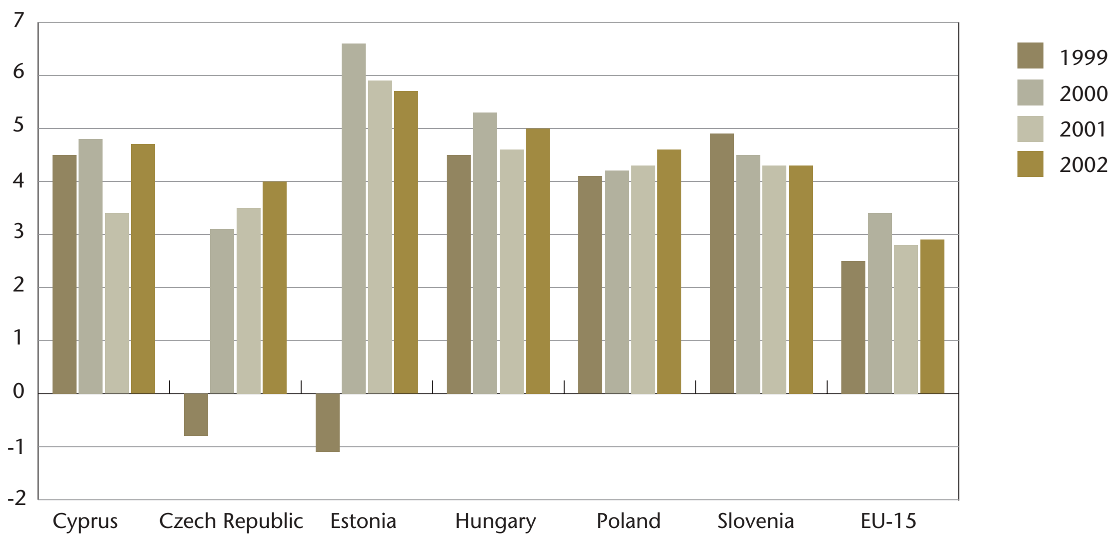
** Cyprus, Czech Republic, Estonia, Hungary, Poland, Slovenia*

Key findings

- The cohesion of an enlarged EU will depend on the economies of the six candidate countries studied (CC6) being able to sustain high rates of growth through increased technological change.
- The CC6 have a "dual economy" of profitable, highly productive foreign investment enterprises on the one hand and domestic firms which struggle to remain competitive on the other.
- The potential for catching up based on new technologies is severely restricted by weak demand for R&D by business sectors.
- Available innovation surveys lead to the conclusion that, compared to the EU, there are fewer innovative small firms in the CC6.
- In 2000 only Poland and Hungary offered fiscal incentives to companies to undertake R&D or innovation projects.
- Even where there are specific departments or ministries with a remit for innovation and technology policy, they do not play a role in co-ordinating innovation policy matters.
- The existence of government policy documents, or even funding agencies and programmes, is no guarantee of either the availability of government funding for innovation policy initiatives or the effective disbursement of funds.
- There are clear signs that funding mechanisms are not meeting targets or are failing to provide the correct incentives for companies to innovate.
- Policy activity in the area of research-industry relations has been intense in most of the CC6 in the latter part of the 1990s.

Figure 1.1

GDP growth rates and forecasts 2000-2002 (annual percentage change)



Policy context

For some years now the European Union has invested heavily in promoting technological innovation as the key to making industry more competitive. SMEs, in particular, play a key role in creating the new ideas that will lead to new products and services. At the time of the study, thirteen countries were seeking to join the Union, and this report is one of two studies examining and analysing the then-current framework conditions for selected innovation issues. It covers six of the countries – the "CC6" – Cyprus, the Czech Republic, Estonia, Hungary, Poland and Slovenia. The former centrally planned states (the CC6 excluding Cyprus) are known here as the "CC5".

The 1993 Copenhagen European Council defined the following economic criteria for accession: the existence of a functioning market economy, and the capacity to withstand competitive pressure and market forces within the Union.

In November 2000 the Commission reported that all the CC6 met the first criterion but only Cyprus had met the second (the situation remained unchanged a year later). Estonia, Hungary and Poland were on course to do so in the medium term while the Czech Republic and Slovenia had further to go. Enlargement requires adoption of the economic framework to meet the demands of competition, and developing innovation performance is a key part of this.

Since the study was published, all six countries – along with four more candidate countries – have concluded negotiations to join the EU, and are expected to become members in May 2004.

How has the transition to a market economy influenced the potential for businesses to innovate?

The central and eastern European countries, the CC5, are still in transition from centralised command economies, and all but Slovenia were closely integrated into the economic system controlled by the former Soviet Union. Of the CC5, only Poland and Hungary were nation states before 1989; the Czech Republic, Estonia and Slovenia are all newly formed (or reformed) states which have ceded from larger entities. Even the one already westernised state, Cyprus, remains divided into two political entities following the civil war of 1974. In such conditions of political and economic upheaval, all the CC6 face major challenges of building strong market economies based on democratic principles that can compete with the historically more stable countries of the EU. So how are they doing?

In the early 1990s all the CC5 suffered a sharp recession as necessary structural reforms were put in place. Growth resumed from 1993, though at differing rates. In the 1990s Poland was, after Ireland, Europe's fastest growing economy, but by 1999 the CC6 still lagged behind the EU in GDP per head, and only Cyprus and Slovenia managed to attain a level comparable with the poorer of the four EU "cohesion" states (Greece, Ireland, Portugal and Spain). Nonetheless, growth rates among all CC6 countries exceeded the EU average in 2001 (Figure 1.1) and were forecast to continue to do so through 2002. These high rates of growth will have to persist for some years if the enlarged EU is to be both economically and socially cohesive.

Productivity has improved throughout the 1990s, but this is more a result of continuing restructuring – layoffs of surplus labour and closures of unproductive factories – than of technological innovation. Obviously there is a limit to the gains that can be made this way and there are signs that the rate of productivity growth is falling (Figure 1.2). Future improvements will require genuine innovation if businesses are to compete in the EU's internal market. Foreign-owned firms are responsible for much of the new business, bringing capital investment and more efficient use of assets. This has created a "dual economy" in which indigenous businesses struggle to compete with standards set by the incomers, but in the longer term the presence of foreign business is expected to diffuse technological innovation into the host economies by developing local subcontractors and tapping research expertise.

One sign of a healthy economy is a buoyant export trade, especially in high-tech goods. In 1999 the proportion of high-tech goods in manufacturing exports in the CC6 was 3-9%, comparable to the southern EU cohesion states. The exception was Hungary with an astonishing 21%, which was almost entirely driven by foreign-owned companies (Figure 1.3).

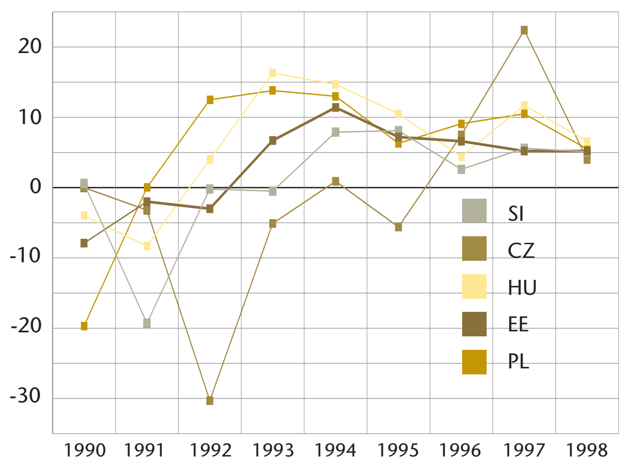
After a spurt following price liberalisation, by 2000 inflation had been reduced to less than 10% throughout the CC6. Unemployment too is now broadly comparable to EU levels, if still higher, although it remains a serious challenge in Poland.

Turning to the financial climate, the study finds that all six countries, led by Hungary, have made progress in reforming their banking and taxation systems, but availability of finance for business lags far behind the EU and is a major cause for concern. Stock market capitalisation remains small: the most developed stock market, in Poland, is still only half the size of that in Portugal.

Privatisation in the CC5 is continuing, with the private sector accounting for more than half the GDP in all countries and approaching 80% in the Czech Republic and Hungary. Many

Figure 1.2

Annual % change in labour productivity in manufacturing



Source: EBRD, Transition Reports 2000 and 1999 of the key players in the new business elite are the same as under the old system, which may hinder the emergence of innovative firms. Nonetheless, it appears that newly-created companies are investing in R&D and training, which augurs well for innovation in the years to come.

There is a high rate of new business creation (Figure 1.4) across the CC5, with Poland leading the way, yet in all countries only 30-45% of new companies are still able and willing to invest a year after their foundation. An impressive proportion of businesses across the CC5 are founded by people with higher educational qualifications, especially in Hungary and Slovenia, which may indicate strong potential for future innovation. The main barriers to growth appear to be the inevitable financial constraints but also intense competitive pressures as these fledgling companies seek niche markets for their products.

Where do the candidate countries stand in terms of innovation performance?

Indicators of innovation performance in the CC6 are not compiled systematically as they are within the EU, and are not always comparable across borders. This suggests that policy decisions are being made on the basis of partial and unreliable data. The report does present a tentative "innovation scoreboard" but difficulties in obtaining complete and accurate data means it is of only limited value in assessing the relative innovation performance of the CC6 countries. (More recently the European Innovation Scoreboard 2002 has included data from the candidate countries, although again data completeness was a problem.) However a number of conclusions can be drawn.

If education is the key to an innovative society, then at first sight all the CC6 appear well placed for the future. Spending on education as a proportion of GDP has been maintained through the 1990s and is comparable to or even greater than the wealthier EU states. Cyprus and Estonia are performing particularly strongly. However, these raw figures conceal two problems, especially among the CC5. First, in all countries but Estonia, despite the high levels of education spending, the share of the population with tertiary level qualifications is low (Figure 1.5). This is likely to hinder the widespread adoption of new technologies in countries which already have a shortage of engineers and IT specialists. Second, both secondary and tertiary education have been slow to change to provide the skills needed for the market economy – particularly for small entrepreneurial firms – in areas such as management techniques, accounting and marketing. Foreign companies established in the CC5 report that local workers lack adaptability and flexibility, and require around six months of training to become as productive as their western counterparts. There is still not enough recognition of the need for regular training and retraining to maintain the necessary adaptability among the workforce in a market economy.

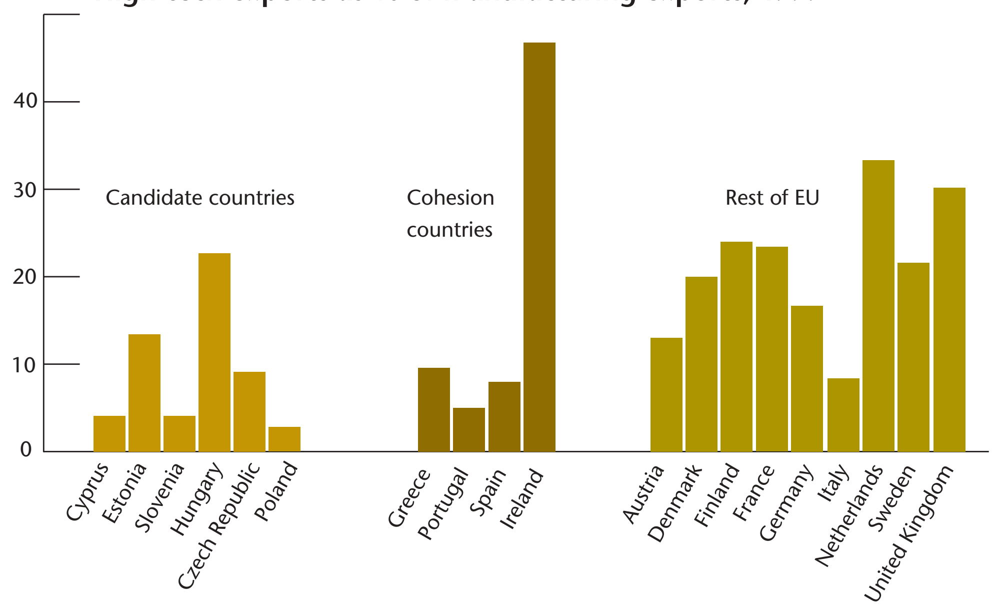
Cyprus does not suffer the same legacy as the CC5, and the emphasis there is on a general upgrading of skill levels rather than restructuring or retraining.

Another important indicator of innovation performance, of course, is the level of investment in research and development (R&D). Levels of R&D in the CC5 fell sharply in the early 1990s as the former state-owned research centres either closed down or were obliged to concentrate on selling short-term services. Since the mid-1990s R&D investment has stabilised or even grown, and is now comparable to that in the EU cohesion states, with the Czech Republic and Slovenia closer to the EU average. The R&D systems in the CC5 are performing well, in terms of patents (although not high-tech patents) and their orientation towards industrial technology. However in some countries, such as Estonia, researchers focus more on basic science than technology. Industrial R&D levels in Cyprus are extremely low.

Objective data on translating R&D findings into innovation in the CC6 are scarce. Only in Poland and Slovenia had there been surveys comparable to the Community Innovation Survey carried out in the EU. They show that the share of innovative firms in those two countries is below the EEA average, but comparable to the situation in Spain, and that innovation is more concentrated in large firms than is the case in the EU. While generalisations are hazardous, one can surmise that across the CC5 innovation activities are in the hands of a few large firms, with very little inno-

Figure 1.3

High-tech exports as % of manufacturing exports, 1999



Source: World Bank, CDROM WDI

vation coming from SMEs. Process innovation seems particularly important, both due to the presence of energy-intensive industries and the low energy efficiency of manufacturers generally. Little more can be said in the absence of internationally comparable data on innovation activities in the CC6.

How do the CC6 shape up in terms of the two essential conditions for modern business, the availability of finance and information technology (IT) infrastructures? We have already seen that the financial and banking sector is underdeveloped in the CC6 and lacks mechanisms for supporting innovation. Venture capital is available on a similar scale relative to GDP as in the EU cohesion countries, with Poland the most developed, but creating a financial system geared to innovation remains a key challenge.

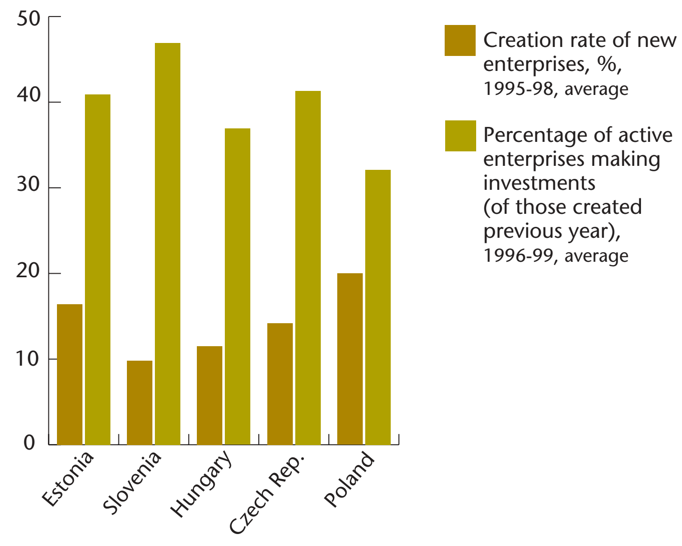
As for IT, the number of personal computers per head of population in the CC5 is again comparable to that in the EU cohesion states, except that Slovenia, at 25%, approaches the wealthier EU members. PC ownership in Cyprus is very low. Statistics for the numbers of internet hosts – an indicator of business uptake of IT – tell a similar story. A looming problem however, is the high cost of internet access in the CC5. In 2000, access in the Czech Republic, Hungary and Poland was the most expensive in the OECD, damping demand for services which are regarded as essential in developing innovative economies.

Is the legal and institutional environment conducive to stimulating innovative activity?

As part of the restructuring of their economies, the former centrally planned states have had to introduce legal provisions and institutions to support a free market economy. These included company law, bankruptcy law, regulatory and financial supervision, and competition policy. While the development of these institutions has lagged behind privatisation and liberalisation, by 2000 the European Bank for Reconstruction and Development reported that all the CC5 countries were close to attaining the level of reform that would allow private enterprises to grow without major institutional obstacles. Cyprus and Estonia have the most favourable legal environments, followed by Hungary. In the other three countries specific problems remain to be solved.

Figure 1.4

Rate of creation of new enterprises (1995-1998)

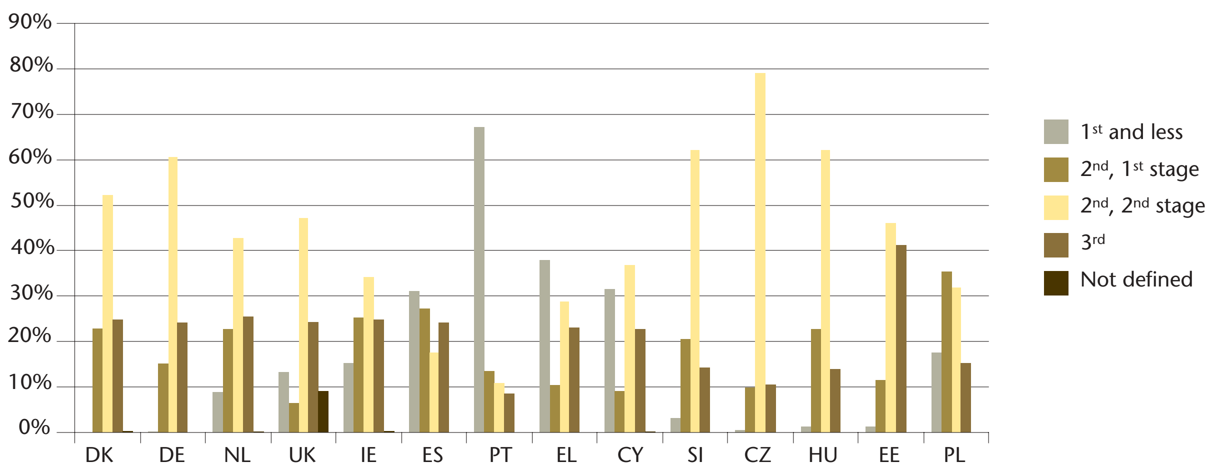


By November 2000 competition policy still had a long way to go, especially in ensuring fair access to business services and financial resources. In some countries, especially Poland, fiscal aid policies to attract foreign investment appeared incompatible with EU regulations.

With the institutions largely in place, attention is now turning to simplifying administrative procedures, especially for start-up companies. Poland and Slovenia have set up “anti-bureaucracy task forces” while Cyprus and Hungary have adopted a simple “one-stop shop” system for registering new companies. Reducing the burden of red tape seems a precondition for stimulating innovation in the CC6.

Taxation policy is another area which can weigh heavily on new businesses. For example, there is some evidence that SMEs and start-ups in the Czech Republic and Hungary face a heavier tax burden than larger companies, in part because tax incentives offered to foreign investors are not available to local companies. However there is now a trend towards a more neutral tax

Figure 1.5 **Economically active population by level of education (1999)**



system. In other countries the problem is more one of complexity. A business survey in Poland found the tax system to be "inconsistent, complex and unpredictable", though measures are in hand to tackle this problem. Tax incentives for innovation in the CC6 are a lower priority at present than reforming the taxation system itself.

Surprisingly, perhaps, the important issue of protection of intellectual property rights (IPR) remains almost ignored. Foreign investors have drawn attention to the unfavourable climate for IPR protection, which is likely to reduce the willingness of entrepreneurs to launch new products. Only Cyprus is a member of the European Patent Office.

Who is responsible for innovation policy matters in the candidate countries?

The study examined the policy and administrative frameworks for supporting innovation in each country. As a rule, responsibility for innovation is shared by several government departments and agencies, though one ministry usually takes the lead. In Cyprus, the Czech Republic, Estonia and Slovenia this is the ministry in charge of economic or industrial affairs, and in Hungary it is the ministry of education. In Poland, policy making and funding are split between the economic ministry and the State Committee for Scientific Research (KBN). Funding for innovation projects is usually drawn from several sources, but in the Czech Republic and Slovenia this can be an obstacle to effective co-ordination. Only Estonia has a dedicated agency for innovation and technology.

Since the mid-1990s new organisations representing non-governmental stakeholders have emerged in the CC6 such as entrepreneurs' associations, business clubs, specialised institutes and technology parks. They have raised the profile of innovation as a policy issue, but the traditional science and research lobbies remain better placed to influence government thinking.

To what extent have the candidate countries developed an innovation policy?

None of the six countries has developed a fully-fledged innovation policy. The existence of policy documents and even of funding agencies is no guarantee that the policy will be implemented effectively or that the funds will actually be available. In some cases an expansion of objectives has been accompanied by a reduction of funding.

Cyprus – While there are ambitious plans to transform the country into an international centre for information technology, there is no explicit government policy on innovation as such. However there does seem to be an increasing awareness of the importance of innovation, and there are a number of small-scale initiatives such as new business incubators.

Czech Republic – Government policy in the early 1990s was to support basic R&D in the expectation that privatised industry would take care of commercial applications. Emphasis has now shifted to support for industrial research, bridge-building between academia and industry and attraction of foreign investment, but there is still no distinct innovation policy.

Estonia – A national innovation programme was launched in 1998, in the recognition that liberalisation alone would not lead to efficient investment for growth. It was an ambitious document (called a "shopping list" by some critics) and has not received the funding necessary to implement it. A more recent national development plan includes a series of measures for fostering innovation and the introduction of new technologies to be managed by the new Technology Agency.

Hungary – Despite a number of initiatives and well-developed infrastructure for innovation support, there is still no political consensus on the content and management of an innovation policy. Indeed, it can be argued that no systematic policy has been implemented since reforms began in the early 1990s. Nonetheless, Hungary is regarded as ahead of the other five countries in the sophistication of its support for innovation.

Poland – As noted above, innovation policy making is split between two government bodies, the economics ministry and KBN, and both produced major policy statements in 1999-2000. The KBN policy focuses on measures in science and technology while the ministry document is part of a new national development plan and is more aligned to promoting an innovation culture. The success of the policies will depend on implementation by other bodies.

Slovenia – A policy for technological development was published as early as 1994 but was only partly implemented. An innovation agency, proposed in 1998, also came to nothing as a result of lack of support from the participating ministries. More recent plans envisage an agency for development and technological research, but it is accepted in government circles that there is too much emphasis on policy-making and not enough on implementation. It is still not clear whether Slovenia has an innovation policy as such.

What types of initiatives have been taken in specific areas of innovation policy?

Training for innovation – Vocational education in the CC6 tended to be for the traditional skills required by large state-owned enterprises and does not now meet the needs of smaller, innovative businesses. While this is a recognised problem, poor co-ordination between government bodies and a lack of data on supply of, and demand for, human resources are hampering efforts to improve the situation. Cyprus and the Czech Republic have set up agencies to co-ordinate activities in this area and some countries have promoted awareness-raising events such as innovation fairs. Initiatives to promote life-long learning are scarce, though Slovenia has held an annual "life-long learning week" since 1996.

As links between academia and industry develop, a number of university courses in innovation management have been introduced, though the emphasis tends to be more on management than innovation. Funding for such courses from foreign donor organisations has been important, but support is often short-term. Good examples are the EU Phare programme, which has supported courses and teaching materials in Hungary, Poland and Slovenia, and a USAID programme to provide technology management courses in three Polish institutes.

Training provided by organisations such as technology parks and business incubators is oriented more towards issues surrounding entrepreneurship and quality management than specific innovation skills, and there is need for better support for the training organisations themselves. The private sector seems to regard training as a low priority but otherwise few data are available.

Innovation management techniques (IMT) – A number of specific tools and procedures for stimulating innovation have been adopted by foreign companies (value analysis, benchmarking, technology watch, and so on), but they are still uncommon in the CC6. Statistical information is hard to come by, but in the absence of data on the uptake of IMTs, the study examines the numbers of companies achieving certification for the ISO 9000 (quality) and ISO 14000 (environment) standards, both of which require a systematic approach to business activities. For their size, Slovenia, the Czech Republic and Hungary lead the way in ISO certifications, with Poland and Estonia further behind. Cyprus falls between these two groups. It appears that ISO certification may be a driver for change and, potentially, innovation. There is also a strong correlation between ISO certifications and a country's openness to trade (Figure 1.6), which suggests that such standards are becoming a prerequisite for successful exporting.

At present there is very little awareness of IMTs in the CC6 either among policy-makers or among businesses, but the findings on ISO certification suggest that public programmes to promote the use of IMTs could be effective in raising competitiveness. A survey within the EU showed that IMTs were as popular in the cohesion countries as in the wealthier states, so a lower level of economic development does not seem to be an obstacle to using them.

Business innovation interfaces and support – As in other areas, there is little reliable information on the extent of links between businesses and public sector research. However, CC6 businesses in general do not see much need to tap R&D results and incorporate them into their production processes. Those that do cannot afford to pay for it. Foreign-owned subsidiaries rely on know-how from their parent companies or strategic partners. As for the universities, they still see their role in traditional terms and have no incentive to work with industry. The former state-owned research centres in the CC5 tend now to seek income from short-term services to industry and are not well placed to undertake longer term, pre-competitive research. Relationships between the research and business communities are now a priority in all CC5 countries, though not yet in Cyprus.

