FINAL REPORT
RESTRICTED
Contract n°: SOE1 - CT97-1065

Title: TSER Project - Small and Medium Enterprises (SMEs) in Europe and East Asia: Competition, Collaboration and Lessons for Policy Support

Project coordinator:
SCOTLAND : Institute for Japanese-European Technology Studies, University of Edinburgh

Partners:
ENGLAND : Queen Elizabeth House, University of Oxford
ITALY : Istituto d'Affari Internazionali, University of Rome, Rome
GREECE : Department of Urban and Regional Development, Panteio University of Athens
ISRAEL : Industrial Policy Development Group, The Jerusalem Institute for Israel Studies

Asian Partners :
JAPAN : NISTEP
KOREA : STEPI
TAIWAN : (Chung-Hua Institution for Economic Research)

Reference period: from 01/12/1997 **to** 29/2/2000
Starting date: 01/12/1997 **Duration:** 24+3 months
Date of issue of this report: 28/04/2000

Project financed within the TSER Programme

INDEX of CONTENTS

ABSTRACT

The **objectives** of the research were to investigate the importance of various factors influencing the **innovative capacit**y and **competitiveness** of small and medium enterprises (**SMEs**), including

- R&D activity
- Networking, including cluster effects
- Skills of founder and employees
- Financing, including VC
- Product and process innovation
- Government policy and institutional support initiatives

in **Europe** (Scotland, England, Italy, Greece and Israel) and **East Asia** (Japan, Korea, Taiwan) in the **software** and **electronics** (hi-tech) industries and in the **garments** industry (lower-tech).

The **methods** adopted were a composite of quantitative and qualitative work on questionnaire and interview data, which resulted in econometric analysis and country-level case studies.

The **research findings** were that

- The main **drivers of innovation** in SMEs were
  - R&D expenditures
  - a minimum level of skilled employees
  - process innovation
  - technology licenses purchased
- The main **drivers of competitiveness** in SMEs were
  - product innovation
  - international embeddedness (particularly with customers and suppliers)
  - efforts to upgrade the human potential within the firm
- **Local** geographical **clustering** does **not** confer **significant** proximity advantages in terms of innovation and competition. Local socio-economic embeddedness was not a significant factor in SME innovation capability and competitiveness. National and **international markets** and **networks** are the **significant** factors influencing SME competitiveness
- The **financial infrastructure** available to SMEs needs considerable **improvements**, particularly in more capital-intensive industries, since this has both a direct and indirect bearing on firms' access to the factors improving innovativeness and competitiveness

The following **policy recommendations** can be made for all three industries

- Measures to support and strengthen the in-house R&D and NPD capabilities of SMEs
- Government support measures for innovation and competition should include the pump-priming of the venture capital market with public VC funding
- Improvements to overall systems for financing SME start-up and growth
- Additional support for international networking, marketing and export activities
- Strategic and industry-specific policies
- Cluster establishment or consolidation policies may still be needed

For less high-tech industries and less industrialised countries within Europe, the following policies would additionally be useful

- Structural measures to upgrade infrastructure, including ICTs
- Measures to improve quality control
- Upgrade skills and professional competence
- Encourage business - technology institution collaboration
- Improve diffusion of business services

1. EXECUTIVE SUMMARY

1.1. Objectives

The objectives of the research were to investigate the importance of various factors influencing the innovative capacity and competitiveness of small and medium enterprises (SMEs), including

- R&D activity
- Networking, including cluster effects
- Skills of founder and employees
- Financing, including VC
- Product and process innovation
- Government policy and institutional support initiatives

in Europe (Scotland, England, Italy, Greece and Israel) and East Asia (Japan, Korea, Taiwan) in the software and electronics (hi-tech) industries and in the garments industry (lower-tech).

1.2. Research results

The main factors determining SME competitiveness and innovativeness were found to be as follows :

- Levels of product innovation
- R&D expenditure per employee
- Ratio of employed scientists & engineers to total employment in the firm
- The number of technology licences purchased
- Changes over time in the ratio of employed scientists & engineers to total employment in the firm
- Levels of process innovation
- The socio-economic embeddedness of the firm at the international level (rather than local level).

The results indicate that in-house technological effort (R&D expenditures, a minimum standard of skilled employees, and process innovation) and technological transactions (licenses purchased) are the main benchmarks of innovativeness, and are also the indirect factors that determine firms performance. Product innovation, international embeddedness (and particularly interaction with international customers and suppliers), and the effort to upgrade the human potential are the direct factors of a firms competitiveness. Given the predictive capacity of the model, the indirect factors can be termed benchmarks of innovativeness and the direct factors benchmarks of competitiveness.

The findings across European and Asian Countries strongly suggest that they share the same benchmarks of innovativeness and competitiveness. It can therefore be argued that the competitiveness of Asian firms does not rely only on low cost strategies, as is widely believed, but also on technological effort, and innovation.

Firstly, firms in the garments sector are less innovative than firms in the “high-tech" sector. In this sense, the low-tech firms can learn from the high tech firms. The second point to be emphasized is that Asian firms score in both garments and high-tech sectors relatively higher compared to the European firms. This is particularly true for garments where European firms appear to be lagging behind Asian firms, in terms of innovation. The differences, however, are not that pronounced in the high tech sector, where the Israeli high-tech firms present the strongest innovation potential.

In the garment industry, in terms of competitiveness, the Asian firms appear to be the best performers, where the Korean firms perform better than Taiwan. Italian Garment firms score better amongst the European, to be followed by the Greek firms. English and Scottish firms are to be found at the bottom of the distribution. The success of the Italian garment firms stems mainly from R&D, whilst in the Asian cases it is skills that play a dominant role. Asian firms on average score higher in process innovation and licensing, implying an extensive process of technological upgrade and adoption of technological changes.

Benchmarks provide pointers for rectifying disadvantages, as well as highlighting national-level advantages. For example, in the garment industry, the main drawback of UK firms appears to be the lack of skilled employees. Even the Italian firms need to upgrade their stock of skills beyond the level of craftsmanship to sustain competitiveness. On the