Support for business start-ups, particularly in high-tech activities, is seen as an important part of innovation policy throughout the CC6, though the measures adopted vary considerably from country to country (echoing the findings from EU studies that successful schemes cannot always be transplanted into different business environments). High-tech incubators in Cyprus have not been a great success, possibly because of the lack of local research expertise. Estonia has seen spin-off firms emerging around the universities in Tartu and Tallinn, and Hungary helps new firms to draw up innovation plans. Poland has more than 250 organisations that support high-tech firms in one way or other, though business leaders comment that incentives for innovation are still lacking.

Business networking is still a new idea in the CC6, with Hungary and the Czech Republic pioneering clustering activities around large, foreign-owned firms and their local SME suppliers, and Poland introducing support for business clusters generally. These activities may be a good way of promoting innovation amongst large numbers of small businesses.

Challenges

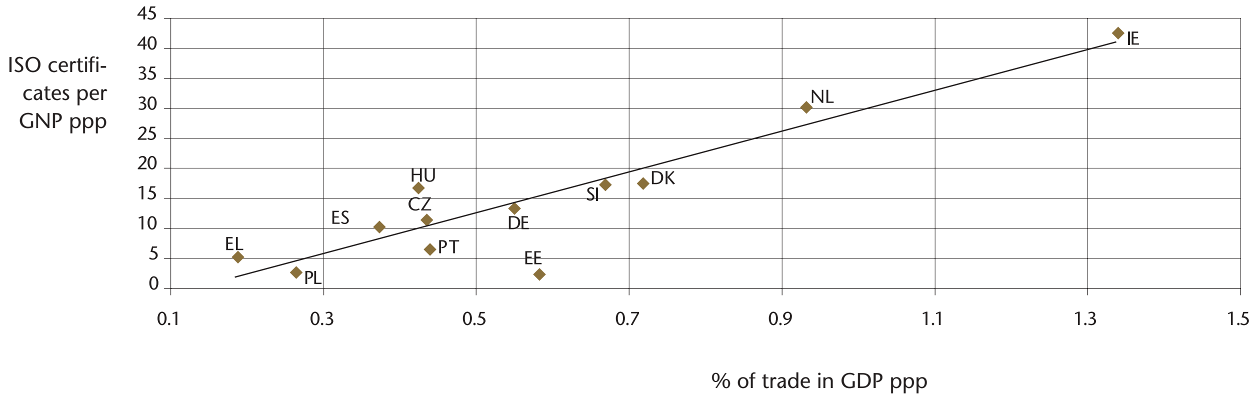
In these six candidate countries, the concept of innovation in its broadest sense remains poorly understood and sometimes is not even accepted. Cultural barriers remain, particularly in the five countries where central planning was dominant for so long. Obedience is often valued more than creativity and businesses are more concerned with making money when times are good than investing in new ideas. There is still an expectation that the state will take care of innovation, and the economic system still does not reward innovation as it should.

The six countries face five key challenges:

- to promote a culture open to innovation and creativity;
- to place innovation at the heart of further reforms of the legal and regulatory environment;
- to increase the number of smaller innovative enterprises;
- to strengthen diffusion of knowledge and technology in the economy; and
- to establish a policy-making process conducive to creating an innovation policy.

Figure 1.6

ISO 9000 certificates per GNP corrected for purchasing power parity (GNP ppp) and trade openness



1.2

Innovation policy issues in seven candidate countries:* The challenges

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Innovation papers No 34, 166 pp
Free, from the Innovation Helpdesk (see back cover) or downloadable from http://www.cordis.lu/innovation-policy/studies/geo_study3.htm
Study team led by: Aide à la Décision Economique SA - ADE (Belgium)

** Bulgaria, Latvia, Lithuania, Malta, Romania, Slovakia, Turkey*

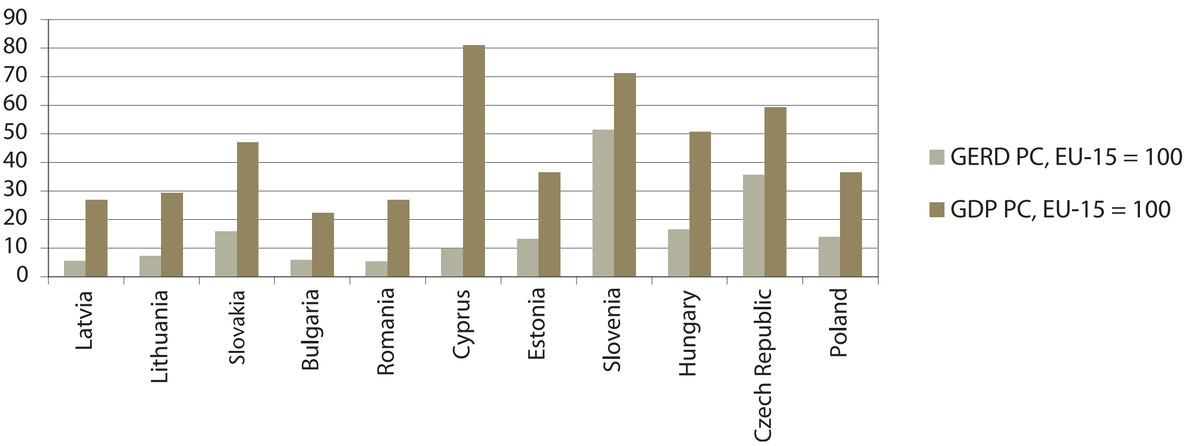
Key findings

- The CC7 generally score lower than the EU15 on innovation-related indicators.
- The main problem is low manufacturing productivity coupled with poor investment in and exploitation of R&D.
- The business environment is improving, but continuing reforms are needed in the banking system, company registration, bankruptcy laws, anti-corruption laws, competition policy, tax incentives for innovation and protection of intellectual property rights.
- Although education levels are high, qualifications and training do not match business requirements. Efforts are being made to improve human resources but demand for skilled workers is not keeping pace with supply.
- Despite a strong tradition in ICT, telecoms infrastructure is poor. However it may benefit from liberalisation. The eEurope action plan is being extended to the candidate countries.
- Responsibility for innovation policy is often divided between government departments and agencies. Turkey has the best-developed innovation system among the CC7.
- The most promising government initiatives are promoting collaboration between academia and business, supporting new technology based firms and fostering business networking.

Figure 1.7

Per capita income and government expenditure on R&D compared with EU 15

Source: Eurostat



Policy context

This report is the second of two studies examining the degree to which governments have planned and implemented innovation policies in the 13 accession and candidate states.

It covers seven countries – Bulgaria, Latvia, Lithuania, Malta, Romania, Slovakia and Turkey. The study aimed to "examine and analyse the current framework conditions for selected innovation issues" in the seven countries – the "CC7".

The CC7 are a diverse group. Malta is a tiny island state, while Turkey has a population greater than any EU state apart from Germany. All but Slovakia are on the periphery of Europe. The five eastern European countries are former centrally planned states building free market economies. Of these, Latvia, Lithuania and Slovakia emerged as nation-states only in the 1990s.

The economic criteria for accession, as defined by the Copenhagen European Council in 1993, are:

- the existence of a functioning market economy
- the capacity to withstand competitive pressure and market forces within the Union

In October 2002 Bulgaria met the first criterion but Romania and Turkey met neither of them. The other five countries in the CC7 are expected to become members of the EU in May 2004.

How innovative are the candidate countries?

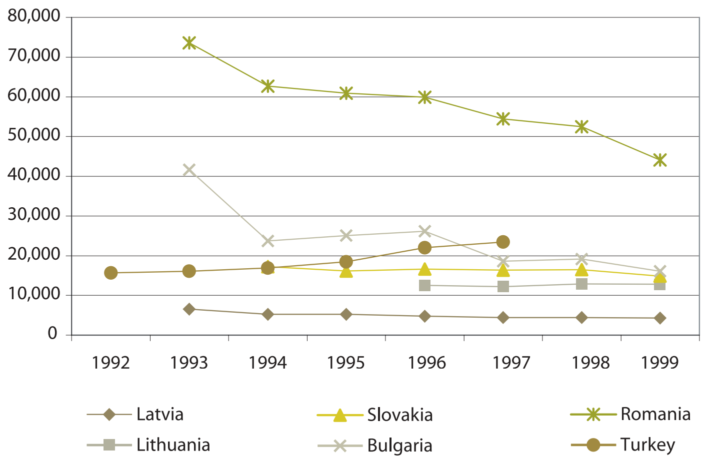
GDP per capita in the CC7 ranges from 24% (Bulgaria) to 53% (Malta) of the EU average (Figure 1.7). Even though economic growth in 1999-2002 was higher than the EU average (2.7% compared to 2.0%) this is not enough to close the income gap. Of more relevance to innovation is labour productivity. Among the CC7 countries, Latvia has made significant gains, while Bulgaria and Romania, along with Cyprus from the CC6 group, have not improved their relative position. The productivity gap appears to arise from differences in technology, management and organisation which are specific to each country.

Figure 1.7 also shows that the amount of spending on R&D in the whole CC13 was only 4% of the EU15 in 1999, and for the CC7 only 0.8% (0.52% of GDP). So while these countries are achieving a respectable level of growth in GDP, R&D does not yet play an important role. With the exception of Turkey, the number of people working in R&D in all sectors of the economy declined in all CC7 countries in the period 1992-99, with Bulgaria, Romania and Latvia the worst affected (Figure 1.8). Research productivity, judged by published papers and patents, is actually high compared with expenditure but low in terms of patents per researcher.

Figure 1.8

R&D personnel (full-time equivalent), 1992-99

Source: Eurostat



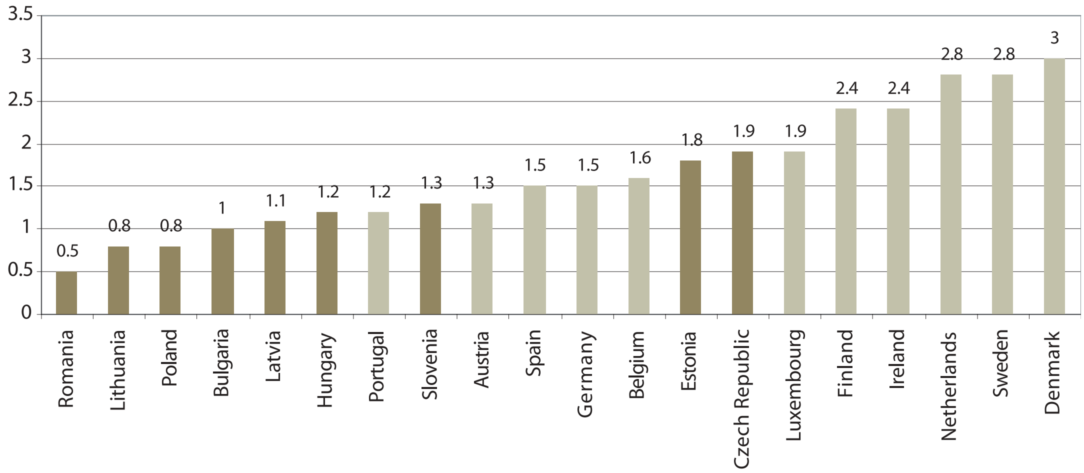
As for education, a high proportion of the CC7 population is qualified at tertiary level, posing an apparent paradox, also present in the CC6, as to why high levels of education exist alongside low levels of income. The answer may lie in the infamous "skills gap" faced by all industrialised countries, but more pronounced in countries still coping with the legacy of an inflexible command economy. People are highly educated, but not in the areas required for business growth. Businesses in the CC7 spend only a small proportion of their expenditure on training, and most of that is by larger companies (Figure 1.9).

Information and communication technology (ICT) is another recognised driver of growth and innovation. While the CC7 countries are generally lagging in the amount of GDP spent on ICT, Slovakia is above the EU average (the Czech Republic

Costs of training as percentage of labour costs, 1999

Figure 1.9

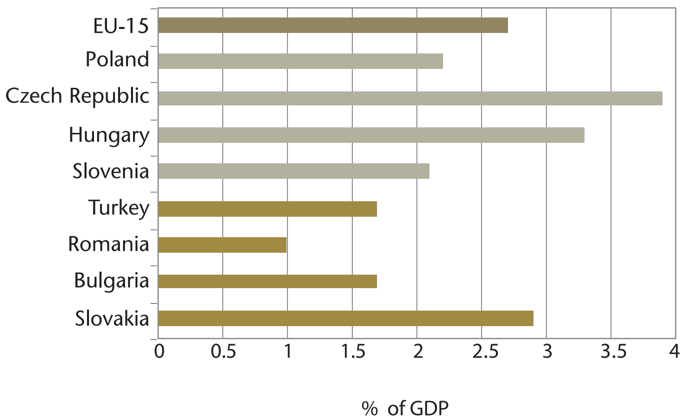
Source: Eurostat



and Hungary are even higher) (Figure 1.10). Data on the diffusion of ICT into the economies are limited, but statistics on the number of internet users and hosts offer some insights. For example, households in Malta have similar numbers of personal computers to those in France and Belgium, while the rest of the CC7 are at the same level as or below Greece, the weakest EU state. Apart from Malta and Slovakia, the CC7 have rates of internet usage five times lower than the EU, which has implications for their potential for long-term growth.

Figure 1.10

IT expenditure as percentage of GDP



Innovation surveys have been conducted in all the CC7 except Bulgaria and Malta. They show that the bulk of innovation expenditure for Romania and Turkey is on machinery and equipment, while Slovakia has a much bigger share for R&D and other intangibles. Universities are not considered important sources of information about innovation, with businesses much more likely to learn about new ideas from their customers and suppliers or from industrial associations.

Mastering quality is the first step towards improving innovation, especially for firms wishing to develop export markets. A useful indicator of how much quality awareness has taken root in an economy is the number of products which have been certified to ISO 9000, the international quality standard (Figure 1.11). By that measure, only Malta (along with the Czech Republic and Slovenia from the CC6) compare well with the EU-15, while the rest of the CC7 lag far behind.

The report constructs an innovation scoreboard for all 13 candidate countries (summarised in Figure 1.12), from which several tentative conclusions can be drawn.

- The CCs lag behind the EU in all areas, especially the creation of new knowledge.
- They fare well in terms of human resource capacities, but are far behind in terms of 'orientation' and 'scale of investments into human resources for innovation'.
- Investment in the creation of new knowledge is weak, especially in the private sector.
- They are performing better than expected in applying knowledge in enterprises. The share of SMEs co-operating on innovative activities is above the EU average, except in Malta.
- The high share of foreign direct investment (FDI) and expenditure on ICT gives the countries a high rating on 'innovation finance, output and markets', even though their financial systems are very weak and investment capital is scarce.

The sparse data that are available show that eight countries are falling behind in terms of innovation and knowledge-based activities, and only Turkey, Bulgaria, Slovakia and the Czech Republic are closing the gap with the EU.

Is it easy to be an innovator in the candidate countries?

On the whole, the CC7 countries have a less developed business environment than the CC6. One major problem is the burden of red tape facing would-be entrepreneurs. All the CC7 need to improve the company registration process, and reduce the cost of licences, permits and other operational costs, and the winding-up of bankrupt firms. In Romania new companies have to secure anything between 23 and 29 approvals just to get started (completing 83 pages of forms) and then face 11 to 23 inspections every year. Only Malta has so far adopted a coherent policy to help SMEs, bringing it into line with the EU countries. Pervasive bureaucracy also creates a climate where corruption can flourish, with officials often demanding bribes for the myriad permits needed to carry on business. Corruption remains a deterrent to economic activity in all the CC7 except Malta.

Winding up a company is even more problematic, involving lengthy bankruptcy and liquidation processes – in Latvia these can take 5 or 6 years. The relative difficulty of 'exit' compared to 'entry' is an important feature of the business environment in several CC7 countries.

Free competition is a precondition for a market economy. Slovakia, Latvia, Lithuania and Malta are the most advanced in enforcing competition rules, with Bulgaria, Romania and Turkey lagging. As for state aid, the candidate countries already spend less on aid per capita than the EU.

Except in Malta, which has a long-established market economy, the financial system in the CC7 is developing slowly, especially in southeastern Europe, and there have been severe banking crises in Bulgaria, Romania and Turkey. High interest rates continue to deter SMEs from borrowing to invest and banks are often reluctant to lend to entrepreneurs. Shallow banking systems dominate in Bulgaria, Lithuania and Romania, with very poor capacity for lending to SMEs.

The tax burden on companies is falling in all CC7 countries, but only Latvia, Malta and Turkey have introduced tax incentives to encourage innovation and they are often ineffective.

Another obstacle to innovation is poor protection of intellectual property rights (IPR). Firms are unlikely to invest in new products if others can steal their innovative ideas. Attempts to construct an index of IPR protection show a lower level of protection within the CC7 than the EU average, but the candidate countries also lack administrative capacity to enforce the regulations that do exist.

What is being done to build a knowledge-based economy?

The two main drivers of economic growth are human resources and ICT. All the evidence, as presented above, suggests that the CC7 economies are lacking in both these areas.

To start with human resources, employment figures show a strong demand for highly skilled people and more students are now moving into higher education. But too few of them are choosing to study engineering, information technology, computing and business administration, the very skills sought by employers. Some countries are suffering a "brain drain" because the local economy cannot find jobs for the highly skilled R&D workforce. As a group, the CC7 invest less in training than the CC6 and this is consistent with their lag in adopting quality control systems in industry. Large companies are much more likely to provide training than small ones.

It has to be said, though, that most of the candidate countries see their priority as developing the formal education system before tackling lifelong learning. Education is seen as the responsibility of the state, and the potential role of business as a social partner is generally underexploited. Interdepartmental rivalry also has its part to play. As in many EU countries, responsibility for education and training is divided between ministries, but the candidate countries still hold to a traditional "vertical" administrative structure with poor co-operation between departments. There are few, if any, examples of co-ordinated innovation and training initiatives.

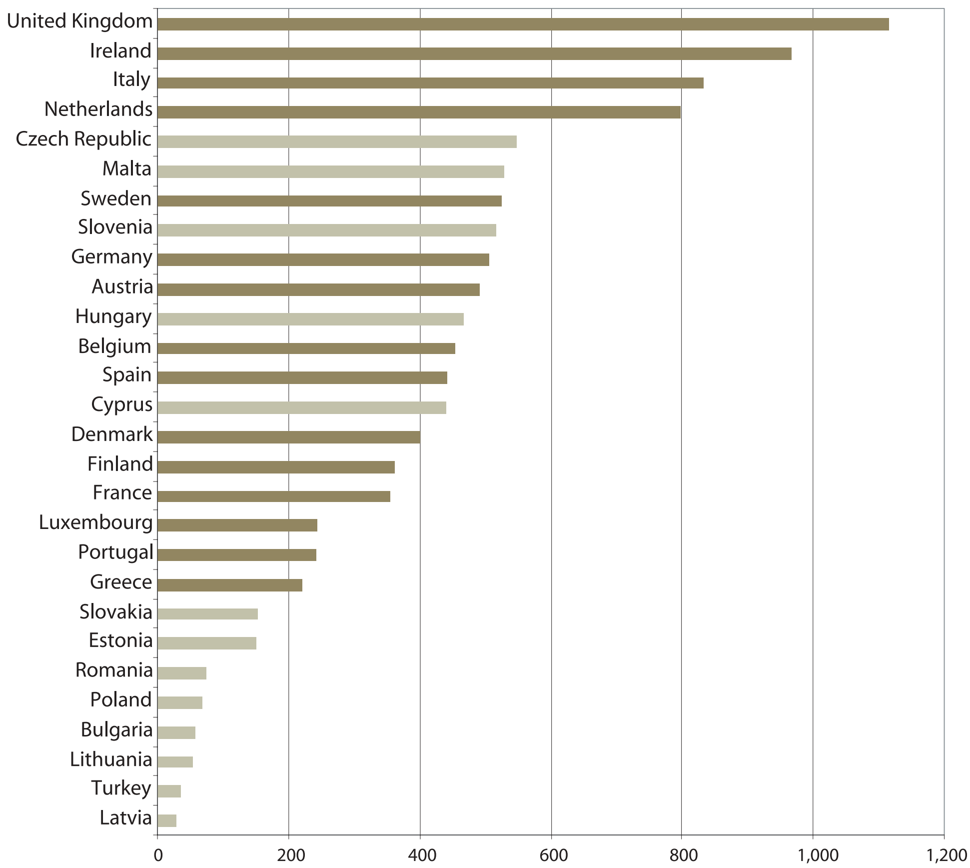
This is not to say that the CC7 have ignored the need to impart new skills. Training programmes have been launched in all countries, notably in Malta and the Baltic states. External aid programmes have also had a major influence, especially in Bulgaria. Co-operation between education and industry is improving, with entrepreneurial skills being taught to engineering students in Lithuania and encouragement of networking between educational institutions and companies. Two thirds of Turkish universities offer management courses, modelled on US experience, often in co-operation with the local private sector.

As for ICT, liberalisation of the telecoms sector, starting in most countries in 2003, should improve competitiveness by reducing communications costs. The ICT industries in eastern Europe have benefited from the strong industrial base established before 1989, with its high standards of technical education. But universities lack modern equipment, financial resources are poor, national markets are limited and small firms are inexperienced in doing business with international customers. Marketing skills are lacking. The telecoms infrastructure is poor, with few broadband internet connections. In contrast Malta and Turkey have good infrastructure but there are not enough ICT specialists.

Figure 1.11

ISO 9000 certificates per 1 million population, 2001

Source: ISO (International Standards Organisation)



The EU has responded to the need for greater uptake of ICT among its member states by launching the "eEurope" action plan. This has been extended to the candidate countries under the "eEurope+" label. Among the objectives is "investing in people and skills, including a focus on working in the knowledge-based economy." Activities include the promotion of networks of learning and training centres for demand-driven ICT.

Most of the candidate countries have been developing policies to promote an information society. One set of initiatives is of a technical nature: national strategies to make greater use of ICT as an instrument of government and to liberalise the telecoms sector. A second type of initiative aims to stimulate the information society on a broader socio-economic level, through training programmes and strengthening ICT services.

Less emphasis is placed on encouraging businesses to use ICT or developing the ICT sector. Turkey stands out in this regard with numerous schemes to foster the use of ICT in business, ranging from internet cafés for SMEs to support for start-ups and training seminars.

What are governments doing to support business innovation?

Innovation is a concept that does not lend itself to the traditional division of responsibilities between government departments. Effective support for innovation requires good co-ordination between ministries, and this is often lacking in the CC7. Turkey stands out in having the most developed structure with a government-level body, TUBITAK, framing innovation policy. It is also the only country in the CC7 which has created agencies dedicated to supporting innovation in industry.

In the EU an elaborate network of private and public organisations has grown up to promote and support innovation, and a similar infrastructure has started to emerge in the CC7. As long ago as 1991, business innovation (or incubation) centres (BICs) started to operate in eastern Europe. Today, BICs exist in all the CC7 countries, though it is not clear how much they focus on innovation as opposed to general business development.

The state-run research institutes of the former centrally planned states have either disappeared almost completely, as in the Baltic countries, or have been privatised, as in Romania and Slovakia. In Turkey, TUBITAK has set up a number of industrial R&D institutes and metrology services.

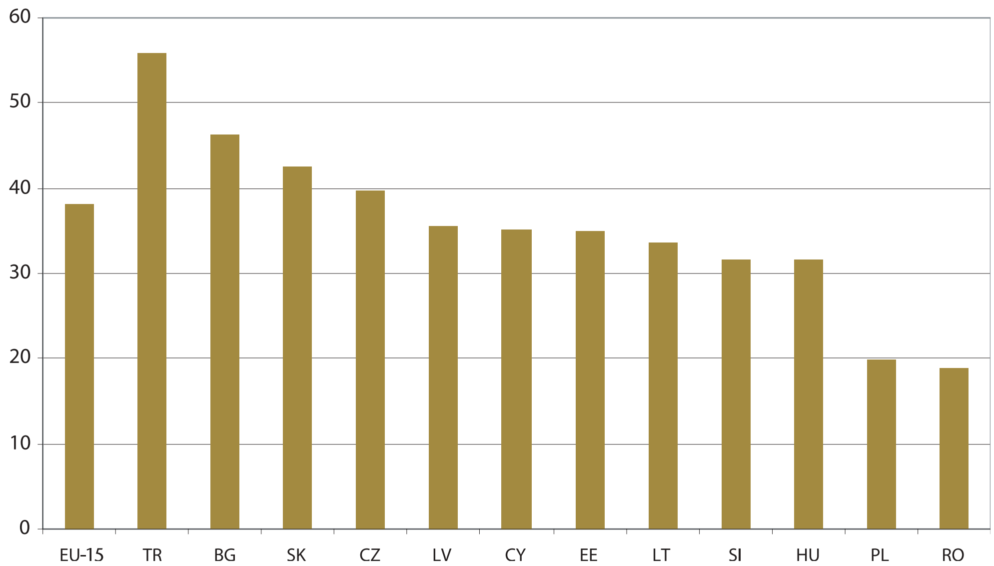
Technology parks are a favourite tool of policy-makers in the CC7, though they vary widely from small-scale incubators to large private developments, and not all of them provide support for innovation. They are often linked to universities or research centres.

Most countries have set up technology transfer organisations of one type or another. Technology centres in the two Baltic states also act as Innovation Relay Centres, linking them to the EU network. IRCs have been established in all countries except Turkey.

Innovation financing schemes are still scarce. Venture capital funds can be found in all seven countries, but they tend to favour large initiatives or development phase investment, rather than the seed capital needed by start-ups. Guarantee funds, though not exclusively for innovation or R&D investments, exist in all the CC7.

Figure 1.12

Innovation Scoreboard trend (average based on 10 indicators)



Innovation policy in the candidate countries: fact or fiction?

The concept of innovation support - as opposed to traditional support for R&D - has been slow to catch on across the CC7 except in Turkey. Innovation as a policy issue is best developed in Turkey, followed by Latvia, Lithuania and Romania, though the level of coherence and coverage of the policy frameworks in these four countries varies.

Bulgaria – Innovation has had a low priority in Bulgaria, perhaps because of the more pressing economic problems it is facing. In 2002 the government launched a new science, technology and innovation policy with the aims of strengthening competitiveness, promoting co-operation between science and industry and encouraging graduates to stay in Bulgaria. The policy has a budget of €630m over 2004-13 with 30% coming from the government.

Latvia – Innovation has been on the policy agenda since 1997, when a national SME development programme was introduced (certain projects, such as technology parks and the IRC, were implemented before that). The present policy is embodied in the long-term economic strategy and a National Concept on Innovation, both adopted in 2001. Plans are in progress to set up a National Innovation Programme.

Lithuania – Discussions on innovation policy date back to 1993, but only since 1998 has there been a coherent effort to develop systematic policies. Implementation has focused on institutional and regulatory frameworks and has tended to neglect issues such as human resources and competences, and the flow of knowledge. Inadequate funding and lack of consensus on priorities have also hampered development. A new co-ordinating body has been proposed to overcome these weaknesses.

Malta – The peculiar nature of the Maltese economy, dominated by a small number of largely foreign-owned companies with smaller firms operating only on the domestic market, has relegated innovation policy to the sidelines. The presence of a relatively large state sector has also tended to stifle innovation, and recent economic policy has concentrated on privatisation and restructuring.

Romania – The principal innovation policy is now the medium-term science and technology strategy, 2000-04. Science and technology are considered essential elements for economic development and the main instruments for economic growth and European integration. Two of the strategy objectives relate to innovation policy while three others are more concerned with improving the country's research potential.

Slovakia – Despite several attempts to formulate policies for science and technology, there is no coherent approach to innovation. Competition continues between objectives related to scientific research and to industrial technology.

Turkey – The only country in the CC7 to have a clear innovation policy, Turkey has ambitious plans for a national innovation system. While the emphasis is moving away from traditional science and technology development, innovation remains technologically focused with less emphasis on cultural or human resource aspects. Systematic monitoring and evaluation of government schemes have been in place since 1999.

An opinion survey in the CC7 found that only a quarter of respondents considered that governments gave sufficient priority to promoting an innovative society, two-thirds did not consider that an innovation policy existed in their country, 2% believed there was sufficient consultation with business and 84% believed that governments should do more to support innovation policy at local and regional levels.

The existence of policies, however, does not mean that they will be implemented or that financial support will be effective or even forthcoming. Turkey has the best record, having funded numerous programmes that seem to have been effective in improving competitiveness.

Isolated innovators or innovation systems?

There are three measures, in particular, that governments can introduce to support innovation.

The first, collaboration between the R&D and business sectors, is weaker than in the CC6, though Malta, like Cyprus, has a very limited scientific base to begin with. Turkey appears to be ahead of the others in promoting such contact, which usually takes the form of grants for co-operative research and technology infrastructure. Turkey, Romania and Slovakia appear to have mobilised most resources and Latvia is planning a major science and technology park. None of the other CC7 yet have multi-annual programmes to improve relations between researchers and business.

Support for new technology-based firms (NTBFs) is also patchy, with the business environment problems outlined earlier being particularly difficult for start-ups. Support in the CC7 tends to be in the form of technology parks and incubators, which are only a partial solution. The importance of infrastructure such as consultancy, advice and technical services is still not fully recognised. Access to investment capital is also difficult. Apart from Turkey, there are few public initiatives for early-stage funding and the small size of the national economies may make it difficult to create them.

A third line of support, the encouragement of business networks or clusters, is a relatively new idea in the candidate countries. Latvia, Lithuania, Slovakia and Turkey are in the lead in developing support for clusters, though in some countries conservative traditions are hindering the mutual trust that allows networks to function.

Chapter 2 **Creation of innovative firms and employment**

2.

Chapter 2 examines three aspects of the drive to create innovative firms and thereby employment. The first study reviewed here concludes that innovative enterprises, especially small and medium-sized ones, tend to add jobs at the expense of less innovative competitors. The second study highlights the crucial role of regional networks in supporting the creation of new technology-based firms (NTBFs). The last study proposes a typology of academic spin-outs, and argues that public as well as private sector resources be focused on those with clearly defined growth strategies.

2.1

Innovative small and medium-sized enterprises and the creation of employment

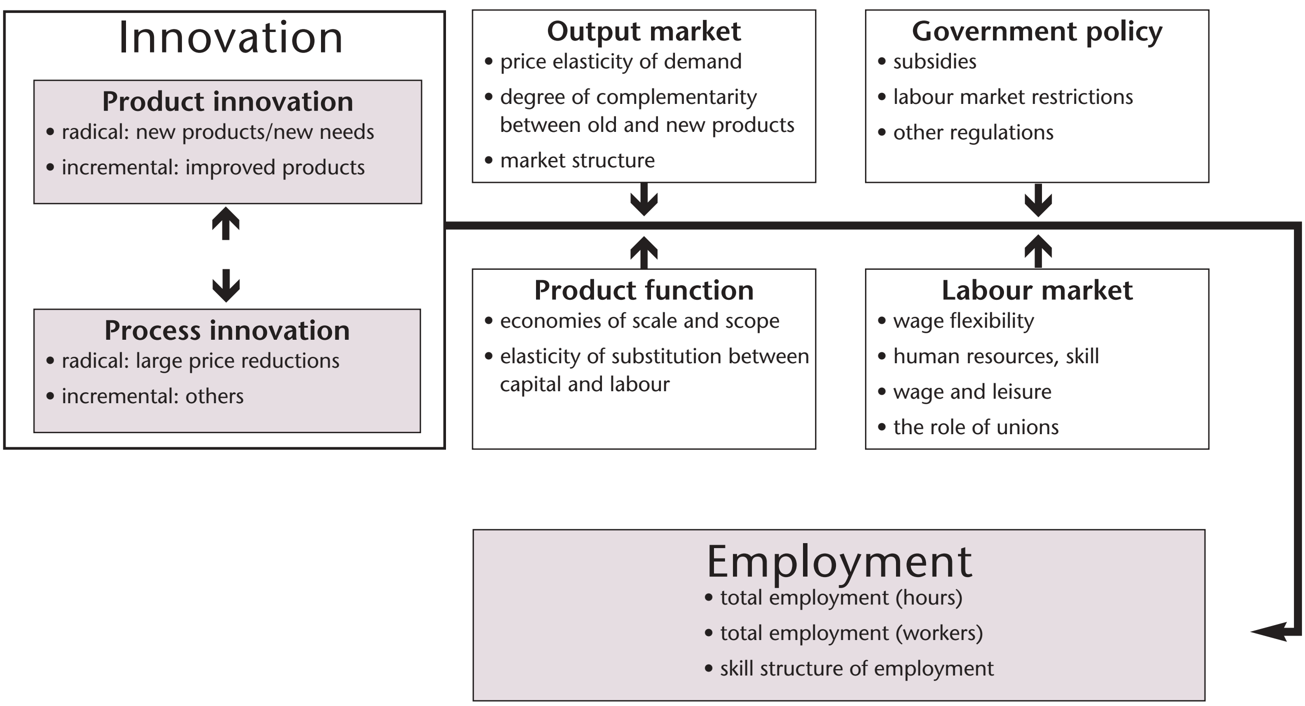
NB-NA-17037-EN-C, ISBN 92-894-3804-5
Innovation papers No 23, 118 pp
Free, from the Innovation Helpdesk (see back cover) or downloadable from http://www.cordis.lu/innovation-policy/studies/gen_study6.htm
Study team led by: Austrian Institute for Small Business Research – IfGH (Austria) and Instituto Vasco de Estudios e Investigación – IKEI (Spain)

Key findings

- In general, innovative enterprises, especially SMEs, in both the manufacturing and service sectors, gain both market share and jobs at the cost of non-innovative ones.
- In the manufacturing sector, R&D focused on product innovation has the greatest employment-generating effect.
- Process innovation has the greatest job-creation impact in the service sector, although it does have a positive impact in manufacturing too.
- Large firms in which continuous R&D is the principal source of innovation exhibit the poorest employment performance.
- Innovation tends to increase the need for highly-skilled workers and to decrease the need for the low-skilled, and this phenomenon increases with firm size. Less innovative firms have a higher share of unskilled workers. Technological change results in an upgrading of job skills in the EU, USA and Japan.
- Innovation support measures for SMEs increase the qualification levels of employees in SMEs.
- Microenterprises (those employing up to nine people) have a lot of potential for job creation through innovation.
- Another area where increased support might pay dividends is in organisational (as distinct from product or process) innovation. Though Europe spends a higher share of its GDP on academic research than the USA or Japan, it seems unable to turn this investment into jobs, because it is unwilling to change traditional styles of work organisation.

Figure 2.1

Factors influencing the impact of innovation on employment



Policy context

The impact of innovation on employment is not straightforward, since many factors come into play (Figure 2.1). In general, **product innovation**, which generates new demand, was believed to increase employment. However, when new products are simply replacements for old ones, negative effects may ensue if the substitution involves more efficient production technology. **Process innovation** is often believed to decrease employment as it enables firms to achieve the same output with fewer resources – and often with less labour. However, the greater the effects of **economies of scale** within a firm, the more likely is innovation to increase labour demand, as internal cost reductions due to the innovative process will lead to increased market share.

Since innovations are introduced by individual enterprises it can be difficult to work out whether a specific sector or even a national economy is innovative or not. In many industrial sectors, large enterprises still account for a high proportion of innovative activities, so the impact of innovation by SMEs may be obscured.

Innovation and employment in firms

Since what firms generally aim to do when they innovate is to increase their share of an existing market rather than increase the size of the market as a whole, the employment effect of innovation tends to be more noticeable at individual firm level than at the macro level. In general, **innovative enterprises gain both market share and jobs at the cost of non-innovative ones**. This effect appears to be more pronounced in SMEs than in large enterprises, in both services and manufacturing industries. On the other hand, **smaller firms face higher risk** through innovation – they can quickly go out of business if the innovation in question is inappropriate. In this case, all the employees may lose their jobs.

A large study in the Netherlands (Figure 2.2) shows that innovative Dutch enterprises as a whole enjoy better employment growth than their non-innovative counterparts. The significant exception is the manufacturing sector – where neither innovators nor non-innovators show any employment growth. Another Dutch study finds that among firms with the same proportion of R&D staff, the **manufacturing** firms that create jobs fastest are those that focus their R&D efforts on **product** (rather than process) innovation. In services, the difference is less pronounced, possibly because the distinction between product and process is less significant. **Process** innovation has the greatest job-creation impact in the **service** sector, although it does have a positive impact in manufacturing too.

In Norway, from 1995 to 1997, employment increased more in enterprises that directed their innovative activities towards developing new products than it did in those that developed new processes. In Belgian companies in the period 1990 to 1996, **combined product and process innovation** was found to boost growth in industrial firms – though the effect on jobs was less than on value added. Process innovation has a positive impact on employment growth in the trade sector, while **product innovations that do not imply process changes have no significant effect** on employment in any of the industry, trade, or services sectors.

Figure 2.2

Employment growth of innovative and non-innovative firms in the Netherlands, 1994-1996, by industry sector

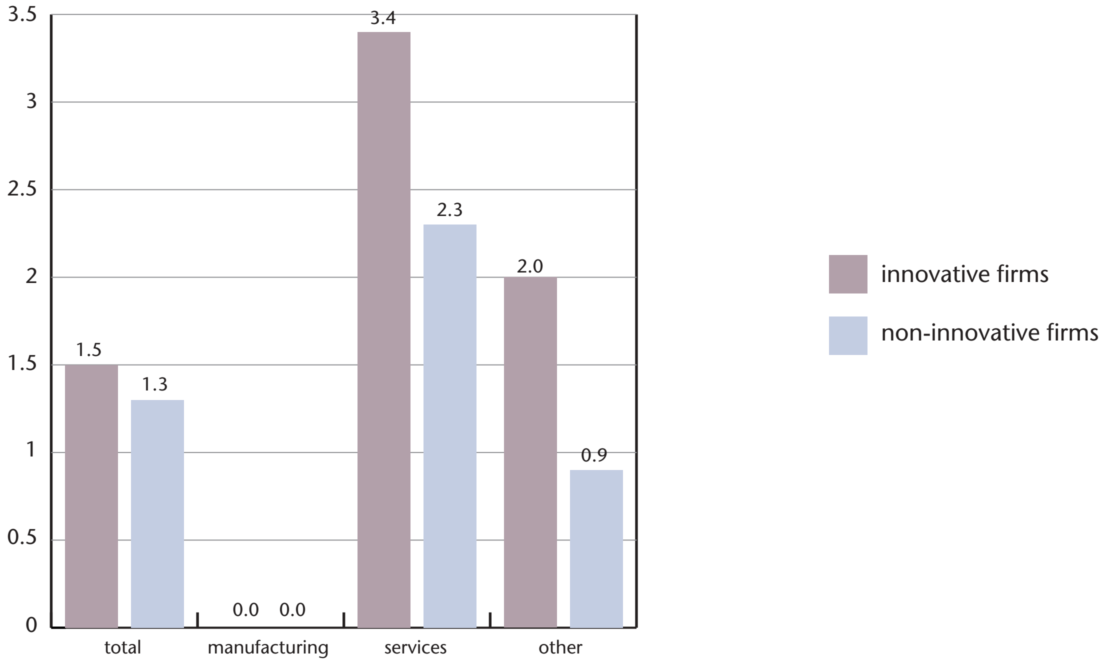


Figure 2.3

Share of employment by qualification level in Austrian SMEs innovating to different degrees, 1997

	Highly innovative	Medium innovative	Less innovative
University graduates of technical studies	5.16	5.45	2.84
University graduates of other studies	0.13	1.07	2.50
High school graduates of technical schools*	17.88	20.17	13.25
High school graduates of others schools**	4.69	9.66	3.13
Skilled workers***	43.32	30.48	16.44
Low skilled workers****	25.82	29.17	58.75
Apprentices	3.00	4.00	3.10
Total	**100.00**	**100.00**	**100.00**

* *secondary education with technical focus*
** *general secondary education*
*** *workers with vocational education and/or professional training*
**** *workers with basic education (primary school)*

In the analysis of Italian companies, those that innovate mostly on the basis of industrial design or investment show the best performance in terms of employment growth rates and hours worked. However, both types of enterprise are usually very small. The investment-based kinds rely on their intrinsic nature for innovation, as internal sources of innovation are practically absent. To a lesser degree this is also true for the market-oriented types, which focus their innovation activities mostly on the next-to-market phase of the product life cycle. **Those – comparatively large – firms in which continuous R&D is the principal source of innovation exhibit the poorest employment performance**. Interestingly, innovative behaviour in investment-based large firms is linked to a decline in the workforce.

Innovation and skill levels

Innovation tends to increase the need for highly skilled workers and to decrease the need for the low skilled, and this phenomenon increases with firm size. In an analysis of 250 SMEs from five technology oriented sectors in Austria (Figure 2.3), **innovative enterprises are found to offer a higher share of highly skilled technical jobs** than less innovative firms. Innovative and non-innovative enterprises employ roughly the same number of university graduates, though innovative SMEs hire more people with technical degrees. But the biggest differences are found among groups of skilled workers – the higher a firm's degree of innovativeness, the more skilled workers it employs.

Data from 1987 to 1994 indicates that in the United States, a cluster of complementary innovations involving **information technology (IT), workplace organisation** and **new products and services** engenders a shift in demand from less skilled towards more highly skilled workers. The use of IT complements the new workplace organisation that involves broader job responsibilities, more decentralised decision-making and more self-managing teams. IT reduces the need for human intervention in a lot of clerical and other routine work, and it also changes the way in which human labour is measured, controlled and reported – so managers are obliged to acquire new cognitive skills to cope with this. Companies using high levels of new technology and undergoing rapid organisational change tend to invest more in the people they take on, for instance in screening and training new employees. Mirroring these findings, firms with a higher proportion of college-educated workers appear to have a higher demand for IT.

In overview, studies in the European Union, the United States and Japan on the impact of innovation all confirm that technological change results in an upgrading of job skills. In this respect, there seem to be few differences between the three regions.

Innovation support schemes

The quantity of employment that innovation support measures for SMEs create is still at issue. But they do have a qualitative effect, namely, they increase the qualification levels of employees in SMEs. This suggests that **innovation support schemes are in practice aiming to correct specific weaknesses within SMEs**, since innovation in smaller enterprises does not lead to an increase in the skill level of employees to the same extent as in large ones.

Recent analyses show that innovation support is targeted mainly at small (10-49 employees) and medium-sized (50-249 employees) firms, and less at micro (0-9 employees) and large scale (more than 250 employees) enterprises. This is most noticeable in Italy and Greece, where innovation support to micro-enterprises is well below the EU average. In contrast, micro-enterprises in Ireland, Germany and Finland receive a higher level of attention. **Better targeting of help to benefit micro-enterprises might aid employment creation**, as smaller firms tend to create proportionately more jobs than larger ones when they innovate. Therefore, the smaller the enterprise, the more help it needs to innovate and the more appropriate are innovation support measures.

Similar considerations hold true with regard to targeting support initiatives towards specific **types of innovation**. It is now generally accepted that, among SMEs, both product and process innovation tend to lead to employment increases. On the other hand, few analyses are available on the effects of organisational innovation on job creation. Innovation support in the EU concentrates on product, process, and joint product and process innovation, but **there is hardly any promotion of organisational innovation**.

EU, US and Japan – comparisons

As in Europe, innovative industries in the United States create more jobs than do non-innovative sectors. However, many of the companies in both continents that are counted as innovative are carrying out **marketing innovations** rather than process or product innovations, and are therefore not relying on technological innovation. The direct effect of R&D intensity on employment growth is slight but positive. However, although R&D intensity and labour productivity growth can to some extent explain differences in employment growth between Europe, the US and Japan, these factors are not sufficient to account for the fact that **Europe creates significantly fewer jobs than the United States**.

Why is this? Measured as a percentage of GDP, Europe devotes more effort to academic research than either the United States or Japan, spending 0.38% of GDP compared to 0.29% in the USA and 0.18% in Japan (Figure 2.4). Furthermore, research is highly diversified in Europe. In absolute terms, Europe lags behind the United States but is still doing better than Japan. However, European countries perform poorly in transforming this research into innovation and marketable goods. The reason behind this appears to be that **Europe has not yet been able to break with the traditional organisation of work** inside the factory or in the management of R&D.

In fact, the innovation policies of the EU Member States show hardly any focus on organisational innovation. **Comparative analyses including the United States and Japan have shown the importance of organisational innovation**. It can be especially good for SMEs' productivity growth and competitiveness to restructure internal or external working relations.

European researchers have found the effect of process innovation on employment to be ambiguous, especially among larger enterprises. However, it appears that in the USA process innovation may have a major impact on employment creation and economic growth, so long as it embraces organisational as well as technological change. The difference may be explained by Europeans' inability to adapt to attempted organisational innovations.

One of the main problems in Europe seems to be the **difficulty of transforming research into innovation – measured by the number of patents**. Europe lags far behind the United States and Japan in the number of American patents it takes out. The efficiency of researchers can be expressed as the total number of patents currently being commercially exploited in a region divided by the total number of researchers and engineers within that region. On this basis, Europe rates much lower than the United States.

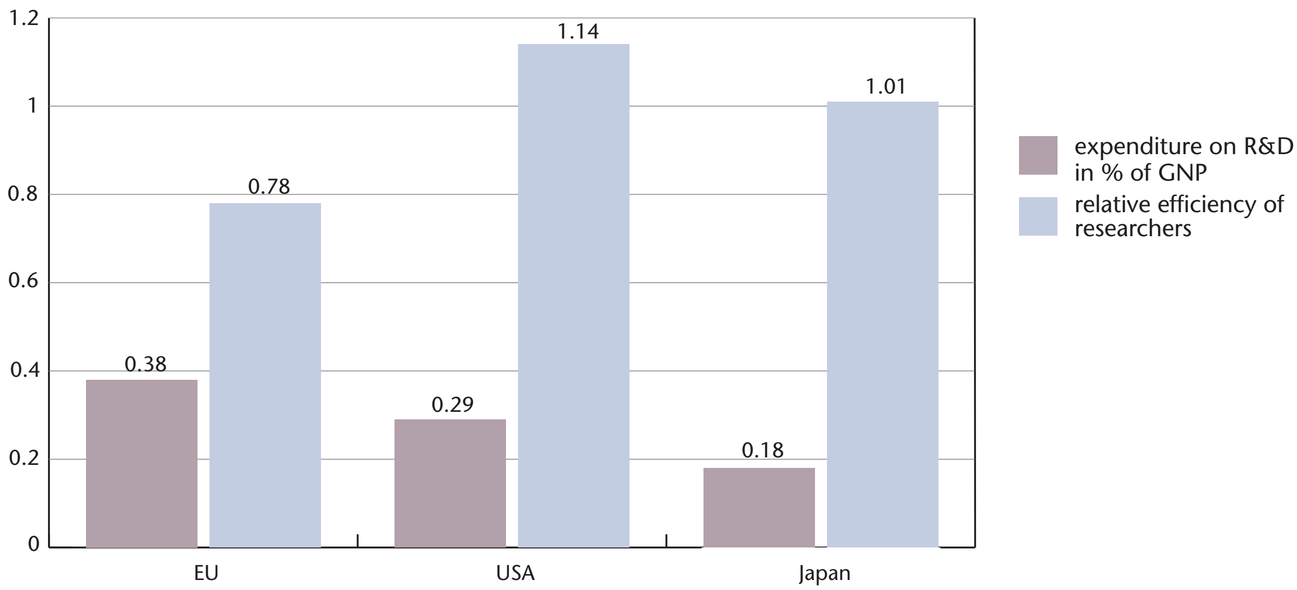
A comparison between Europe, the United States, and Japan suggests that the observed **interdependencies between productivity and employment growth** hold for European countries and the United States, while in Japan there is no obvious correlation discernible between these two variables.

One trend with regard to which the three regions show no significant difference is that **R&D intensity, which is an indicator of innovativeness, is positively related to wage levels, and in turn to qualification levels of the workforce**. Employees benefit from an increased level of productive R&D by receiving higher salaries or wages – which may be a good indicator for higher qualification levels of the workforce.

In addition, **the power of the trade unions** might have considerable influence over the effects of technological progress on employment. Strongly unionised labour markets are sometimes blamed for the delayed train of innovation in Europe compared to the United States or Japan. Unions may try to impede the implementation of new technologies, and so sustain labour intensive jobs. This in turn reduces a firm's incentive to invest in R&D.

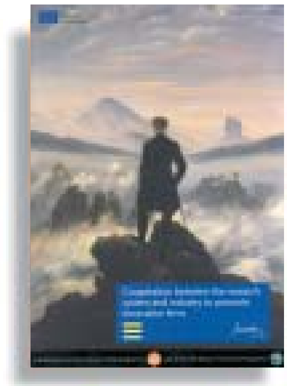
Figure 2.4

Expenditure on R&D and relative efficiency of researchers in Europe, USA and Japan



2.2

Cooperation between the research system and industry to promote innovative firms



NB-NA-17042-EN-C, ISBN 92-894-3929-7
Innovation papers No 26, 160 pp
€20.50, from the Publications Office (see inside back cover)
Study team led by: Socintec SA (Spain)

Key findings

- Innovation is most effectively undertaken within the context of a group interconnected by a set of common features, such as geographical location.
- Few universities have sufficient resources to sustain an entrepreneurial culture, and most spin-off businesses are generated by industry.
- The most probable future entrepreneurs are people who have already started a business in the past, followed by young doctoral researchers.
- The most likely source of a successful spin-off is either a large company with significant internal research activity or a big university.
- The single factor contributing most towards spin-off creation is the stimulation of a social culture inclined to innovation and entrepreneurship.
- The three biggest barriers to spin-off creation are thought to be a poor entrepreneurial culture, lack of training in entrepreneurial skills and the lack of venture capital.
- The factors that contribute most strongly to success with spin-offs are fostering awareness of entrepreneurship among researchers and professors, availability of seed capital and premises, the ability to assess the capability of technical ideas to move to market, and networking with investors, CEOs and business schools.
- The most cost-effective types of support are intangible services such as training, monitoring and evaluating the business plan, networking, marketing, registering intellectual property rights, and searching for potential business partners. A virtual incubator, i.e. an internet-based platform, can deliver all these services.

Figure 2.5

Tools to enhance successful innovative firm creation and survival

• **Awareness-raising**	Develops a culture that encourages would-be entrepreneurs to step forward
• **Logistical support**	Includes both real and virtual incubator services
• **Evaluation of ideas**	A commercial appraisal of ideas, followed by feasibility studies where appropriate
• **Financing**	Includes both seed and venture capital in addition to public sector schemes for guaranteeing loans for start-up costs
• **Training**	Relates to developing the necessary managerial and entrepreneurial skills
• **Expert advice and mentoring**	Particular emphasis is placed on drawing up and presenting the business plan
• **Dissemination**	Exchanging examples of good practice through networks across Europe

Policy context

A significant minority of innovative businesses are born as spin-offs from academic research. The Commission has long argued that a more effective interface between researchers and industry is needed to ensure that even more new ideas are turned into products and services. In 1996, the *First Action Plan for Innovation in Europe* aimed to "improve the links between research and innovation", in particular by encouraging co-operation between universities and private companies.

The conclusions of the Lisbon Summit in 2000 strengthened this policy by specifying actions to "encourage the key interfaces in innovation networks, i.e. interfaces between companies and financial markets, R&D and training institutions". Later the same year the Commission went a step further in its Communication, *Innovation in a knowledge-driven economy*, which stated that "the increased emphasis on the private sector in its double role of technology user and translator of market needs into research problems has led to the emergence of a new policy goal of improving the research/industry interface". Numerous workshops, expert panels, and other events have been held in recent months to improve understanding of this interface. They have also led to the launch of support actions to facilitate the exchange of good practice – which had previously been hard to identify.

Creating innovative firms

The various attempts that have so far been made to forge closer links between public research and business have generally taken one of two basic approaches. The first presupposes that researchers require an environment free of outside interference, in which the practical commercial value of their results is not used to evaluate the quality of the work done. The second is based on the belief that the educational and research roles of a university and other academic institutions must be balanced against their commitment to society – especially to the local business community.

Some of Europe's public initiatives to stimulate new firm creation rely almost wholly on providing **grants**, which has given rise to a so-called 'grant culture'. This obliges innovators to conform to predefined formulae for fundable projects, while still not helping administrators to monitor how public funds are spent. Probably a more effective – though time-consuming – means of supporting innovative firm creation is to make links with individuals who can add value and lever in external resources. These **networks** can reveal the entrepreneurs who will lead new venture creation, the know-how behind the product to be commercialised, and the investors needed to build a new company. Several European countries are trying to overcome fragmentation by promoting regional networks. Germany's EXIST programme, a regional approach to stimulating spin-off activity at higher education establishments, found that more support is available, costs are reduced, and transaction times shortened when the breeder institutions and the founders of firms are situated close together. In fact, it is now generally accepted that innovation is most effectively undertaken within the context of a group that shares a set of common features – in this case geographical location.

As a rule, entrepreneurs have difficulties in obtaining venture capital funds during the early stages of their venture. **Pre-seed and seed funds** provided through public initiatives are a particularly helpful means of bridging the gap between originating an idea with commercial potential and obtaining funding from private sources. They have an added value since their award often helps to keep private investors on board during the earlier stages of a project.

For an entrepreneurial university, the generation of research-based spin-offs raises rather than lowers the level of research, leads to higher standards of study, and can attract more financial resources. It also makes it more likely that knowledge workers will remain within a region, either in a spin-off firm or in one with a commercial relationship to it. However, few universities have sufficient internal resources to sustain an entrepreneurial culture – **it is currently research by industry itself that is the greatest generator of spin-off businesses.**

Survey of European organisations involved in new firm creation

A survey for the Enterprise DG shows that 64% of European organisations actively involved with new firm creation are well acquainted with some actual research-based spin-off companies. Another 28% have knowledge of such enterprises, but not in their immediate working environment. On the other hand, 8% appear to have little or no idea of what the term 'spin-off' implies.

As regards awareness of language pertaining to the research/industry interface, respondents are most familiar with terms that apply to the physical environment in which new firms are created. Over 80% know the meaning of the terms 'technology park' and 'business incubator', and around 70% are aware of 'science park'. There is less familiarity with terms denoting specific programmes like LIFT (28%) and UNISPIN (18%).

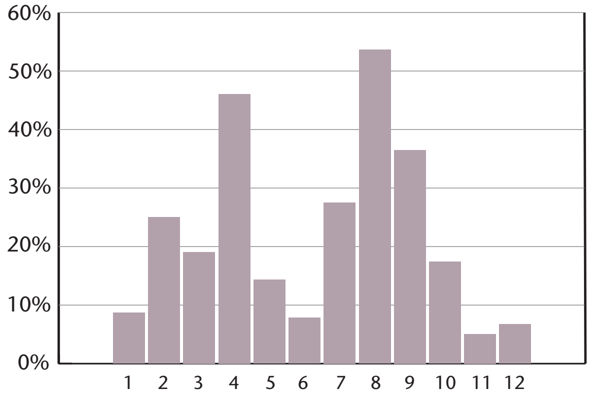
Awareness of the types of activity undertaken locally to enhance co-operation between R&D and industry to create new firms is highest when it involves personal contact. Regular meetings between R&D and industry representatives are arranged by 47% of respondents, and visits by researchers to companies to explore common interests by 33%. However, only 22% are aware of agreements that exist between large corporations and local governments to stimulate company spin-offs.

Nearly 40% of participants do not regard the rules and regulations surrounding new business creation as a key issue, while 7% have no knowledge at all of the legal steps required. However, 22% believe these present an important obstacle to creating a new company. It is worth noting that only some 7% consider that it is legally complicated for a researcher to create a spin-off.

The sources of spin-offs: Identifying the profile of a likely entrepreneur is important, as it means that promotion and awareness programmes can be better directed towards the right target group. As shown in Figure 2.6, around 54% of the sample single out the most probable future entrepreneur as someone who has already started up a business in the past. The next most likely set of candidates are young researchers carrying out doctoral work (46%), well ahead of senior managers in private companies. Investment traders, full-time university professors, and assistants on grants are all perceived as rather improbable entrepreneurs.

Figure 2.6

Categories of individual most likely to create spin-offs



1 Full-time university professor
2 Part time professor
3 Senior full-time researcher
4 Young researcher doing doctorate work
5 Research assistant
6 Assistant on a grant
7 University student
8 Former entrepreneur
9 Senior manager of a private company
10 Freelance consultant
11 Investment trader
12 Long-term unemployed person

The most likely source of a successful spin-off is either a large company with significant internal research activity (47%) or a big university (44%). Government interface organisations (7%) and technical colleges (13%) are the least likely sources – public research institutes, technological centres, and medium-sized private companies with internal R&D all rate more highly.

The single factor contributing most towards spin-off creation is considered to be the stimulation of a social culture inclined to innovation and entrepreneurship. Networking is a powerful tool in this context, and it often provides the quickest route to finding potential entrepreneurs. Also very important is fostering education and training in entrepreneurial attitudes, and the development of more active interfaces between research institutes and industry. In contrast, improving market and technical information sources and dissemination, increasing basic research finance to obtain technical breakthroughs, and reducing taxes for new innovative companies during the first years of operation are of relatively minor importance.

Barriers to spin-off creation: Two-thirds of respondents believe that the most important barrier is a poor entrepreneurial culture (Figure 2.7). Nearly half think that the lack of training in entrepreneurial skills prevents people starting up a business, while about one-third think that the lack of venture capital presents an obstacle. Very few consider the existence of too many competitors (2%) or technical risks (5%) as barriers, and only about 10% refer to a lack of good ideas.

Key factors for success: The five factors that appear to contribute most strongly to entrepreneurial success are the following:

- fostering awareness of entrepreneurship among researchers and professors
- availability of seed capital funds at the institutions' disposal
- having the use of physical infrastructures such as a company incubator
- possessing the resources to assess the capability of technical ideas to move to market
- actively networking with investors, CEOs and business schools

Other grounds for success – the existence of business angels, being located in an industrial zone or the ability to overcome legal and administrative limitations for professors and researchers – though valuable, are less significant.

Infrastructure support

Incubation has become a potent instrument of regional innovation policy in several Member States. It offers a favourable environment within which new ventures can consolidate themselves in the early stages of development, by providing offices, research facilities and secretarial and other services. **Ready access to incubators facilitates the creation of new spin-offs**. However, incubators established by local or regional governments generally house new firms that have not directly originated from the public R&D system. This is because truly academic spin-offs are usually nurtured within the precincts of the parent institution whose set-up costs are met largely by national governments.

The most cost-effective types of support for new ventures are a range of intangible services such as training, monitoring and evaluation of the business plan, networking, marketing strategies, help to register intellectual property rights, and searching for potential business partners. A **virtual incubator**, i.e. an internet-based platform, can deliver all these services through a network in which co-operation between the R&D system and industry might be fully optimised, drawing expertise from a variety of sources. Although a number of initiatives have already been started, the results have yet to be monitored over time and a cost-benefit analysis made.

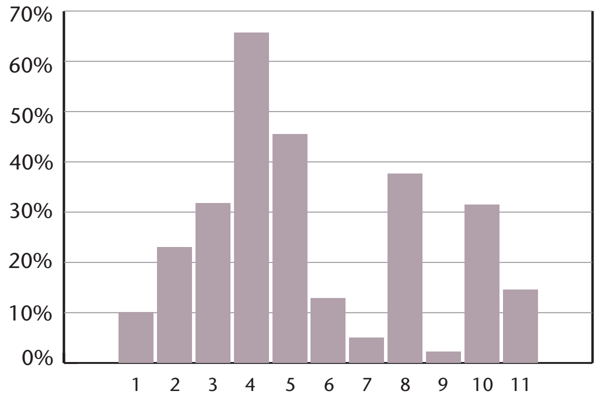
Incubators have a greater chance of success when their design and management are shared with companies that already have experience of getting similar products to market, rather than being run solely by the parent research institution. It is crucial to be able to combine technical, entrepreneurial and business management skills if the new venture is to succeed. This applies to virtual incubators too, though in this case they would probably be most effective when created within a 'cluster' in which knowledge of a particular industrial sector is common to a network of participants from research, support services and industry.

Benefits of co-operation

The process of new spin-off creation is most vigorous when all the partners are clear about the potential benefits, as this translates into a sense of ownership and engenders closer interaction. Good technical ideas bear commercial fruit when the diverse agents acting together do so synergistically, through mechanisms integral to their activity. The benefits can be outlined as follows:

Figure 2.7

Main factors that hamper the creation of new firms



1 There are very few good ideas
2 Researchers´ lack of interest in financial issues
3 Researchers feel very safe and comfortable in their jobs
4 Poor entrepreneurial culture
5 Lack of training in entrepreneurial matters
6 High costs of the administrative procedures
7 Technical risks
8 Commercial risks
9 Too many competitors
10 Lack of venture capital investment
11 Others

For the entrepreneur:

- **Business acumen.** Co-operation enables business people to pass on their commercial skills and experience.
- **Reduced time-to-market.** The improved mobility of people between institutions can result in better project planning. Companies will thus be launched more rapidly and on firmer ground.
- **Finance.** When funds are provided jointly by a range of public and private organisations, more seed and early-stage finance becomes available.
- **Broad view.** In a collaborative partnership the entrepreneur has access to information from a wider range of sources.

For the partners:

- **Spread risk.** Co-operation spreads the risk and can lead to further business opportunities.
- **Improved venture selection.** A panel of representatives from the partner institutions can evaluate business plans more thoroughly.
- **Optimised use of resources.** Collaboration permits the best use of finances available, and the economy of scale may attract private venture capital.
- **Better knowledge management.** Industry is mostly interested in identifying current needs of new entrepreneurial projects, while universities are interested in finding routes to successful commercialisation of research results.
- **More control over external factors.** When R&D institutions and companies co-operate on a project they are constrained by the same external factors, including the conditions dictated by the market for the product or service to be commercialised.

For society as a whole:

- **Useful knowledge.** The knowledge and experience generated in the collaborative process has wider applicability.
- **Enhanced entrepreneurial culture.** Institutions working in partnership with others for the first time are likely to open up to opportunities to do the same in future.
- **Power to lobby for simpler administrative procedures.** It is easier to obtain commitment from government to simplify bureaucratic hurdles when there are a number of different organisations within a partnership.
- **Capacity for dissemination.** The more participants involved in co-operation, the greater the capacity to diffuse knowledge and results, thereby also raising awareness in the community.

Figure 2.8

Level and growth of early-stage and total venture capital investment per capita, 1996-1999, by country

Source: European Trend Chart on Innovation. Thematic report: Innovation finance, 2001

In euro per capita	Early-stage		Total		Trend 99 / 96 (99 as multiple of 96)	
Country	**1996**	**1999**	**1996**	**1999**	**Early Stage**	**Total Investments**
Austria	0.0	1.8	0.1	11.3	54.8	105.8
Belgium	2.0	20.9	10.8	66.7	10.4	6.2
Denmark	0.4	5.9	6.5	22.3	13.4	3.4
Finland	1.8	13.3	7.9	48.7	7.5	6.2
France	1.7	9.0	14.7	48.9	5.4	3.3
Germany	1.2	12.3	8.8	38.9	10.5	4.4
Greece	0.6	1.9	3.1	6.8	3.2	2.2
Iceland	-	53.9	2.9	86.6	n/s	30.2
Ireland	0.8	11.3	10.5	29.2	13.4	2.8
Italy	0.8	2.6	8.9	31.2	3.2	3.5
Netherlands	6.0	22.4	38.8	111.8	3.7	2.9
Norway	1.3	7.1	19.4	61.6	5.3	3.2
Portugal	0.1	0.9	3.4	12.0	7.3	3.5
Spain	0.3	2.4	4.9	18.5	7.9	3.7
Sweden	0.6	27.7	48.3	146.8	43.9	3.0
Switzerland	0.8	28.7	17.9	62.1	38.2	3.5
United Kingdom	0.7	4.4	51.3	198.3	6.2	3.9
Total Europe	1.2	8.5	17.7	65.9	7.3	3.7

2.3

University spin-outs in Europe – Overview and good practice

NA-NB-17046-EN-C, ISBN 92-894-3460-0
Innovation papers No 21, 72 pp
Free, from the Innovation Helpdesk (see back cover) or downloadable from http://www.cordis.lu/innovation-policy/studies/im_study4.htm
Study team led by: Bannock Consulting Ltd (United Kingdom)

Key findings

- There are over 300 spin-out programmes across the EU.
- A possible way to increase entrepreneurship and mobility between universities and industry might be to offer academic staff who attempt a spin-out the right of return should the venture fail.
- The variety of approaches in evidence across Europe can be distilled into a four-fold classification: top-down, network, incremental multi-layer and technopole.
- The network approach, in which a privately-funded university incubator, a business support agency and financiers work together, is considered the most effective, especially in areas with buoyant local economies. It elicits greater economies of scale and builds critical mass quickly, particularly in isolated regions that cannot readily access innovation finance or management expertise.
- Spin-out development cannot be left to venture capitalists, as their investment criteria are too restrictive. Public subsidies are essential to ensure that the widest possible choice of projects is considered.
- Intellectual property rights should not be handed over too early to investors, and are perhaps best dealt with on a cross-licensing basis with investors, start-ups and universities sharing ownership.

Policy context

As part of its remit to foster innovation and knowledge transfer in Europe, the European Commission's Enterprise DG initiated the Finance, Innovation and Technology (FIT) Project to encourage higher levels of co-operation between researchers and investors. This objective was also supported by the Lisbon Council, which made the creation of an innovative culture in Europe one of its chief priorities.

Encouraging spin-outs

Start-up companies 'spun out' of academic institutions or research centres need business management expertise, the ability to enforce intellectual property rights, and capital, including seed funding.

Spin-outs are new companies created to exploit ideas germinated in research centres, laboratories or universities. In comparison with granting a license to an existing company, a spin-out enables researchers to keep some control of the way their ideas are transformed into products in the marketplace. But the challenges entailed in fostering an entrepreneurial culture in universities should not be underestimated.

Different forms of funding are required at various stages throughout a spin-out's development. The general consensus is that public subsidies are better suited to spin-outs still under programme supervision, otherwise known as being at the conversion stage. Companies that have progressed beyond conversion are more likely to benefit from the management expertise and market discipline associated with venture capitalists taking an equity stake.

Success stories such as the Innova programme of the Technical University of Catalonia (UPC) demonstrate that a bottom-up approach is desirable with higher levels of autonomy assigned to individual research departments, which compete for funding. Strong leadership from above is also required to cultivate an entrepreneurial mindset amongst academics and research scientists. A possible way to increase entrepreneurship and mobility between universities and industry might be to offer academic staff who attempt a spin-out the right of return should the venture fail.

Spin-out activity in Europe – country breakdown and examples

There are just over 300 spin-out support programmes across Europe. The level and form of support these programmes provide varies markedly from country to country, with activity spread across university campuses and science parks. Regional networks also feature prominently in those countries with most support programmes. The UK has the highest number of programmes (87+), followed by Germany (44+) and France (36). In the UK, spin-out programmes are centred on university campuses and supported by two key government initiatives, the Enterprise Fund and University Challenge Scheme. The former, worth €221m, focuses on providing early stage funding for high-tech companies. The latter helps universities to set up seed funds to commercialise research work.

In Germany, regional support networks facilitate the commercialisation of new technologies by forging links between industry, research centres and universities. In France, a network of 31 incubators linking 70 universities and research institutes supports spin-outs. In Nordic countries such as Finland (18 programmes) technology centres located near universities are the main form of support for spin-out programmes. In Spain (21 programmes) spin-out activity centres on university campuses (half its 60 universities have technology transfer programmes and 10 have dedicated spin-out programmes). Advice and direct business services are the most popular services provided by spin-out support programmes.

Development models

A spin-out company's investment potential depends on the philosophy underpinning its development. For some, the pursuit of research is the primary objective regardless of whether it leads to a commercial application. This is referred to as the **lifestyle** model, which creates sustainable employment but not economic growth.

The **growth** label is applied to spin-outs focused on the commercial development of new ideas and is favoured by venture capitalists seeking a financial return on their investment. It is popular among larger institutions that already have technology transfer mechanisms and close ties with industry in place. However, for the growth approach to succeed, the right mix of financial and management expertise is needed to ensure an idea has every opportunity to develop into a commercially viable proposition. Ideally, a balance needs to be struck between the 'growth' and 'lifestyle' approaches, so that too strong a focus on short-term financial gain does not result in viable research ideas being dropped. The emergence of networks spread across multiple institutions gives rise to a further distinction on the basis of whether a spin-out stems from an in-house research project (primary) or an idea developed outside (secondary).

Spin-out programmes vary markedly across Europe, and as regards funding and organisation can be classified into four main types. Those which receive government funding via centrally co-ordinated agencies exemplify the **top-down** approach. This approach works best in countries where spin-out programmes are underdeveloped. The **network** approach relies on the creation of networks linking investors, incubators and business support services, and is popular in France, Germany and Sweden.

In Switzerland, components of a spin-out programme (incubators, seed and venture capital) are put in place gradually, constituting the **incremental multi-layer** approach. A fourth, **technopole**, approach can be added modelled on the UCP's

Innova programme, which imposed cultural change from above by making university departments compete for funding. Overall, networks are considered the most effective means of developing spin-outs as they elicit greater economies of scale and build critical mass quickly, particularly in isolated regions that cannot readily access innovation finance or management expertise.

A free market approach to the development of spin-outs is not always desirable as venture capitalists only invest in the small proportion of projects that meet their strict investment criteria. During the conversion stage, failure rates are high, and without public subsidies some spin-out projects may not advance further. Public subsidies, therefore, are essential in order to ensure that the widest possible choice of projects is considered.

Good practice

There are advantages and disadvantages to separating spin-outs from the host institution. In Germany, for example, the Fraunhofer Gesellschaft Patent Centre established a separate entity to manage spin-outs in order to attract venture capital investment. Programmes that are independent of the university or research centre have a higher public profile and are also more likely to attract higher-calibre business managers.

The role performed by incubators is further endorsed by the need for innovation finance to be allocated in a systematic manner so that the worst-performing projects are eliminated early on. This requires managers with extensive business expertise, who are more likely to be attracted to incubators offering higher financial rewards. In areas where management expertise is scarce, networking is an effective mechanism for accessing a wide range of informal contacts. It is also a good way for universities with small research bases to work with others to develop spin-outs.

The inherent value of a spin-out lies in the newness of the idea it is looking to commercialise. To safeguard against use by another party, patent claims should be broadly worded. They also need to be based on a clear legal framework. Venture capitalists are less willing to invest in companies where the intellectual property rights (IPR) reside with the university. Practitioners concur that IPR should not be handed over too early to investors and is perhaps best dealt with on a cross-licensing basis with investors, start-ups and universities sharing ownership.

Whilst subsidies or sponsorship add to the pool of available capital for funding spin-outs, the 'smartest' form of investment is money allocated by programme managers with the expertise to determine which projects deserve funding. However, an over-reliance on private-sector financing, which emphasises profitability, can conflict with the objectives of technology transfer. External investment should be sought once a spin-out has progressed beyond the conversion stage. Having said that, as a means of benchmarking how well a project is progressing, milestones should be established at the conversion stage. This is important given the scarcity of funding available in the early stages of a spin-out's development.

The various forms of innovation financing, including venture capital, business angels, corporate venturing and sponsorship, have their advantages and disadvantages in terms of the level of control ceded and alignment with the company's interests. Rather than relying on one form of funding, multiple financing options are the best approach. But it is not simply a question of money. Ultimately good management determines whether a spin-out succeeds or not.

Follow-up

The lessons and conclusions of this FIT project have been fed into the design of the Gate2Growth initiative, its tools and services. The Gate2Growth Incubator Forum is also providing opportunities for continued exchange to develop these insights (see *www.gate2growth.com*).

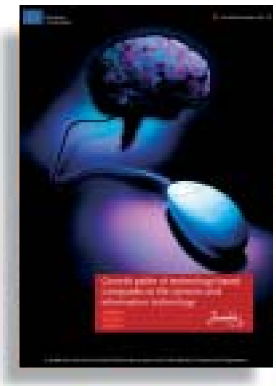
Chapter 3 **Innovation finance**

3.

Chapter 3 summarises four studies on the financing of innovation. The first examines the role of different sources of finance in the growth of new high-tech firms. The second finds that publicly-backed or mutual loan guarantee schemes are a very effective means of closing the equity gap, especially when they are packaged with advice. The third looks at informal investment by business angels as an alternative bridge over the equity gap facing growing firms, and the last finds that investment analysts both want and need training in entrepreneurship and technology trends.

3.1

Analysis of the typical growth path of technology-based companies in life sciences and information technology, and the role of different sources of innovation financing



NB-NA-17054-EN-C, ISBN 92-894-4569-6
Innovation papers No 32, 182 pp.
Free, from the Innovation Helpdesk (see back cover)
Study team led by: Universiteit Gent (Belgium)

Key findings

- Three categories of high-tech start-ups emerge: companies that are not growth-oriented, those where the founder is willing to let the company grow but without clear direction, and those with explosive growth plans from the beginning.
- Most European start-ups stay small, the main aim of most entrepreneurs being self-employment. But venture capital-backed firms, which start with substantial capital and a very mixed founding team, show exponential growth.
- The larger and more diverse the founding team, the better the chance of growth. Without access to advice on business strategy, management and protection of intellectual property, start-ups fail to grow.
- Many firms – dubbed "prospectors" – start as consultancies, and then move into production when they are strong enough to raise capital.
- If the time to market is crucial, prospectors can be overtaken by faster-moving VC-backed firms. Starting a VC-backed firm in an emerging environment without all the required human resources means taking a higher risk, but creating a prospector firm risks losing the first claim on the market.

Policy context

High-tech start-up companies play a vital and increasing part in Europe's economy. They are innovative, they show faster than average employment growth, and they survive in greater numbers than non-technology-based start-ups. The Lisbon European Council called on member states to improve the climate for small businesses and in particular to focus on small companies as the main engines for job creation in Europe. This study reports on the characteristics of such companies in Europe.

High-tech start-ups and research-based spin-offs

Over 90% of Europe's NTBFs (new technology-based firms) start up in life sciences or information technology. Around a quarter of these are research-based spin-offs, set up to commercialise an invention arising from research at a university or other research establishment. Figure 3.1 illustrates how these relate to other types of high-tech start-ups. High-tech start-ups can be grouped according to six key features:

- **Clarity of product and market** – the company may have a technology and a clear idea of how to develop and market it, or a technology in need of further commercial development, or it may lack any clear idea of product or market. More than half of European high-tech firms founded before 1995 (when the high-tech stock markets were being set up) had no clear idea of their product or market.

Figure 3.1

Drivers and constraints of high-tech start-ups

	Technological uncertainty	No technological uncertainty
Technology push	research-based spin-offs (academic and corporate)	technology contingent start-ups
Business pull	technology spin-ins	technology adopters

- **Capitalisation** – this is improving. Before 1995, two-thirds of high-tech start-ups were set up with the legal minimum of capital required to found a company, falling to 43% after 1995. Companies starting with a capital between €200,000 and €500,000 increased in the later 1990s, from 11% to 27%. Companies starting with over €1m also grew in number, from 14% to 19%, but this is far behind the US situation.

- **Experience of founding team** – the larger and more diverse the founding team, the better the chance of growth. Companies tend to have founders with technical skills only, or technical people plus some with commercial experience, or technical people plus some management or marketing professionals.

- **Business model** – many companies start by consulting, to bring in income with little capital cost. "Research boutiques" are funded by public-sector grants, but there is a danger of continuing research and consulting without developing the company further. Some remain as this sort of technical consultancy; some start in this way but with the intention of becoming a growth-oriented VC-backed firm (the "soft start"). A third type of start-up (making up 10% of the total) is product-oriented from its inception. During the 1990s the number of technical consultancies decreased (from 56% to 32%) while that of "soft start" companies doubled (from 23% to 46%). This suggests that the availability of risk capital allows them eventually to realise their true aim.

- **Growth orientation** – most European start-ups stay small, the main aim of most entrepreneurs being self-employment. These family businesses wish to stay independent, and avoid external equity financing or debt, which limits their growth prospects. Management is not accountable to external shareholders and is not pressured to maximise profit. In contrast, entrepreneurial growth-oriented firms (which are common in the USA) value wealth creation and distribution to stakeholders other than the owners. Again three categories emerge: companies that are not growth-oriented, those where the founder is willing to let the company grow but without clear direction, and those with explosive growth plans from the beginning.

- **Target market** – the growth of a company and its international orientation are closely related. One type of new high-tech company takes its technology to international markets almost immediately – "born globals" such as the late-1990s "dot-coms". Many of these (35% since 1995) target an eventual international market but develop the local market first, and the remainder only reach a local market.

These six features can be combined to describe three major types of start-up company:

- **Technological SMEs** are high-tech companies with low growth, focused on the local market, and acting as "research boutiques" or technical consultancies. They start with minimum capital and provide the founder with employment.

- **"Prospector" firms** make a soft start as a consultancy, and grow slowly with the aim of becoming product-oriented after several years. Founding teams usually have mixed skills.

- **Venture capital-backed firms** show exponential growth and start with substantial capital and a very mixed founding team. They are often formally founded after a period funded by pre-seed capital from family and friends. This form is common in the USA, but in Europe only 12% of high-tech firms have venture capital backing.

The proportion of prospector firms has increased since 1995 (from 25% to 43%), while the proportion of technological SMEs has fallen (from 64% to 41%). Some prospector firms were forced to take this route because they were unable to complete the skills mix of the team and raise venture capital. Technological SMEs founded before 1995 often become VC-backed eventually. In some cases the founders could not create a VC-backed company because the time was not right for their technology. Figure 3.2 summarises the features of the three types of start-up.

Figure 3.2

Characteristics of three types of high-tech start-ups

	Technological SME	Prospector	VC-backed
Clarity of market	no product / market identified	substantial product development and market positioning needed	clear product / market idea based on technology platform
Capitalisation	€0-60,000	€375k average	€1-4.5m
Founding team	technical	essentially technical, some with junior management experience	core founding team technical, plus hired managers with business expertise
Business model	consulting and service-oriented	product-oriented, or mix of this with consulting	product-oriented
Growth orientation	low growth target; focus on keeping control of firm	growth orientation but long gestation	exponential growth target; time to market is vital
Target market	local	international early on	international from beginning – "born global"

Development of an entrepreneurial climate

An entrepreneurial environment is characterised by the availability of **early-stage funding**, the development of **incubation capacity** (a protected environment with services for young companies) and the development of an **entrepreneurial community** (company/sector clusters, networking and information flow). Eleven European regions, plus one from the US (Cambridge, Massachusetts) are ranked in Figure 3.3 according to their performance in these three areas. The regions can be grouped into:

- **poor environment** – no pre-seed capital, incubation focused on physical location and not on networking, e.g. non-technology regions of EU, northern Italy.

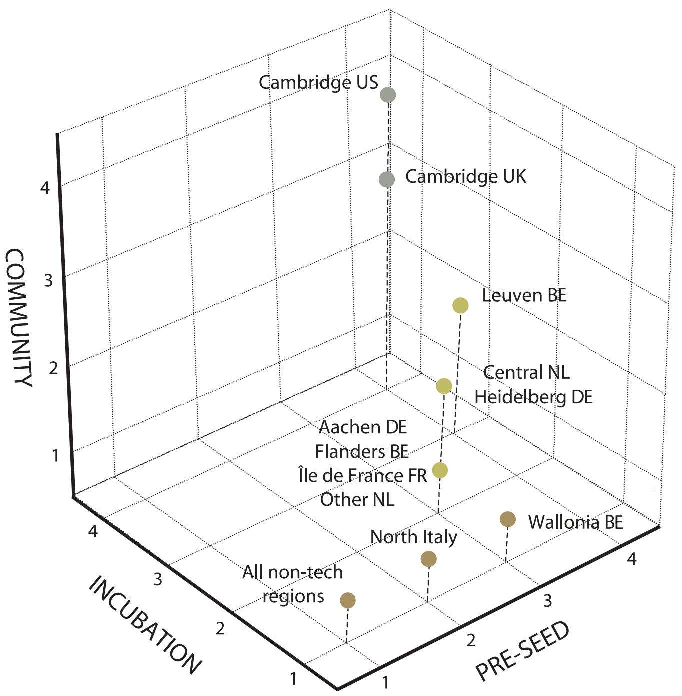
- **emerging environment** – pre-seed capital available, mainly from public sector, incubation is physical and technological, some emerging business support, e.g. Hessen, Ile-de-France.

- **developed environment** – pre-seed capital widely available through private initiatives, private incubators and developed entrepreneurial network, e.g. Cambridge UK, Leuven.

One essential for the development of an entrepreneurially rich environment is a prominent **strong research institution**, seeking public sector funding for research projects. However these grants are ill suited to commercial exploitation of innovations, and some countries have developed separate **public sector pre-seed capital** funds. Examples are the Belgian model of university funds with private backing, and Dutch pre-seed capital in a public incubator. In the German TBG (Technologie-Beteiligungs-Gesellschaft) scheme, pre-seed capital is invested in very early-stage start-ups, usually co-operating with an incubator.

Figure 3.3

Stages of development of the entrepreneurial climate in 11 EU regions and one US region



Developed environment
Emerging environment
Poor environment

The **incubation capacity** of a region comprises physical incubation (buildings) plus technical incubation (support services), of which there are many forms. Physical incubators date from the late 1980s - and it emerged fairly rapidly that it was not enough to offer workspace at low rent. Without access to advice on business strategy, management and protection of intellectual property, start-ups fail to grow.

Technological incubation initiatives allow academics to carry out contract research and commercialise some of the results. Tested in Leuven, Belgium, they can be a major stimulus to innovation, and a step towards a research-based spin-off. Public-sector incubators tend to concentrate on one type of start-up company, whether technological SME, prospector or VC-backed. There is a need for more individual assessment of the market and local conditions.

Types of start-ups favoured in different entrepreneurial climates, and their growth paths

The different types of entrepreneurial climate have a sharp impact on the type of start-up that can succeed (Figure 3.4). **Technological SMEs are the only realistic start-up mode in a poor climate**, because of the lack of capital and business support. These start-ups are likely to remain service firms with little prospect of growth. Five out of six high-tech firms in northern Italy are technological SMEs, and only one is a prospector, scoring low on capitalisation and diversity of the founding team.

Prospectors tend to develop most in emerging entrepreneurial climates, but the firm must be advanced enough technologically to focus on business development. One of the main problems is that pre-seed capital often comes from public organisations which take a large share in the company. When the company is ready for market investment, the pre-seed investor is still influential and the incubation period can take too long.

Even for prospector firms the eventual target market is international. **If the time to market is crucial, prospectors can be overtaken by faster-moving VC-backed firms**. Starting a VC-backed firm in an emerging environment without all the required human resources, or without a developed market, means taking a higher risk, but creating a prospector firm risks losing the first claim on the market.

VC-backed firms can be set up in emerging entrepreneurial environments, often as spin-offs from public research institutes. Some institutes turned to the American model of VC backing for start-ups after falling short of success with technological SMEs. In practice the necessary business expertise is still often lacking.

A developed entrepreneurial climate allows all three types of high-tech start-ups. VC-backed companies have much the best chance of survival, especially those targeting a rapidly developing market. Internet-related companies, like the marketing dot-coms, are almost always found in developed entrepreneurial regions. Business plan development takes longer than for prospectors, as time is spent in creating a team with diverse skills. Pre-seed capital (from the founders or business angels) is often less used than in an emerging environment, because of the fast growth path. Learning by experience during incubation is replaced by learning in business after VC-backing. The company rapidly comes to depend less on the local environment and more on the product and market.

Examples of European regions with concentrations of biotechnology and IT companies

The **Flanders** Interuniversity Institutes for Biotechnology (VIB) and for Microelectronics (IMEC) are the hub of one of Belgium's technical incubation centres, developed by government investment to increase the regions' capacity for biotechnology and IT research. VIB has a yearly turnover of €7m, earned mainly from contract research and joint projects with industry; it also fosters technology transfer by licensing or creating spin-offs, and invests in promoting the image of biotechnology. IMEC is financed by research grants, contract research and government subsidies. It develops production processes for the next generation of electronic circuits, as well as opto-electronic components, solar energy systems, sensors and integrated circuits.

Linköping in Sweden has a Centre for Innovation and Entrepreneurship with a business development programme for high-tech entrepreneurs. Sweden is active in business networking, with many inter-university training seminars and a network of alumni now acting as business angels for high-tech start-ups. Sweden has a long list of public support initiatives, including the Swedish Industry Fund, which provides conditional loans and equity for research-based firms.

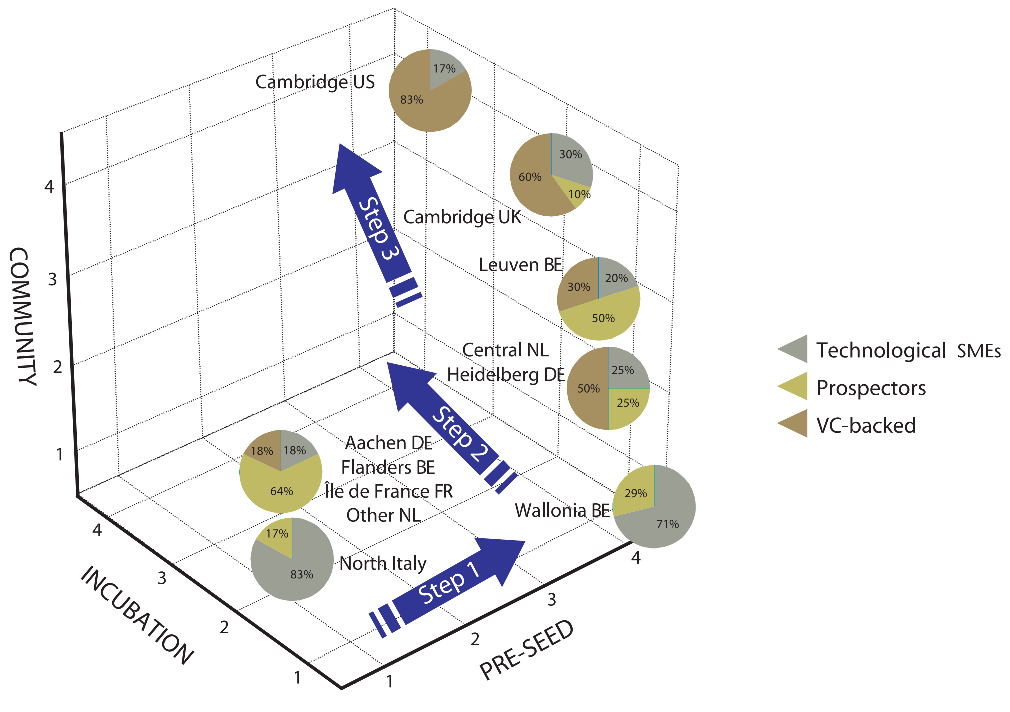
Cambridge in the UK also has extensive spin-off development, with about 1,200 high-tech firms employing some 37,000 staff. Its Judge Institute studies high-tech entrepreneurship and gives seminars to potential company founders. Several individual entrepreneurs have created seed capital funds and business angel networks.

Factors for growth in biotechnology and information technology (IT)

Biotechnology and IT are major growth sectors dependent on the extension of knowledge and its effective exploitation. Both are concerned with the development of new products and processes important to 21st century society – therapeutics, diagnostics, agro-biotechnology, bio-informatics, bio-electronics, industrial software, electronics and the internet. They illustrate the many factors of company growth discussed in this section. But **the potential to lead rather than to grow is closely related to the company's ability to protect its technology from imitation**, either through patents, trademarks and other legal provisions, or because of competitors' lack of competence. Complementary assets are important – the manufacturing and marketing channels, brand name, reputation and complementary technologies. Control over both gives a strong market position, but one which is difficult for a start-up to achieve. In both the biotechnology and IT sectors, there appears to be little room for more than a few fully vertically integrated companies.

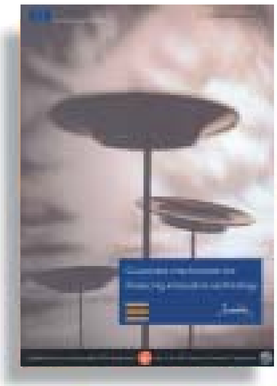
Growth prospects of three types of high-tech start-ups

Figure 3.4



3.2

Guarantee mechanisms for financing innovative technology



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Study team led by: MCS (United Kingdom)

Key findings

- A guarantee is often vital to ensure access to finance in a climate where banks are hesitant to support high-risk, low-profit ventures with only intangible assets.
- However banks are beginning to realise that contrary to common assumption, NTBFs (new technology-based firms) present a *lower* financial risk than SMEs in general, because they usually have a core of very highly educated, mid-career professionals, even though they may lack management and marketing experience.
- Most schemes guarantee loans, but those targeting NTBFs, who are keen to benefit from fast growth, often guarantee venture capital equity. While mutual and some state schemes aim to be self-supporting, other state schemes benefit from subsidy.
- Guarantee schemes face a default rate of between 3% and 10% of the sums guaranteed. Guarantees do not tend to reduce the interest charged on loans.
- Some governments are building private sector capacity by supporting mutual guarantee societies.
- The most obvious role for public backing is where banks are underdeveloped, but even where the banking system is sophisticated, public backing can be useful in reducing the interest rate that guarantee schemes have to pay.
- Compared with the financiers and policy-makers, NTBF owners have a weak voice in scheme design. One of the main problems facing guarantee schemes is how to make themselves better known to SMEs.
- Guarantee schemes are more effective when part of an integrated programme of financial and advisory support measures.

Policy context

The Lisbon European Council called for a better environment for high-tech start-up companies, including access to finance and other types of support. The Commission's 2000 Communication *Innovation in a knowledge-driven economy* then called on member states to step up their efforts to create a legal, fiscal and financial environment favourable to start-ups. Meeting difficulties in raising funds, young innovative companies are turning increasingly to public or mutual society guarantees to underwrite early-stage loans. A guarantee often proves vital to ensure access to finance in a climate where banks are hesitant to support high-risk, low-profit ventures with only intangible assets.

New technology-based firms (NTBFs)

Banks are beginning to realise that **contrary to common assumption, NTBFs may present a *lower* financial risk than general SMEs**. While they may have very few visible assets, high-tech start-ups usually have a core of very highly educated, mid-career professionals. What they may lack is experience in management and marketing.

Yet NTBFs face some special problems. As they are creating an innovative product, they find it difficult to predict how much it will cost to bring their technology to the marketplace. And time is of the essence: if investment is not made in time, the market opportunity may be lost. NTBFs need support services and advice such as those offered by incubators (see section 3-3), especially in areas such as marketing and the protection of intellectual property. Given the right financial and other support, they have the undoubted potential to make a major contribution to the economy.

Loan guarantee schemes

Guarantees have traditionally been offered to cover **loans** (usually from banks), but nowadays also cover **equity** (usually venture capital), and more rarely **mixed loan**/**equity** packages. Guarantee schemes may be **mutual** (given by societies of private companies), **state** (run by national or regional government) or **supranational** (like the European Investment Fund, which offers co-guarantees, counter-guarantees and advice on improving existing schemes). Mutual and some state schemes aim to be self-supporting, but other state schemes benefit from subsidy.

Guarantee schemes have a particularly key role for NTBFs, as part of an integrated programme of financial and advisory support. NTBFs need to find funding for successive phases of development, and commonly progress from loans, through risk capital from informal investors and later venture capital companies, before eventually floating on a stock market. Guarantees, which insure these financial packages, can make the difference between viability and failure, since particularly in the earlier stages companies may have little to offer as collateral. Though schemes for SMEs in general are generally loan-based, those specifically targeting NTBFs include equity, loan and mixed guarantee schemes – indicating that equity guarantors are keen to participate in the high growth potential of NTBFs.

Guarantees vary in the **proportion of a loan that is guaranteed** (usually between 50% and 100%), the **maximum amount covered** (€7k to €12m) and in their other conditions. Despite the fees levied, in many cases the interest charged on the loans guaranteed is high. Guarantees last between 3 and 10 years.

Guarantee mechanisms in financing innovative technology

Many schemes target small, growth companies by setting a level of maximum turnover. The Danish Seed Capital Grant Scheme lists as eligible: entrepreneurs, inventors, small business managers, science parks and hospitals. The Italian UFP scheme targets new firms started by young people and women, environmental technology firms and all types of new technologies. Evidence suggests that compared with the financiers and policy-makers, NTBF owners have a weak voice in scheme design.

The **conditions applied to the grant of a guarantee** typically cover the credit period of the corresponding loan, the interest charges, repayments, collateral required and a product liability guarantee. Some, like the Austrian scheme for guarantees for domestic projects, insist on regular communication between the borrower, the bank and the policy administrators. Others specifically exclude co-support of an investment project by other bodies. Extra safeguards may be brought into play for more risky projects.

Guarantee schemes face a default rate of between 3% and 10% of the sums guaranteed. Most schemes require the lender to follow every other means of obtaining repayment, including bankrupting the borrower, before the guarantor pays the balance. If borrowers do not default in the first two years of a loan, they are unlikely to do so. Close monitoring and continuing professional advice is most useful in reducing the risk of default.

Problems and solutions

Guarantee schemes have developed rapidly in recent years. Some have evolved in countries previously without them, often aided by the European Investment Bank or schemes in other countries. One of the main problems facing guarantee schemes is **how to make themselves better known to SMEs**. Efforts to improve information availability through other financial institutions and websites have improved communication.

In eastern European countries, banks are more risk-averse than in most EU member states. They tend to avoid loans of over two years' duration and lack the skills needed to value collateral or to deal with small enterprises. Some will even refuse a 70% state guarantee unless full collateral covers the balance. This suggests a role for government, which can afford to take a longer-term view of the advantages of stimulating innovation in the new member states.

Figure 3.5

Features of guarantee schemes targeting NTBFs

Country	Scheme name	Scheme type	Guarantee proportion and conditions
Austria	Equity financing with venture capital funds	Equity	guarantee covers 50% of paid-in capital
	Equity Capital Guarantees	Equity	up to €730k per SME
	Dynamic SMEs	Mixed	up to €730k per SME per project. Guaranteed percentage: for credits up to 80% of outstanding credit balance; for equity up to 50% of amount invested, or up to 100% for small interests of individuals
	Young Entrepreneurs	Loan	up to 80% of bank credits for investments and take-over costs; maximum €145k
	Guarantees for domestic projects	Mixed	guaranteed sum of financing should not be less than €364k, or for equity participation not less than €182k. Guarantee covers up to 85% of capital and interest. Guarantee can cover up to 100% of a junior loan
Germany	ERP Innovation Programme Loan Variant	Loan	RTD phase: loan for up to 100% of eligible costs up to €5m. Market introduction phase: loan for up to 50% of eligible costs up to €1m (old Länder), 80% or €2.5m (new Länder & Berlin). Bank receives guarantee of up to 60% loan plus priority claim on collateral
	KfW BMWi Technology Equity Programme	Mixed	guarantee covers 100% of loan and specifies investment of 70% of equity stake (up to €1.4m) in old Länder & West Berlin – 80% in new Länder & East Berlin
	Innovation - Equity Participation Variant	Mixed	guarantee covers 60% of loan and specifies investment of 75% of equity stake (up to €5m) in old Länder & West Berlin – 85% in new Länder & East Berlin
	Risk Capital (Equity and debenture guarantees)	Equity	guarantee covers up to €5m per participant but specifies loan is invested as equity in old Länder & West Berlin (up to 40% of equity stake – 50% in new Länder & East Berlin)
Denmark	Research and Development Projects	Loan	guarantee covers up to 45% of total development costs. Project total budget must be at least €30k
	Seed Capital Grant Scheme	Mixed	grant covers 50% of costs of preliminary project, typically for outside services; up to €112k. Successful projects may become eligible for support by other Vækstfonden schemes, which may increase chance of obtaining a guarantee
Finland	Growth and Employment Guarantee Scheme	Loan	n/a
Italy	UFP	Loan	amount guaranteed is assessed for each project; UFP and trade associations negotiate maxima for each association. Typical guarantee covers up to 50% of loan; minimum guarantee €20k and maximum €387k
	Confidi Toscana	Loan	guarantee covers up to 50% of loan. Loan maximum is €150k or rarely €250k; loan must be for high-tech
Netherlands	Twinning	Equity	maximum guarantee per project is €109k
	Technostars Techno-startersfonds Zuidoost NL	Equity	guarantee covers between €45k and €227k; higher amounts are possible in co-operation with financial partners of Technostars
	KREDO	Loan	guarantee covers up to €1,815k per project. Maximum credit is 40% of project costs
Sweden	Almi Företagspartner	Mixed	offers start-up loans and credit guarantees for small firm expansion or investment in innovation and technology
	Industrifonden	Mixed	offers conditional repayment loans, credit guarantees, project guarantees, capital in return for royalties; projects must have budget of over €226k
USA	SBIC (Small Business Investment Companies)	Equity	most investments by SBICs are between €0.27m and €4.6m

The difficulty involved in **valuing intellectual property** – which may be a company's most valuable asset – means that it cannot be used effectively as collateral. Financial analysts need better training (see section 3-4), so that lending institutions can better assess project risk.

In France mutual schemes have declined, while public schemes have developed: premiums have not covered the cost of defaults, and when funds have been depleted, they have closed. The Italian, Spanish and Portuguese governments have intervened to train mutual guarantee societies, and build their capacity to bear risk. In countries where commercial banks are strong, public guarantees probably have a more limited role. However, **public borrowing power in money markets, the use of subsidies and the regulation of finance institutions can all be helpful in reducing the funding gap for young companies**. For example, the German Credit Guarantee Association's loan guarantee scheme, which is underwritten by the *Länder*, enjoys a more favourable credit rating than commercial banks.

Scheme evaluation and findings

The guarantee schemes examined all have arrangements for monitoring and evaluation. In some cases (such as Almi Företagspartner, Sweden) client companies found that **the endorsement of holding a guarantee opened access to further finance**. KREDO (Netherlands) prioritises its applications on the grounds of market potential, innovative nature and exemplary effect. A 1998 evaluation of KREDO showed that its guarantees had been an incentive to companies to develop new electronic services.

However other guarantee schemes have **difficulties in balancing their assets and outgoings**. Even though some clients of Italy's Unione Fidi Piemonte (UFP) feel that its cost is high, increased uptake is taxing the capacity of the scheme's assets. Studies of the Canadian Small Business Finance Act (CSBFA) scheme suggest that larger loans tend to have higher default rates.

Advantages of guarantee schemes

Guarantee schemes are clearly **more effective when part of an integrated programme of financial and advisory support measures**. Italy's UFP illustrates their key advantages. Its priorities are to **spread and transform risks**, to **improve the negotiating and contractual position** of clients and to **give professional financial guidance**. It combines the traditional guarantee on a short-term loan with a general restructuring of the company's finances, including planning its long-term borrowing requirements. The UFP scheme is backed by the EIF, and guarantees can be invoked quickly if a client runs into difficulties. It also has special programmes with benefits to both companies and the community, such as cutting the guarantee fee to companies creating new jobs.

Some exemplary practices

Many schemes show imaginative new approaches, including professional advice on structuring overall financial programmes. Technostars (Netherlands) insists on a sound business plan. Almi Företagspartner (Sweden) gives legal and technical consultancy covering business establishment and expansion, product development, market strategy, information technology and patents. Its special loan scheme for enterprises owned by women, training programmes and business contacts networks are innovative and focused. Some schemes, such as Denmark's Research and Development Projects, allow guarantees to be renegotiated to reduce debt if circumstances change.

Figure 3.6

Guarantees issued (schemes targeting NTBFs only)

Country	Scheme name	Number of guarantees issued
Denmark	Seed Capital Grant Scheme	None – guarantee is an assurance that the young company will become eligible for direct guarantees on loans and venture equity as it grows
Finland	Growth & Employment Guarantee Scheme	About €521m granted for domestic risk finance in Finnvera's first year. Of this, state guarantees were €202m and other guarantees €45m
Italy	UFP	Guarantees worth €55k covered loans of €134k in 1998
Netherlands	KREDO	KREDO budget for 2000 was €9m
	Twinning	23 businesses awarded Twinning capital since 1998
Sweden	Almi Företagspartner	Almi parent company manages fund of €447m, some of which provides credit for new clients
	Industrifonden	Fund totals €430m, which covers guarantees, loans and venture equity
USA	SBIC (Small Business Investment Companies)	79 new SBICs licensed 1994-96 with €1,063m of private equity capital. Prediction for 1997 was 40-50 further SBICs with €530m

3.3

Informal investors and high-tech entrepreneurship

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Study led by: MCS (United Kingdom)

Key findings

- The start-up of a new technology-based firm (NTBF) is often financed by the founder, friends and family, with the help of bank loans. Loan guarantees may help, but as the firm grows, the risk often outgrows the bank's limits. As institutional venture capitalists do not like to invest sums of less than about €400,000, business angels fill the "equity gap".
- Business angels are wealthy individuals, who support a growing firm with advice and contacts, not just cash. They tend to invest between €15,000 and €400,000, with most investments falling below €80,000.They may be grouped into six types depending on their experiences and preferences.
- There are about 200,000 business angels in the USA, investing some €55 billion. In Europe they are rarer: the UK has 18,000, and France and Germany a significant number. In southern Europe, start-up funding tends to come from friends and family, and outside investors are distrusted.
- Business angels will typically sell their investments to a venture capital company, which will support the company till it can be sold to an established company or be floated on a high-tech "new market".
- Business angel networks and business incubators can encourage informal investment by improving information flow. Even so, many business angels will base their investment decision primarily on their judgement of the personality of the entrepreneur.

Figure 3.7

Business angels – characteristics, investment criteria and expectations

Type	Entrepreneur	Corporate	Income seeking
Characteristics	The most active and experienced angel	Companies (or directors) making angel-type investments	Active individual investors, but with lower level of investment than other types
Wealth and level of investment	worth over €1.6m, with annual income over €167k. Invest over €837k	Almost 40% of survey group had invested over €837k in new ventures	30% of group worth less than €167k. Invest €40-84k
Investment objectives	Financial gain, but also fun and satisfaction	Financial gain, but this is often less than earned by individual angels	Create a job for self and financial return
Main criterion for investment	Personality of company founder	Personality of founder or manager	Personality of founder or manager
Investment location	Not important	Prefer to invest close to location of angel	Not important
Other factors	More open than other angels to investing outside own field of experience	Own experience in sector is important	

Policy context

The availability of seed and early-stage venture capital is a major concern to innovative high-growth companies. New technology-based firms (NTBFs) have assets which are largely intangible, and are perceived to be very risky, so raising finance is often difficult beyond the early stages. However, **NTBFs are vital to economic development**, and show rapid growth and high added value. They lead in product innovation and job creation: between 1991 and 1995 they showed 15% growth in employment, compared to 2% in the top 500 companies in Europe.(1)

The typical growth phases of a company (see section 3-1) start with the first concept and decision to set up the company, funding typically being raised from banks by the founder, family and friends. With growth, continued high cash needs bring the business face to face with **the equity gap** – the stage before venture capitalists (VCs) are interested in a relatively small, high-risk investment. Equity finance of less than about €400,000 (£250,000) is very difficult to obtain. At this stage, with banks often unwilling to accept the company's risk/asset balance, **the most likely source of support is from informal investors**, known as business angels – wealthy individual entrepreneurs who are able to contribute both equity and business expertise. Loan guarantees (see section 3.2) are also important, and many governments have introduced loan guarantee schemes to underwrite finance to small companies.

Given further growth into profit, venture capitalists (VCs) will become interested in investing capital. VCs expect to exert substantial influence on the running of the company, and commonly take over the stake of business angels. They are corporate investors, able to provide large-scale equity finance to companies they believe promise high rewards. Their backing will see companies through take-off, leading ultimately to flotation on one of Europe's new high-tech stock markets.

Bank debt attracts many entrepreneurs in the early stages, because it allows them to avoid sharing control of the business. But it involves giving the banks some security, and assets are mainly intangible at this stage. In contrast, **equity finance is provided in relatively small amounts by business angels, and in large amounts by VCs**.

Banks, business angels and venture capitalists are complementary sources. Bank funding and informal investors often cover the first 2-3 years and raise up to €10 million. VCs step in at 2-3 years with sums in the region of €5-25 million, and if the company is successful, flotation might be expected at around 5-6 years.

The role of informal investors

Business angels help to meet the needs of NTBFs by contributing funds and raising the creditworthiness of the company. They also complement the existing managers' technological knowledge with advice on commerce, marketing and management. Finally, they can help prepare business plans, strategy and accounts.

Business angels' individual investments vary between €15,000 and €400,000, but most tend to invest less than €80,000. The survey confirmed the operation of **six types of business angel** with different styles and objectives.(2) Figure 3.7 summarises the features of the different types.

The UK has the most developed informal investor market in Europe with 18,000 active and potential investors, currently investing €800m in 3,500 businesses. Germany and France also have active angels, but in other member states they are much rarer. The USA has between 150-250,000 individual business angels, providing over €55 billion to American enterprises, including €17 billion to high-risk, early stage firms.

Wealth maximising	**Latent**	**Virgin**
Private individuals with several investments in new ventures	Inactive for past three years, but having made at least one investment before that	Not yet made an investment in an unquoted venture
80% of group worth over €837k. Invest €40-167k	50% of group have over €167k available for investment; some much more	Less funds than all other angel types, but this not felt to be a restriction
Financial gain and job for self	High financial return and job for self	Higher return than from stock market; also job or income for self
Personality of founder or manager	Personality of founder or manager	Personality of founder or manager
Not important	Strong preference for venture close to angel	Prefer to invest close to location of angel
Opportunities for co-investment; access to knowledge of other investors	Clearly available exit routes	25% say own experience in sector is important

Informal investing is typical of the capital economies of the US, UK, Australia and Canada. In many southern European states, small companies are financed from family sources and bank credits – an outside creditor with influence is less welcome. Aversion to risk is strong, and in many countries bankruptcy is viewed as a disgrace, whereas in the US proposing a new venture after bankruptcy is taken as a brave effort to start again with the benefit of knowledge gained. Also in the US, much more investment by all angel types is made on grounds of social responsibility than in Europe, where only corporate angels take this viewpoint.

Key issues for informal investors

Business incubators are able to help start-up companies at their most vulnerable time. Often situated near universities, incubators typically provide workspace and services at preferential rates. They also give access to expertise on such topics as taxation, intellectual property, finance and markets. Incubators often house a cluster of companies in a particular technology sector. Young companies in this environment are able to make important business contacts who will reinforce their growth. Typically companies are able to leave the incubator within a few years.

Incubators can help reduce the information gap between the low-visibility technologist-entrepreneurs and potential informal investors. The emphasis of incubators on timely access to finance may be one of the reasons for their higher success rate than science parks.

Entrepreneur is matched to investor either informally, through angels' business contacts, through **business angel networks**, or through business introduction services such as ***www.gate2growth.com***, supported by the European Commission. Some angels prefer informal contacts, especially if their decision to invest rests mainly on the personality of the entrepreneur. More formal networks are run either by the private sector, for instance by accountancy firms (without a fee but with the promise of 'due diligence' work), by the public sector (for instance local authorities or training and enterprise agencies), or by profit-making networks charging both sides. Figure 3.8 shows the advantages and limitations of using business angel networks.

A **business plan** is one of the most effective ways to show a potential informal investor why the venture is worthwhile. Consensus has developed on what should be in the plan - the executive summary is the most important, and often the only part that is read by potential investors. The plan must be concise, realistic and able to attract and hold the interest of the potential investor.

After the entrepreneur and potential investor have explored the deal possibilities, the entrepreneur may be reluctant to give up control of the company. A good personal understanding between the two is essential if the relationship is to work – an expert facilitator can help to take the company through to the next phase of growth.

In Europe the proportion of formal and informal venture capital going to start-up companies is small compared to the USA. American investors are a mix of institutions and small private investors, and the emphasis is on **high-tech start-up companies**. US small investors have easy access to tax breaks, so millions of individuals put about 5% of their money directly into small stocks. This investment gives US start-up companies a much more flexible source of funding than those in Europe.

In the EU the focus has moved much more toward developing and exploiting technologies. Here most investment capital is under the control of institutional fund managers. A number of schemes, particularly in France and the UK, offer tax privileges for individuals on investments in the ordinary share capital of private companies. The UK's Corporate Venturing Scheme encourages larger firms to invest in small growth companies, allowing tax relief of 20% on investment in unquoted companies worth under €25m. In 2000, the UK government also cut capital gains tax, benefiting angels who prefer capital gain on exit from a company to dividend income.

Figure 3.8

Advantages and limitations of business angel networks

Advantages	Limitations
Provide easier access to potential investors than an individual search	May be too localised and passive, so limited in the number of investors participating
Provide a pool of experience which benefits less-experienced investors and entrepreneurs (some provide training)	May lower their acceptance thresholds for venture proposals to attract enough investors
Stimulate demand for private equity finance, by promotional actions	May need to improve quality of screening of proposals
Preserve privacy of investors, protecting them from unsolicited demands	Angel network officials not able to offer advice or recommendations due to legal liability
Improve quality and reliability of information moving between investor and entrepreneur	Many angels are very independent and reluctant to join a formal network
Provide a forum for discussion	Financing of network may need public support as unlikely to cover costs from fees
Able to interact with business incubators and with technology commercialisation officers of universities	

Four EU initiatives support venture capital funds for early stage technology investments:

- The Equity Programme of the European Investment Fund (EIF) supports high-tech innovative SMEs;
- The European Investment Bank's European Technology Facility (ETF) finances national initiatives to help young high-tech companies;
- The ETF's Start-up Facility invests up to €10m in venture capital funds to provide equity or other risk capital to innovative start-ups;
- The I-TEC (Innovation and Technology Equity Capital) scheme supports venture capital invested in technology-based, high-growth SMEs.

Other EU initiatives also give indirect support to the early-stage growth of this type of company, including the European Regional Development Fund, Europartenariat, the Fifth RTD Framework Programme and the European Social Fund.

Business angels and venture capital companies both need to have an exit route from a company, so as to release their investment and any profits. It may not be easy for an angel to withdraw before the company reaches stock market flotation, so possible routes should be considered in the business plan. While flotation is the most common exit in the USA and Canada, **in Europe sale to a trade competitor is more common.** Flotation is best suited to companies with substantial profits and turnover growth, or exceptional potential. A trade sale costs less than flotation and is more appropriate if the company is unlikely to reach the size needed for successful flotation. Figure 3.9 shows data on typical angel deals.

Until recently, companies could be floated on the new high-tech stock markets such as the Alternative Investment Market (AIM) established by the London Stock Exchange, Nasdaq Europe (the successor to EASDAQ), EuroNM (a joint venture between the "new markets" in Amsterdam, Brussels, Frankfurt, Milan and Paris), and the London-based TechMARK. However, it would seem that the IPO (initial public offering) window will effectively remain shut for the foreseeable future.

(1) Coopers and Lybrand, Economic Impact Surveys of the US and Europe*, 1996.*
(2) Coveney, P. and Moore, K. Business Angels: securing start-up finance*. John Wiley, New York, 1998.*

Typical angel deals

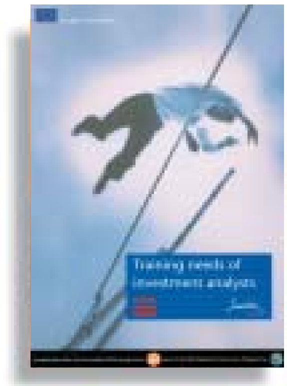
Figure 3.9

	Entrepreneur	Corporate	Income-seeking	Wealth maximising
Average total investment	€276,000	€340,000	€38,000	€86,000
Average initial investment	€186,000	€252,000	€27,000	€33,000
Average number of rounds of investment	2.0	1.7	1.5	1.75
Average number of co-investors	2.3	1.3	3	2.5
Average size of equity stake taken (%)	38	51	20	n/a
Average annual rate of return achieved (%)	61	8	n/a	n/a

Source: Coveney, P. and Moore, K. Business Angels: securing start-up finance*. John Wiley, New York, 1998.*

3.4

Training needs of investment analysts



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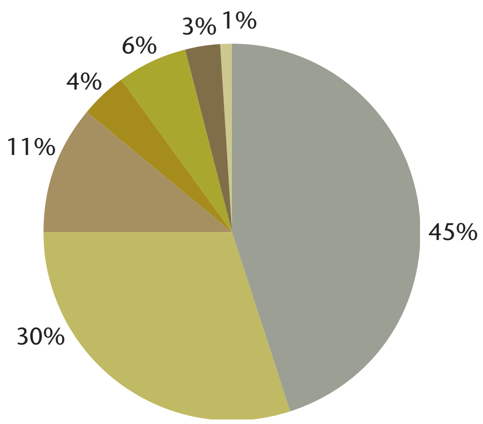
Innovation papers No 13, 48 pp
€17.50, from the Publications Office (see inside back cover) or downloadable from http://www.cordis.lu/innovation-policy/studies/fi_study3.htm
Study team led by: IP Strategies (Belgium)

Key findings

- Investment analysts on both sides of the Atlantic tend to study finance or economics to degree level and then go on to gain an MBA. Less than one-fifth have studied a technical discipline such as engineering. There is no specialist training in investment analysis in universities, and vocational training is limited to financial issues. They learn most of their skills on the job.
- Moreover, four out of five analysts have spent the whole of the last ten years working exclusively in finance. Only 3% have both financial and technical experience.
- This may leave them at a disadvantage when they are called upon to judge the prospects of a high technology business, because in this field traditional valuation methods are less relevant. High-tech firms are judged not on their profitability, but on the growth prospects for the particular technology they are developing.
- Analysts devote around eight days per year to training, which mainly takes the form of seminars and conferences on valuing high-tech businesses. They complain, however, that these courses are too theoretical and out-of-date.
- What analysts demand is up-to-date courses on the key technologies in which money is being invested – the internet, telecommunications and biotechnology – using real-life case studies and delivered by valuation specialists. They would spend up to a week per year attending such courses – if they were available.
- Within the industry, opinions differ as to what the best training is, and the venture capital and investment banking sectors demand different skills. Venture capitalists look for a technical degree plus MBA, experience in a 'sharp end' technology company, and entrepreneurial strengths, whereas investment bank analysts favour engineers with a strong financial and technology background.

Figure 3.10

Sectors of interest to venture capital analysts in survey



Investment Sector

- All sectors (45%)
- Information technology & Biotechnology (30%)
- Information technology (11%)
- Biotechnology (4%)
- Services (6%)
- Manufacturing (3%)
- Food, agriculture, environment, leisure (1%)

Policy context

When a young growth company presents proposals to a venture capitalist (VC) or an investment bank, the future of the company can depend on the depth of technology and financial understanding of the investment analyst appraising the proposal. Put the other way around, **poor analyst training can prove a serious barrier to innovation financing**. The Commission's 2000 Communication, *Innovation in a knowledge-driven economy*, set out five objectives to overcome cultural or institutional obstacles to innovation. The fourth of these objectives was to improve the key interfaces in the innovation system - including those between enterprises and financial markets.

It is vital to gather information on the qualifications and experience of investment analysts, both at present and as required for the future, in order to raise the standards of assessment of projects asking for financing. Different skills apply in the venture capital and the investment banking sectors, and professional institutions and trade associations play complementary roles in training. The evolution of the new capital markets serving high-technology companies also created a need for financial analysts with a new level of sophistication and understanding of technology. **Relevant training for analysts in financial aspects of entrepreneurship, technology trends, and the basic principles of technology is essential.**

Survey and methodology

A study commissioned by the Enterprise DG set out to define the needs for skills and vocational training for investment analysts both in the venture capital sector and in investment banks specialised in small caps(1) and technology stocks (hereafter referred to as investment banks).

The study defined the analysts' educational background and assessed whether they were satisfied with the training courses currently available to them. After university first and higher degrees, **most professional financial advisers learn their skills on the job**, but vocational training is increasingly available. However, there is an identified shortage of specialised training, for instance in market making or specialised financial analysis for VC companies. Most analysts gain a finance or economics qualification and an MBA, and then work in a securities house and possibly with a particular industrial sector to learn about its technology. Many analysts themselves admit needing more training on new technologies. Junior and senior analysts have slightly differing views on training needs.

Venture capital investment activity in Europe is concentrated in biotechnology and information technology (Figure 3.10). While most VC analysts have degrees and experience in finance and business administration, **they do not have education or experience in these technology areas**. According to most participants in the study, this is because **vocational training is either unavailable or out of date**. While almost all respondents had attended training within the previous five years, none mentioned any technological training.

Bank investment analysts in small caps/technology usually hold pure finance degrees. Training events are available in particular technology areas, but participants often fail to keep up-to-date with technology trends.

Present education and training

Current training courses for VC analysts appear to focus **almost exclusively on financial matters**. These cover finance, portfolio management, risk management, equity and bond valuation, business plans, potential investments, negotiations, mergers and acquisitions, and also legal and tax issues, management, leadership and ethics. European VC analysts attend training courses at a wide range of institutions both in Europe and the USA (Figure 3.11).

There is no specific training for investment analysts at European universities, and most bank investment specialists have pure finance degrees. Similarly there do not appear to be any formal training courses linked to small caps and technology stocks. However, about half the participants had attended seminars or conferences on the valuation of information technology companies, telecommunications, internet, semiconductors or GSM (Global System for Mobile Communications) technology.

VC analysts believe that the ideal recruit for their role has a technical degree plus MBA, experience in a 'sharp end' technology company, and entrepreneurial strengths. This triple competence will equip a young recruit for a career as an expert diagnostic analyst. Senior analysts also recognise the value of investment analysts without experience but with an MBA (who could learn on the job, and hold supporting, administrative roles), and of senior partners with a technical background, industrial experience and entrepreneurial success (who have learnt on the job, and have a positive attitude to innovation).

By contrast investment bank analysts favour engineers with a strong financial and technology background. In both sectors American analysts broadly agree with their European colleagues, except that American VC analysts did not identify a lack of training in entrepreneurship, and American investment bank analysts identified a need for training on the application of new econometric models to new technologies.

The perspective of European venture capital investment analysts

European venture capital analysts are highly educated: half have

Figure 3.11

Providers of venture capital training courses to European analysts

Trainer	% of citations	Length of course (days/year)	Cost (€ per day)	Score (0-10 – 10 is best)
IMD, Lausanne, Switzerland	1	15	1,133	9
NASBIC/VC Institute, US	5	6	400	8.6
Metro University, Switzerland	7	7	428	8.5
3I, UK	8	25	800	8.3
AIFI, France	1	5	1,000	8
IBM	2	1	1,000	8
BVCA, British Venture Capital Association	21	4	688	7.9
EVCA, European Venture Capital Association (in each European country)	24	4	500	7.9
INSEAD, France	12	8	837	7.6
AIMR, US	5	5	400	7
London Business School, UK	1	12	833	7
Price-Waterhouse Coopers	2	2	1,500	7
Wharton Business School, US	2	5	600	7
Harvard Business School, US	2	5	600	6.5
ASCRI, Spain	2	2	1,500	6
Dale Carnegie, Switzerland	2	20	750	6
DVFA, Germany	2	16	1,563	6
Total/average	**100%**	**8**	**991**	**7.5**

a financial background plus a higher degree (MA, MBA or PhD) and a further fifth have an engineering background plus one of the same range of higher degrees. Science (10%) and law (7.5%) degrees are not uncommon. Senior analysts tend to have more varied experience than juniors. Analysts' time (and therefore experience) has, for four out of five analysts over the last ten years, been spent exclusively in finance. Only 3% had combined financial and technical experience.

Eighty percent of VC analysts had undergone training during the past five years, while those who had not gave either a preference for on-the-job learning, or lack of time as the reason. Juniors attended more training courses than seniors. **VC analysts did not attend any technical training courses**.

Two out of five VC analysts declare an interest in future training, and 70% of these would be prepared to spend up to five days a year in training (in addition to the average eight days they currently spend).

Training for VC investment analysts in the USA

Most US VC analysts hold a degree in finance and an MBA. The courses attended within the last five years are mainly general, covering law, taxation, leadership, communication, management and ethics. **As in Europe, VC analysts do not have training courses in current trends in technology, the market for technology or technology itself**. They attend training for an average of four days per year, costing $3,500, while European analysts attend training for eight days at a cost of €7,930. Three training organisations are mentioned: AIMR, NVCA and CFA.(2) US analysts do not attend training in Europe, unlike European analysts who mention training in the US with AIMR and NASBIC.(3) US VC analysts call for training in market and technology trends and in basic technology, but unlike in Europe they do not lack training in entrepreneurship.

The perspective of European investment bank analysts

The information gained on the education of investment bank analysts specialising in small caps/technology is more difficult to interpret as it is not quantitative. Most have higher degrees, and a background in pure finance. Recent training consisted of conferences or seminars on high-technology industries, such as those provided by Dataquest, the Gartner Group, national associations of financial analysts in EU member states, and trade associations in the UK. Training offered by the national associations of financial analysts is criticised as too theoretical and detached from reality (for example examining stock options without covering how to apply them in high-growth enterprises). **There are no formal training courses related to small caps and technology stocks**. The key areas where bank investment analysts feel training is not available are shown in Figure 3.12, and they indicate that they would support future training in these areas.

The critical factor about valuing small technology companies is that they tend to be judged on their potential growth in the context of the overall evolution of the sector and the technology they use or are developing, rather than on their profitability. The high degree of uncertainty means that **traditional valuation methods may be of little use** in the case of technology stocks. To understand a company's work, bank investment analysts in these sectors therefore need a detailed knowledge of both the technology and the sector. They must be able to judge what is special about it, how it will evolve, and whether it might become the norm. They also need to keep abreast of rapid change - here conferences meet a need, but **it is rare for technology events to be oriented to the needs of investment analysts**.

Training for investment bank analysts in the US

Investment bank analysts in the US are also likely to have a pure finance background, as there is no specific academic education for investment analysts at US universities. In practice, the only training that analysts undertake is attending conferences and seminars on valuation methods for information technology companies and other topics relating to new technologies. Seminar providers mentioned are the market research companies Forrester Research, Zona Research, Gartner Group, Dataquest and Datamonitor. Again as in Europe, these seminars draw criticism for **not keeping up to date with the technology**, especially as concerns the internet, GSM, telecommunications and biotechnology. Another criticism is that to be effective in helping analysts in their task, the **seminars need to be much more practical** with real case studies, and need to be given by specialists in valuation methods. As well as the training gaps identified by EU investment bank analysts (Figure 3.12), the US analysts want to learn how to apply new econometric models to new technologies.

(1) Small capitalisation companies, which have different definitions in the EU (stock market capitalisation below €1.5bn) and in the US (stock market capitalisation below €950m).
(2) AIMR = Association for Investment Management and Research, NVCA = National Venture Capital Association and CFA = Commercial Finance Association
(3) NASBIC = National Association of Small Business Investment Companies

Key training gaps of venture capital analysts and investment bank analysts

Figure 3.12

Venture capital analysts	Investment bank analysts specialising in small caps and technology stocks
Strategic management, entrepreneurship, leadership, communication, ethics and psychological profile assessment of entrepreneurs	New trends in technology and market
New trends in world economy; mainly in the new technologies	Technology basics for non-technologists, e.g. physics, telecommunications, internet, medical, information technology, wireless application protocols
Basic technology for non-technologists	Growth stock valuation and related problems

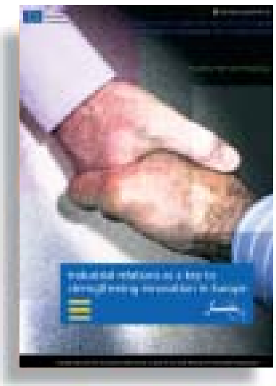
Chapter 4 **Industrial relations**

4.

Chapter 4 summarises a study of the impact of different industrial relations policies on innovation in firms. The study develops a generic model of 'innovation-friendly' industrial relations policies, distinguishing between indirect employee participation through trade unions and works councils and direct, face-to-face consultation and delegation. The great majority of firms have not yet implemented even the most basic forms of employee consultation, and public policy has a key role in stimulating debate on the types of industrial relations policies that promote innovation.

4.1

The impact of industrial relations on innovation



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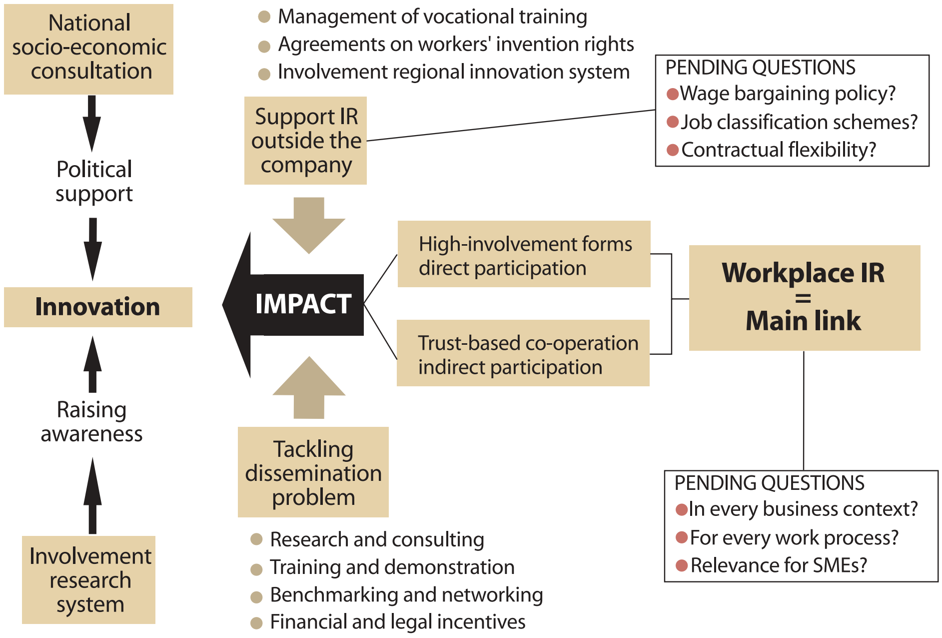
Study team led by: KU Leuven (Belgium)

Key findings

- Employee participation in workplace industrial relations may be direct or indirect.
- Though in theory participation should encourage innovation, in fact studies are inconclusive as to whether **indirect** types of 'industrial democracy' – trade unions or works councils – are good for innovation or not.
- The evidence is mounting that **direct** participation – through consultation and delegation of responsibility about immediate work tasks – does lead to a more innovative approach.
- Direct participation is practised in two-thirds of companies in Scandinavia and the Netherlands, but only about half of companies in the rest of Europe. Resistance is based on grounds of culture and cost.
- Western European countries exhibit four styles of industrial relations. Along the spectrum from co-operative to adversarial these are the Nordic, the 'core', the Anglo-Saxon and the Mediterranean styles.
- More research is needed on the relationship of wage bargaining and work flexibility to innovation.
- Trade unions should be invited to help formulate innovation strategies.

An innovation-friendly framework of industrial relations (IR)

Figure 4.1



Policy-makers have by and large ignored the impact of institutionalised industrial relations policies and workplace employer/employee relations on innovation. However, an increasing body of research highlights the positive impact employee participation in workplace industrial relations has on company productivity and innovation (Figure 4.1). Examples of 'innovation-friendly' industrial relations (IR) policies exist which can be used to raise awareness amongst employees, managers, trade unions and policy-makers, and ultimately to bridge the knowledge divide. Although IR practices vary markedly between the EU Member States, the various industrial relations frameworks can be tabulated and clustered – an exercise which shows that they correlate to some extent with innovativeness (Figure 4.2).

Policy context

The European Commission's Lisbon Strategy called for the modernisation of work practices as a means of fostering higher levels of competitiveness, an essential building block in Europe's bid to become a dynamic knowledge-based economy. In an effort to clearly establish links between workplace relations and innovation, this study examines IR policies in the 15 EU Member States, and their impact on innovation. It assesses these policies on the contribution they make to the framework conditions for innovation (wage bargaining, employment flexibility, research and regional innovation initiatives) adapted from the European Action Plan on Innovation. The study reviews extensive literature on the subject, and analyses 20 cases in detail. From this it builds a generic model of 'innovation-friendly' IR policies, which shows positive links between industrial relations and innovation.

Impact of indirect and direct employee participation

Trade unions and work councils comprising employee and/or management representatives are the main forms of 'indirect' employee participation in workplace industrial relations (Figure 4.3). Most studies investigating the impact of unions on innovation are inconclusive. Research dating back to the 1970s based on US and German examples supports the traditional view of unions as being resistant to organisational change, emphasising the negative impact wage bargaining can have on innovation, research and development and the implementation of new technologies.

Theoretically, however, organisational change is more likely to be successful if it is carried through in close co-ordination with works councils or trade unions. Trade unions are also more likely to support innovations that improve rather than harm employment opportunities and wages.

Figure 4.2

Industrial relations systems and their correlation with innovation performance

	Indirect participation % workplaces	Direct participation % workplaces	Involvement in vocational training	Employment protection	Traxler Classification wage bargaining	Information Society consultation	Innovation Scoreboard
Nordic							
Denmark	66	60	State-led, joint management	1.5	Lean corporatism	No	3.5
Finland		66	State-led, social partners	2.1	Other corporatism	Yes	4.7
Sweden	92	66	State-led, social partners	2.4	Other corporatism	Yes	6.5
Core							
Austria		51	Joint management	2.4	Lean corporatism	Yes	-2.5
Belgium		50	Joint management	2.1	Corporatism/statism	(Yes)	-2.5
Germany	66	49	Joint management, demand-led	2.8	Lean corporatism	Yes	0.6
Luxembourg		51	Demand-led			No	-4.4
Netherlands	55	69	Joint management	2.4	Lean corporatism	Yes	2.9
Anglo-Saxon							
Ireland	58	52	State-led, joint management	1.0	Lean corporatism	Yes	1.2
United Kingdom	61	54	Demand-led, partnership trend	0.5	Neoliberal	No	4.4
Mediterranean							
France	80	54	Joint management	3.1	Statism	No	-0.6
Italy	80	49	Joint management	3.3	Lean corporatism	Yes	-5.9
Greece		51	State-led, consultation	3.7	Statism/other corporatism	(Yes)	-7.9
Portugal	33	43	State-led, consultation	3.7	Statism/other corporatism	No	-8.7
Spain	83	47	Joint management	3.2	Other corporatism	No	-5.9

Innovation Scoreboard indicator: a tentative summary indicator deduced from the ranking of countries on each of the Scoreboard indicators.

Recent research on German works councils concludes that whilst no direct links with innovation can be established, people who take part in organisational and technological change at the behest of management promote product innovation. Studies of indirect employee participation in Germany found that works councils streamline communications between management and employees, ultimately forcing management to take employees' views into consideration when embarking on change.

Evidence is mounting, however, in support of links between direct forms of employee participation and innovation. Recent studies indicate that direct participation has a positive effect on communication and knowledge dispersion within a company, decentralises decision-making and reduces development times. For instance, European car manufacturer BMW used direct employee participation in tandem with input from works councils to stimulate product innovation.

Findings from the European Foundation for the Improvement of Living and Working Condition's *Employee Participation in Organisational Change* (EPOC) survey suggest direct participation is widespread across 30% to 50% of companies in EU Member States. However, a composite indicator taken from the *European Survey on Working Conditions* points to a much lower incidence. Direct employee participation is more popular in the Nordic countries (Denmark, Finland and Sweden) with 66% or more of employees participating in face-to-face consultation or individual delegations. Direct employee involvement is also high in the UK (54% of employees) and France (54%). The southern European countries lag behind with the lowest incidence in Portugal (43%).

Hindering factors

The disparities between northern and southern European countries highlighted by EPOC's survey findings reflect different cultural attitudes towards direct and indirect employee participation. Although direct employee participation is infiltrating companies throughout the EU, few of these organisations are 'transformed' in the sense that employee involvement is an integral part of the company culture.

A 1999 survey conducted by Business Decisions Ltd estimates that no more than 10% of European companies have implemented the most basic forms of IR practice. This can be attributed to management resistance and issues of implementation, including the high level of upfront investment required to make direct employee participation work. The relationship of aspects of IR policy such as wage bargaining and work flexibility to innovation is still relatively unexplored.

Role of policy-makers

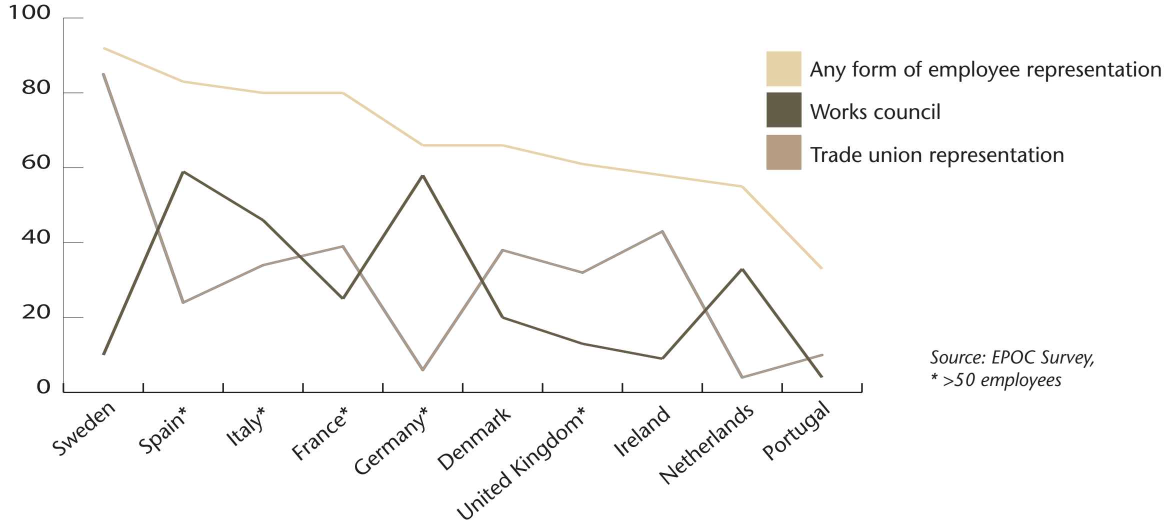
Policy-makers need to play a broader role, helping trade unions, management and employees to overcome obstacles to implementing innovation-friendly industrial relations policies. Trade unions should be invited to help formulate innovation strategies. National governments could fund additional research into the IR/innovation dynamic. Existing forms of employee participation need to be assessed to determine if they should be expanded.

Additional policy support could be provided by projects to demonstrate the impact of IR on innovation. Experiences could be shared and mutual learning fostered through the development of educational programmes such as Finland's Workplace Development Programme, which provides employees and management with concrete examples and research on organisational change.

At the transnational level, the EU could play the role of catalyst or mediator in addition to funding research programmes to bridge the knowledge divide in areas such as the impact of wage bargaining on innovation. The EU is also well positioned to monitor and enforce the implementation of innovation-friendly IR policies in countries with a history of adversarial encounters between trade unions and management.

Figure 4.3

Share of workplaces with employee representation (1996)



Source: EPOC Survey,
** >50 employees*

Regional innovation networks, which are the cornerstone of regional innovation strategies, also have an important role to play. Mutual co-operation between regional networks and employee delegations from the initial planning phases is likely to ensure the development of labour market policies that aid rather than impede innovation. Apart from their traditional bargaining and co-ordination role, unions also have a role to play in supporting and implementing employee training programmes.

Industrial relations styles and approaches

Based on the level of central co-ordination of trade union activity and employee consultation on policy issues, four major IR regimes have been identified in Europe (Figure 4.4). In the '**Nordic corporatism**' model union activity is centrally co-ordinated. Few policy decisions are made without consulting unions and works councils. Direct and indirect forms of employee participation are well supported. In the '**core**' countries – Austria, Belgium, Germany, Luxembourg and the Netherlands – trade unions and works councils have a strong legal basis and play a pivotal role in research and technology transfer and the formulation of economic policy.

The United Kingdom and Ireland typify the '**Anglo-Saxon**' system, which relies heavily on voluntary participation rather than centrally co-ordinated IR activity. Trade unions are rarely consulted on policy issues and in the absence of collective bargaining resort to lobbying. In the '**Mediterranean system**', collective bargaining is virtually non-existent and reforms are generally instigated by conflict or adversarial means. Whilst Finland and Sweden fit comfortably into the Nordic model, satisfying all the criteria of a mutually co-operative highly-co-ordinated IR system, most European countries are hybrids comprising elements of one or more systems. Italy's centrally co-ordinated IR system with strong trade union representation is reminiscent of the Nordic model but its hierarchical structure and tendency for conflict is also typically Mediterranean.

Internal impact of industrial relations

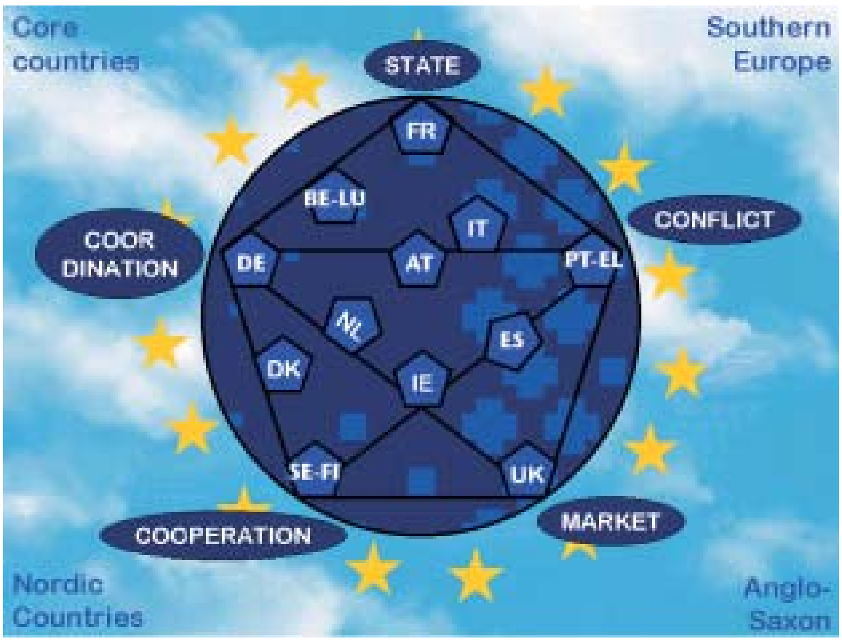
The law in most EU countries stipulates that works councils must be consulted on technological and organisational change, but this does not guarantee employee involvement in key management decisions. The legal framework underpinning the operations of work councils differs markedly between countries. In Germany, Italy and France works councils have a strong legal basis and so management is more likely to consult them. However, in Greece and Portugal the concept is less entrenched and their legal status is weaker.

Although legal provisions can strengthen the role played by employee representatives, management tends to consult trade unions and work councils during the implementation phase rather than the initial planning stages. The industrial relations climate (co-operation-Nordic versus adversarial-Mediterranean), management attitudes to employee involvement and the absence or presence of strong employee representation can strengthen or weaken the impact of indirect employee participation.

Direct participation, on the other hand, is more likely to give rise to high employee involvement. Direct employee participation incorporates the consultative approach, where employees are actively encouraged to vocalise their opinions on organisational change. The final decision, however, still rests with management. Alternatively, delegation awards employees a higher degree of autonomy from superiors and underscores 'high-

Figure 4.4

Dominant approaches to industrial relations



involvement' work practices, which leverage employees' knowledge, skills and abilities as a key competitive differentiator.

The philosophy underpinning 'high-involvement' work practices is that there is a strong correlation between high levels of employee involvement and a company's performance. For instance, by harnessing employees' skills and knowledge, problems can be more easily solved. Job commitment, which is a pre-requisite for innovation, also tends to be highest amongst employees who believe management values their input. From this one can safely conclude that a co-operative relationship between employees and management improves company productivity, and that employee endorsement of organisational and technological change encourages management to innovate.

External impact of industrial relations

Outside a company, the impact of the industrial relations framework on innovation is less clear-cut.

• **Vocational training**

In a knowledge-based economy innovation hinges on the ability of employees to adapt their knowledge and skills to a variety of tasks. In this context, vocational training has become increasingly important, giving birth to the concept of 'continuous learning' including informal on-the-job training. In Europe there are four main types of vocational training, which reflect varying degrees of trade union and work council participation.

• '**Regulation by social partnership**' refers to those systems where the scope and nature of vocational training programmes are based on agreements between unions and employers. This system pertains in Belgium, the Netherlands and Spain where company funding of vocational learning is compulsory. The '**limited state-led system**' applies to Mediterranean countries such as Greece and Portugal, where union activity is weak. Here vocational training is part of the national employment policy and largely financed by government. The Scandinavian countries, which boast high levels of direct and indirect employee participation, view vocational training as an integral part of adult learning, referred to as a '**broad state-led system**'. Whilst unions play an advisory role, funding is largely provided by the state. In the UK and Ireland, where IR activity occurs on an ad hoc basis, training is determined by market demand – '**demand-led market regulation**'. The Nordic countries along with the UK boast the highest percentage of people (20% or more) in continuing education, while adult participation in continuous learning is lowest in those countries lacking a mutually co-operative centrally co-ordinated IR infrastructure.

• **Labour mobility and contractual flexibility**

There are conflicting schools of thought on whether job security or flexibility is likely to create an innovative company culture. Some maintain that employees are more likely to innovate if employment is assured. Others believe that more flexible working relationships lead to higher levels of knowledge dispersion within and between companies and constitute a safeguard against complacency. In most instances, flexible working arrangements are instituted as a cost-cutting measure rather than as a means of inducing innovation, which supports the view that employment security is essential for innovation. Through consultation and collective bargaining, unions can influence employment protection legislation, which governs

Figure 4.5

Industrial relations at economy level – the innovation system: overview of main findings

Innovation theme	Industrial relations issue	Industrial relations practice
Innovation depends on human skills and resources	Vocational training	Continuous vocational training regulated by social partnership
	Labour mobility; employment protection legislation	Concertation on law making; involvement in dismissal procedures
Improving policy support for the innovation strategy	Macro-consultation	Economic and Social Councils Consultation on information society
Promoting networking and clustering of companies	Regional innovation initiatives of the social partners	Regional or local social pacts; task forces; organisational innovation campaigns; raising awareness of technological changes; joint management of regional development agencies
Increase the cost attractiveness of country as a location of innovation	Wage bargaining, competitiveness	Wage moderation, lean corporatism
Protection of intellectual property rights	Regulating intellectual property rights of workers	Collective agreements on property rights, suggestion schemes
Strategic vision of R&D	Industrial relations and research policy	Participation on national boards and councils Participation in foresight programmes Participation, promotion of government-funded programmes; research activities of trade unions

employment security. However, their influence is confined to certain aspects of legislation such as unfair dismissal or specific security clauses in company contracts.

• Tripartite policy consultation

Science and technology policies are important drivers of innovation. The ultimate objective is to raise policy-makers' awareness of the link between innovation and mainstream industrial relations policies. However, trade union representation on policy-making bodies depends on the industrial relations system in place. Union input into science and technology policies is weakest under the Anglo-Saxon and Mediterranean models.

Based on local partnerships between universities, research firms and industry, innovation networks also play an integral role in technology transfer at the regional level. Whilst trade union participation in formulating and implementing regional innovation strategies is desirable, there are few concrete examples apart from Austria's Styria Round Table, which influences regional economic strategies.

• Wage bargaining

Despite an array of literature documenting the impact of wage negotiations on economic factors such as inflation, no links have been established between wage bargaining, labour costs and innovation. Traditionally trade unions have been portrayed as championing 'excessively' high wages, which are perceived to have a negative impact on a company's ability to finance innovation. Recent studies challenge this view concluding that collective wage bargaining enhances job security thereby increasing productivity. Many questions remain as to the impact wage bargaining has on innovation. However, EU wage negotiations are highly centralised and focused on company flexibility and competitiveness (Figure 4.5). The general trend is towards wage moderation, which Dutch economist Kleinknecht maintains is harmful in the long run as it rewards non-innovative companies over innovative ones.

• Trade unions and research

Although there are no strongly developed links between research organisations and trade unions, in France, Belgium, and the Scandinavian countries unions are represented on national research councils. Sweden's Council for Working Life and Social Research encourages employees to participate in research and provides training for union members. Unions are also involved in specially designated programmes for devising strategic forward planning on technology-related issues.

One can broadly conclude that there are a number of 'grey areas' in terms of linking the external industrial relations framework with innovation, particularly in terms of gauging the impact of wage bargaining and employment flexibility. Where links have been established, fuelling innovation was not the intended purpose. There are also clear disparities across the EU, which can partially be explained by the different industrial relations styles and approach that exist in each country.

Special remarks on countries	Review & assessment remarks
'Core' countries (France, Belgium, Netherlands, Austria) adopted this system early (other countries seem to follow)	Important topic in the industrial relations systems for the moment (from an employment policy perspective)
No concertation or involvement in Anglo-Saxon countries	Controversy about the role and the place of employment contract flexibility
Formal concertation especially in 'core' countries	The innovation issue is rarely tackled directly and explicitly
Growing industrial relations field in every EU country	
Most of the EU countries	Lack of research on the relationship between wage bargaining, labour costs and innovation
Austria & Sweden, particular involvement	
France, Belgium, Finland, Denmark, (Sweden) Sweden and Germany most notable examples	No clear view on role social partners play in these boards; No European study exist on involvement of social partners in foresight programmes

Chapter 5 **Taxation and innovation**

5

Chapter 5 looks at corporate taxation as a way of incentivising innovation-related expenditure by companies. The study concludes that well-designed tax incentives, carefully adapted to local circumstances, do encourage additional business investment in R&D. It goes on to examine the potential for strengthening such incentives within the European Union's regulatory framework for state aids, and concludes that the current exemption of tax breaks for research and development should be extended to cover non-R&D innovation activities such as technology transfer, training and industrial design.

5.1

Corporation tax and innovation

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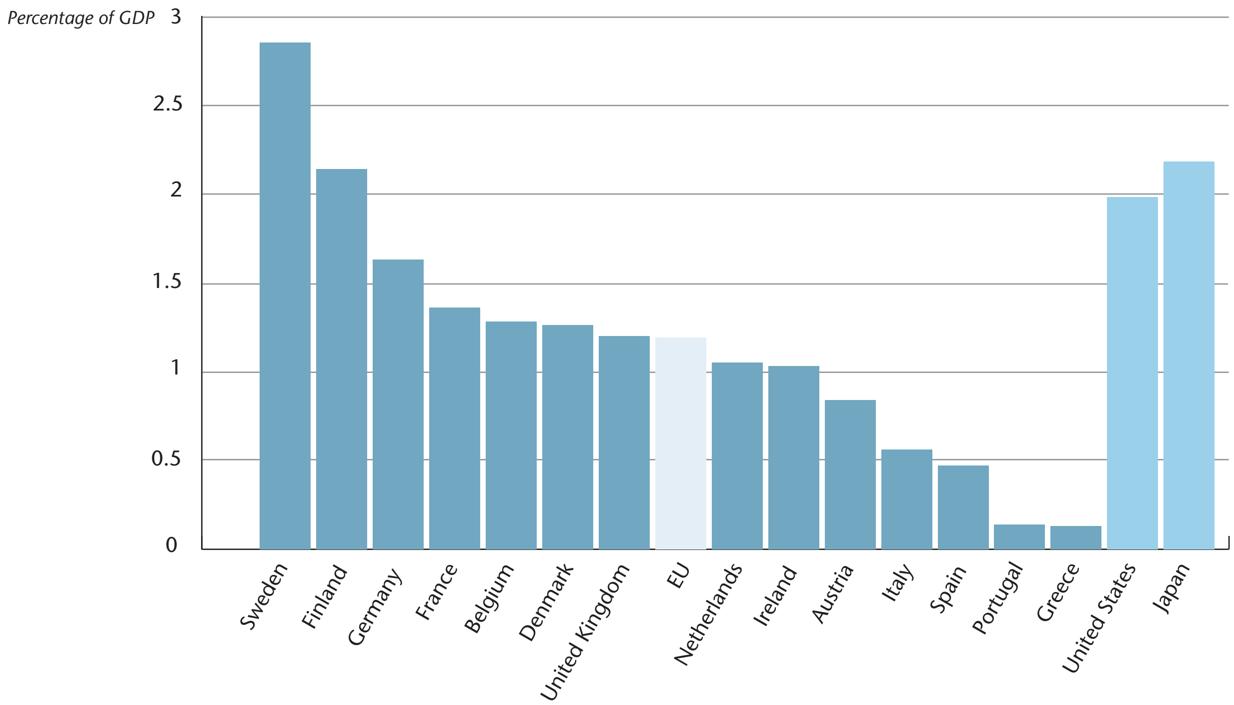
Key findings

- Well-designed tax incentives, carefully adapted to local circumstances, have the potential to encourage additional business investment in RTD.
- Technological innovation crucially involves inter-linked activities not encompassed by traditional definitions of R&D.
- An EU regulatory framework for state aids which encompassed non-R&D innovation activities would contribute to innovative capacity and competitiveness.
- Governments must tailor fiscal incentives to the strengths and weaknesses of their national industrial fabric.
- Fiscal incentives are a natural policy tool for market-oriented governments wishing to boost innovation expenditure throughout the economy.
- Among the possible tax incentives for innovation, volume-based schemes – which reward all expenditure on the defined activities – are the simplest to implement, administer and operate, and are easiest for companies to understand and calculate.
- The rate of take-up for innovation tax incentives is consistently lower among eligible SME than among larger companies. If SMEs are to benefit fully from such measures, they must be easy to understand, simple to administer, and backed by an adequate support framework to provide information and assistance.
- No single scheme of fiscal incentives for innovation is optimal for all national economies.

Figure 5.1

Business expenditure on R&D as a percentage of GDP, 1999

Source: European Innovation Scoreboard 2001



Policy context

Overall, the European Union's innovation performance improved in the second half of the 1990s – but more slowly than that of the United States, which already led the EU at the start of the decade. Assessing Member States' performance against 17 innovation-related indicators, the Commission's *Innovation Scoreboard 2001* identified private sector spending on R&D as one of two areas in which the EU as a whole does particularly poorly. (The other is high-tech patenting in the US.) Poor performance, says the Commission, appears "to reveal structural weaknesses of the European innovation system and justify action at European level... There is an urgent need for action to strengthen business R&D. Member States are encouraged to initiate or increase incentives".

Such incentives can take two basic forms:

- **financial incentives** – direct government funding for private sector innovation activities through grants, loans, subsidies, etc.
- **fiscal incentives** – tax relief measures which encourage firms to carry out innovation activities by reducing their cost

Each form has its own advantages and disadvantages. The choices made by national governments to employ one or the other, or to combine the two, depend on their wider policy objectives. Nevertheless, both types of support constitute 'state aid'. Because they are applied at national level they might distort competition between firms within the single European market, and are therefore subject to strict control under Articles 87 and 88 of the EC Treaty.

Incentives for innovation are designed within the framework of the EU's long-term goal of reducing overall levels of state aid. This has led to widespread interest in improving the 'gearing' of state aid – that is, in identifying means of achieving larger improvements in innovative performance with smaller contributions from public funds. State aid can only be justified as a response to market failure. But giving grants to sectors chosen by governments is not always the most efficient use of public money, since policy-makers do not always accurately identify the industries or technologies that will drive future economic growth. Fiscal incentives – because they are normally available to *all* businesses – have the virtue of allowing the market to decide which sectors and which technologies offer the greatest opportunities to improve competitiveness and profitability.

Fiscal incentives, rather than research grants, were specifically recommended by the Lisbon Summit: "The European Council asks the Council and the Commission, together with the Member States where appropriate, to take the necessary steps as part of the establishment of a European Research Area to... improve the environment for private research investment, R&D partnerships and high technology start-ups, by using tax policies, venture capital and EIB support."

There is already evidence of growing interest in fiscal incentives for innovation among Member State policy-makers – notably in the United Kingdom and Spain. The European Commission, in its September 2000 Communication, *Innovation in a knowledge-driven economy*, identified "use of taxation and other indirect methods to encourage innovation and research" as an emerging policy trend.

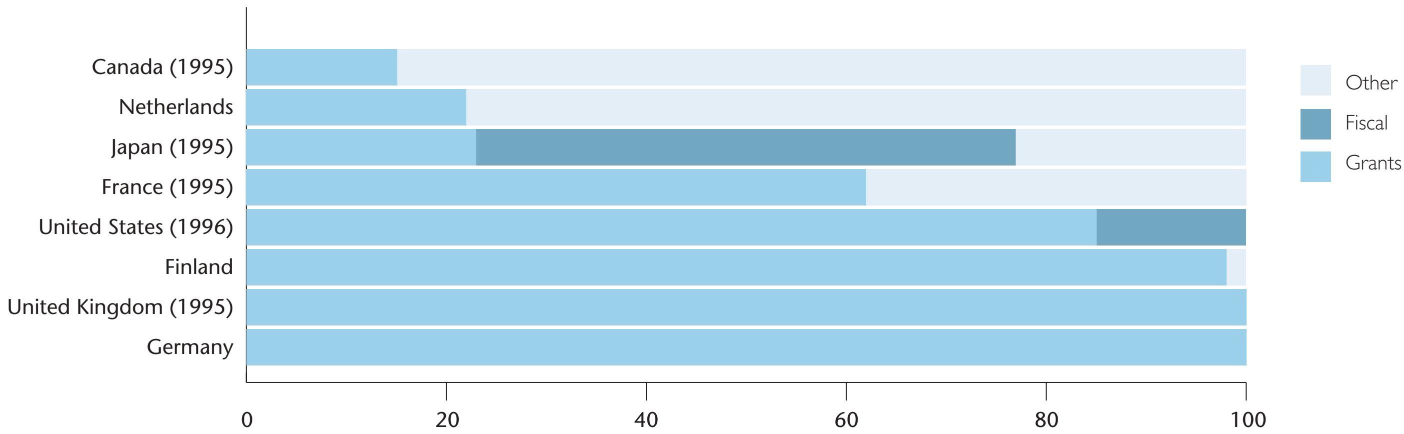
Incentivising innovation – the options

Innovative activities comprise the creation, adaptation or adoption of new or improved products, processes or services and their successful introduction to the market. According to figures published by Eurostat in 2001, EU enterprises devoted an average of 3.7% of turnover to product and process innovation in manufacturing sectors, and 2.8% in service sectors. As a measure of the formal creation of new technological knowledge by the private sector, companies' spending on research and technological development is one of the main indicators of a country's innovative performance. Figure 5.1 shows that in all EU countries except Sweden and Finland business R&D expenditure accounts for a smaller share of Gross Domestic Product (GDP) than in the US and Japan. In five Member States, it is less than 1%.

Figure 5.2

Public support for industrial technology by type of aid, 1997

Source: OECD Science, Technology and Industry Scoreboard, 1999



Governments can finance innovation in three ways (Figure 5.2):

- the funding of **public research**, and the infrastructure through which its results are diffused to industry – here, companies benefit *indirectly* from the outputs of public sector activity
- financial incentives, offered through programmes of **grants**, **loans** or **subsidies**, for businesses themselves to perform specific innovative activities
- fiscal incentives or **tax relief measures** which encourage firms to invest in innovation by reducing its cost

Of the two forms of direct support for enterprise, financial incentives such as grants, subsidies and 'soft' loans are used to assist key projects, enterprises, sectors and technologies. This type of public investment is relatively easy for governments to control because the total amount of financial assistance is normally agreed and budgeted for in advance. On the other hand, the complex administrative procedures required to determine eligibility make access to such schemes time-consuming and difficult for many companies, especially SMEs. In addition, they risk channelling public funds towards industries which nevertheless remain uncompetitive, or technologies which fail to win market acceptance.

Fiscal incentives – normally included within national corporation tax regimes – allow companies to reduce their tax bills as a reward for carrying out innovative activities, enabling them to reduce the total costs of such investments. They have both advantages and disadvantages when compared with financial incentives:

- **advantage:** Fiscal incentives impose a much lower administrative overhead on both governments and enterprises. Companies wishing to benefit from grant, loan and subsidy schemes must typically invest considerable time in preparing proposals and submitting applications, with no guarantee that they will be successful. If they do succeed, further project reporting is also often required. In turn, applications and reports must be evaluated and monitored by civil servants. Fiscal support measures avoid much of this bureaucracy.
- **advantage:** Tax relief measures are a more efficient means of creating an incentive for *increases* in innovation expenditure, and are therefore particularly useful in countries whose innovation expenditure is currently low, and with an underdeveloped innovation framework.
- **advantage:** Fiscal incentives allow companies themselves to determine how they should spend their additional technological innovation budgets, rather than this being determined by a bureaucratic central authority.
- **disadvantage:** Tax incentives are more complex to design, since they must achieve their objectives without distorting existing fiscal policies.
- **disadvantage:** Since take-up is to some degree uncertain, it is hard for governments to predict the total loss of tax revenue. Upper limits may be set on the amount of relief that any one company is permitted to claim, but complete control of overall costs is impossible.

A patchwork of provisions

Current use of financial and fiscal incentives varies considerably between EU Member States. Most commonly, governments provide a mix of both types of incentive, although their relative significance differs widely from one country to another. No country places its entire incentive regime within fiscal policy, and some northern European countries – Finland, Sweden and Germany – promote innovation principally through direct financial aids such as grants or loans.

Each government's choice about how best to allocate limited resources is influenced by national culture as well as by its country's economic structure and performance. In countries whose innovation performance is below the EU average, governments tend to choose incentives designed to stimulate activity across the whole economy, rather than within specific sectors. They are more likely to prioritise fiscal incentives, which have the advantage of allowing companies to decide which sectors present the greatest opportunities for future business success. In particular, Portugal and Spain offer fiscal incentives to all companies seeking to improve their innovative performance, regardless of size or sector.

In countries where innovation expenditure is already high, the case for potentially costly tax credits or allowances is harder to make. Here, governments tend to employ targeted aid programmes to 'fine-tune' their economies by directing support towards specific sectors or technologies where they believe it is most required. This approach seems to work well in countries such as Germany, Sweden and Finland which have well established innovation frameworks, with secure legal processes and strong links between companies and research and technology centres.

Some countries with historically high innovation expenditure and well-developed innovation systems – the US, France and, more recently, the UK – support R&D both fiscally and financially. Their fiscal incentives are normally incremental schemes, which apply to all companies but only reward expenditure over a predetermined baseline – normally, the average of expenditure in previous years. Here, the budgetary impact is usually regulated by setting limits which reduce the tax advantage to each company.

It should also be noted that corporation tax regimes themselves vary significantly across the EU. Standard rates range from 20% in Ireland to 40% in Belgium, although several countries are in the process of introducing fiscal reforms that will lower corporation tax rates – to just 12% by 2003 in Ireland, for example. At the same time, the calculation of effective tax rates – notional rates that take into account other economic factors and therefore allow comparisons between the tax burden on enterprise in different countries – remains extremely difficult.

R&D – a special case?

Most current innovation-oriented fiscal incentives are in practice applied to activities at the earliest stages of the innovation process, while assistance is seldom available for the later stages. The United States and many EU countries offer tax incentives for research and development, but there are no examples of incentives for marketing or commercialisation. R&D is now widely acknowledged to be only one component of the dynamic innovation systems which drive growth in the global knowledge-based economy – systems which critically also involve flows of information, know-how, technology and qualified personnel between industrial firms and researchers, investors and customers. In particular, the focus on R&D discriminates against SMEs, which rarely have the capacity to engage in R&D directly but instead innovate by acquiring know-how through technology transfer, training, industrial design or other means. So why have governments on the whole been so slow to broaden the scope of fiscal measures supporting innovation to encompass non-R&D activities?

First, governments tend to prioritise those activities where market failure is most acute. It could be argued that in many EU countries market failure relating to the *supply* of knowledge is in practice less acute than for its application and commercialisation. Nevertheless, tax incentives tend to be offered for activities which carry the highest risks – typically, for basic or enabling research whose commercial return is distant and uncertain, and where firms are therefore most reluctant to invest.

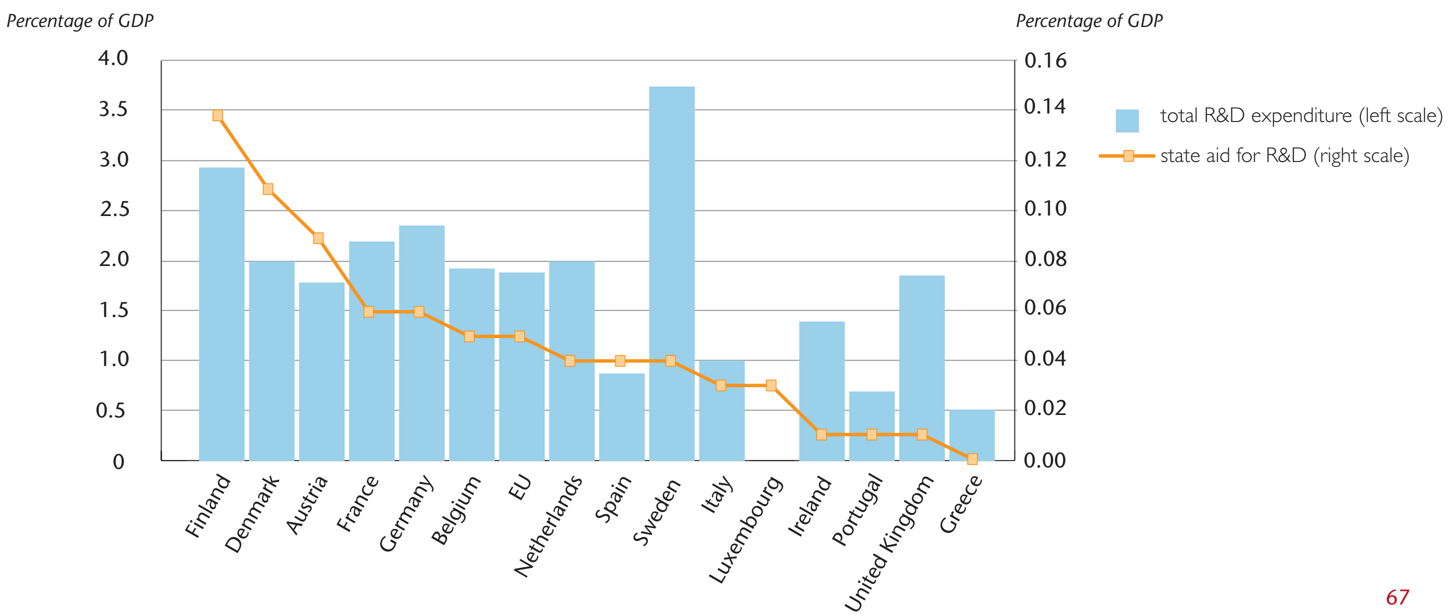
Second, public administrations find innovation much harder to define than R&D, as it involves many activities which are difficult to delimit. To prioritise and limit fiscal support, and so that firms can determine what expenditure qualifies for assistance, fiscal legislation must incorporate definitions that identify with clarity and certainty the boundary between those activities which are supported and those which are not. Technological product and process innovation (TPP) is defined in the Oslo Manual(1) as comprising "implemented technologically new products and processes, and significant technological improvements in products and processes... [involving] a series of scientific, technological, organisation, financial and commercial activities", and innovative firms as those that have "implemented technologically new or significantly technologically improved products or processes during the period under review". But these definitions remain insufficiently detailed to account unambiguously for all elements of the innovation process. Even a comprehensive definition of R&D has proved difficult to formulate, and most EU governments have aligned their tax laws with the OECD Frascati Manual, which defines R&D as "creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications". R&D, says the Manual, covers "three activities – basic research, applied research, and experimental development".

Third, the current Community Framework for State Aid for R&D does not cover non-R&D innovation activity as a discrete category. Any measures that selectively benefit some companies and are therefore capable of distorting competition or affecting commerce between states are classified as state aids. They are strictly controlled to ensure the proper functioning of the internal market, and with the long-term goal of reducing overall levels of aid. State aid for R&D varies considerably across the EU – but, although it ranges from just 0.5% of overall R&D expenditure in the UK to 5.5% in Denmark (see Figure 5.3), it nevertheless dwarfs early-stage venture capital as a source of funding for innovative activity in almost all Member States. The current legislative framework exempts support for R&D from the general control of state aids, but is based on the outdated 'linear' model of innovation. It limits aid to 100% of costs for fundamental research carried out by commercial firms, 50% for industrial research, and 25% for applied research and development. But it makes no provision for non-R&D innovation activities, and most Member States have been reluctant to test the eligibility of fiscal incentives for such activ-

Figure 5.3

Overall R&D expenditure, and state aid for R&D, as % of GDP, annual average 1997-99

Source: European Commission, State Aid Scoreboard, second edition, 2001



ities. Only Spain explicitly offers incentives for specific pre-competitive technological innovation activities other than R&D in its corporation tax legislation.

The range of fiscal incentives

The United States and all EU countries allow companies to write off their total R&D spending against taxable profits in the year the expenditure is made. Three principal mechanisms are used to provide incentives over and above this basic allowance:

- An additional **tax allowance** enables firms to deduct from the tax base more than 100% of their expenditure on innovative activity. Firms that are in profit may write off their total R&D expenditure from taxable income and a further percentage from the tax base.
- A **tax credit** enables firms to deduct a percentage of their innovation expenditure from their tax liabilities or tax bills. Credits are applied as volume-based (flat rate), incremental or mixed schemes. Volume-based schemes reward all expenditure during a fiscal period, and are therefore easy for both companies and tax authorities to calculate, but they offer no guarantee that beneficiaries will reinvest the value of the incentive in increased levels of innovation activity.
- **Accelerated or free depreciation of investment** in machinery, equipment or buildings used exclusively for innovation activities. Throughout the EU and in the US, free or accelerated depreciation is permitted for capital expenditure on R&D infrastructure and equipment, providing companies with an incentive to invest in modern equipment and so stimulating advances in products and processes. Exact allowances vary considerably from one country to another. Both free and accelerated depreciation offer a delay in the payment of taxes rather than an actual tax reduction.

Despite the acknowledged difficulty of comparing fiscal legislation in different countries, the OECD 'B-index' offers a measure of tax generosity for R&D in terms of the after-tax cost per unit of R&D expenditure, once all available incentives are taken into account.

Figure 5.4 illustrates the generosity of both fiscal and financial support to R&D within OECD countries in 1996. Countries like Denmark and the Netherlands favour fiscal incentives, with relatively little direct subsidy. Germany, Italy, Sweden and the United Kingdom, meanwhile, rely more on financial incentives – although in April 2002 the UK introduced a new R&D tax credit which will alter its position. Others provide both generous fiscal incentives and high direct financial subsidies. The generosity of Spain's preferential tax treatment for investment in R&D is exceptional. Figure 5.5 shows that Spanish companies need to increase their income by just €0.69 to recover each euro invested. In other EU countries, by contrast, lengthy write-off periods and a lack of tax credits increase the level of pre-tax income required to recover investments – German companies, for example, must increase income by €1.05 to recover each euro of R&D investment.

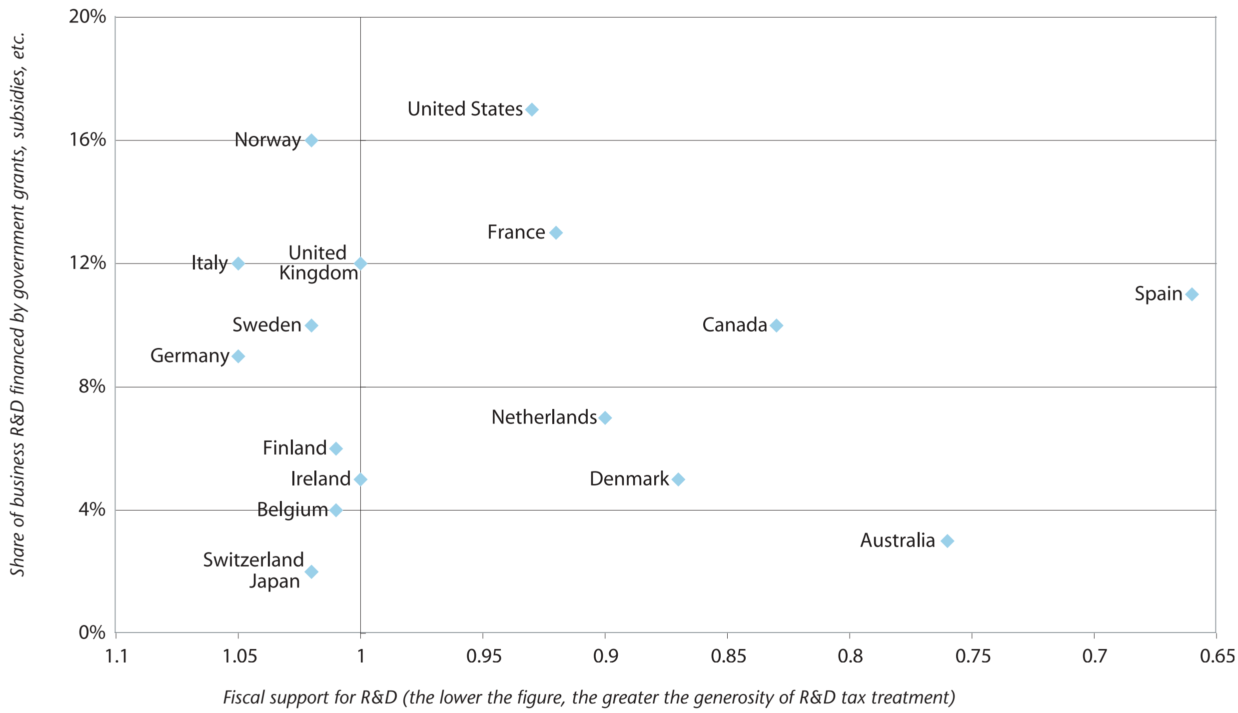
Good practice

Most existing empirical studies of the effectiveness of fiscal incentives have been carried out by US economists, and have sought to answer the key question: 'Do fiscal incentives for R&D lead to a significant rise in company R&D expenditure?'. International experience shows that R&D-related fiscal incentives may not achieve their full impact for several years, since firms are slow to adjust their spending patterns on R&D. In countries where tax credits for R&D are offered, the increase

Fiscal and direct financial support to business R&D, 1996

Figure 5.4

Source: OECD Secretariat



in R&D expenditure reaches only around 10% of the tax forgone by the government in the first two years. After five to ten years, however, the increase in R&D expenditure reaches around 100% of the tax forgone, as companies respond to the new market signals.

Figure 5.6 shows the technological innovation activities which receive fiscal incentive support within EU countries and the USA. Blue dots indicate that a country has a tax incentive which targets the specific activity, and red dots identify incentives representing notable good practice when assessed against the following design criteria:

- **Clarity** – Both policy-makers and companies must understand why an incentive has been introduced, what it seeks to achieve, and the activities it is able to support.
- **Simplicity** – An incentive should not be too complex. If companies are unable to understand how an incentive should be applied then take-up rates are likely to be low. Incentives should be simple to administer and apply both for companies and for public administrations.
- **Certainty** – Policy-makers require mechanisms which limit the amount an incentive will cost, while companies require the certainty that once an innovation project is begun, it will qualify for incentive support when completed. The certainty principle should also include the ability to obtain a quick decision from fiscal authorities in advance of a project, when confirmation is required as to whether an activity qualifies for support or not.
- **Compliance** – Any new incentive must comply with all relevant national and international legislation in force, including EU State Aid legislation.
- **Non-discrimination** – The introduction of a new incentive should neither benefit one firm at the expense of another, nor adversely distort existing market factors.
- **Effectiveness** – A measure of the number of benefiting firms.

Each of these principles is important for the design of any new incentive, but some trade-off between the various criteria is inevitable. For example, if the policy goal is to stimulate *increases* in expenditure, then incremental incentives may be chosen, even though they are more complex than volume-based incentives. Good practice achieves optimal trade-offs in order to achieve the original aim.

Finally, it is also important that any fiscal incentive is accompanied by a method of assessment to evaluate its effectiveness, and a monitoring system to determine its cost.

(1) OECD, European Commission & Eurostat, Oslo Manual – The measurement of scientific and technological activities: proposed guidelines for collecting and interpreting technological innovation data*, 1996. Available from http://www.oecd.org/pdf/M00018000/M00018312.pdf*

Tax subsidy per € of R&D expenditure, large firms, 1999

Figure 5.5

Source: OECD Science, Technology and Industry Outlook, 2000

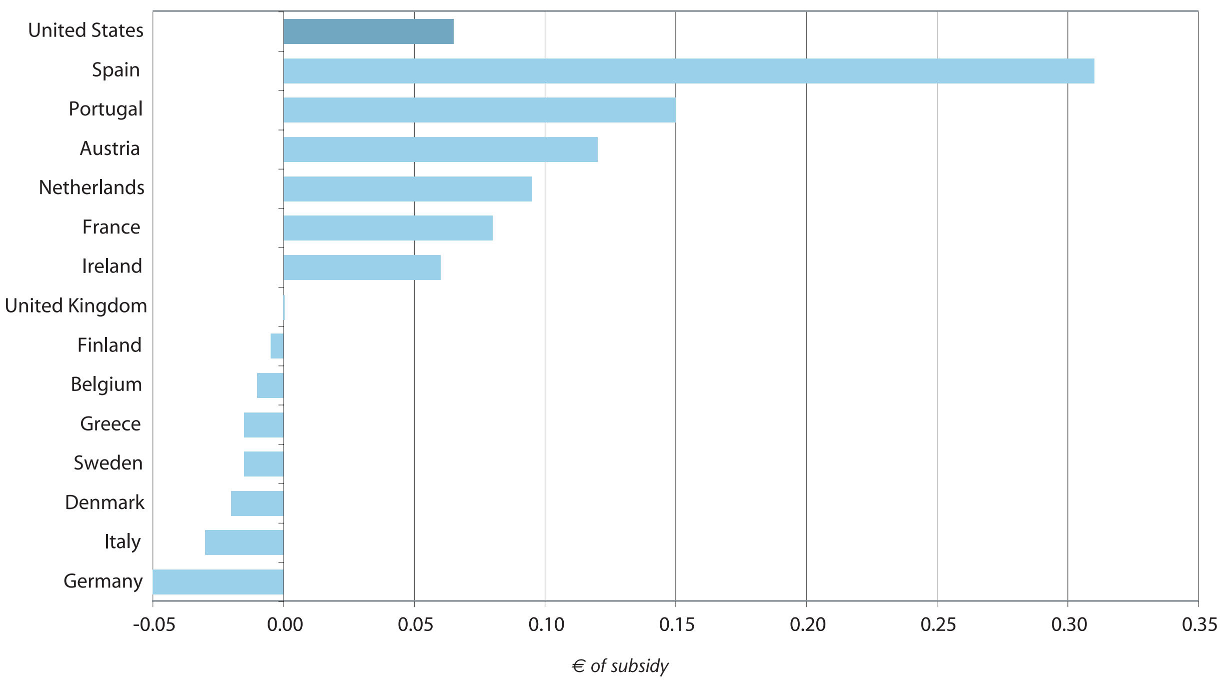


Figure 5.6

Tax incentives for policy target areas of innovation activity, by country

Red dots indicate schemes that match good practice criteria
Source: Study authors

Tax incentives for innovation	Austria	Belgium	Denmark	Finland	France	Germany	Greece	Ireland	Italy	Luxembourg	Netherlands	Portugal	Spain	Sweden	United Kingdom	United States
Business expenditure on R&D		•			•				•		•	•	• (red)		• (red)	•
R&D capital expenditure	•	•	•	•	•		• (red)	• (red)	•	•	• (red)	•	• (red)	•	• (red)	•
Technology transfer								• (red)					• (red)			
Industrial design and process engineering					•								• (red)			
Quality certification					•								• (red)			
ICTs and electronic commerce													• (red)		•	
Software					• (red)		•						•			
Patent applications		•			• (red)		•									
Training					•				• (red)	•			•			
Contracting of researchers					•				• (red)		• (red)	•	•	•	•	•
Co-operation with research institutes		•			•				• (red)			•	•		•	•
Creation of innovative start-ups					• (red)											
Share ownership in start-ups			•		•			•	•	•	•	•	•		• (red)	

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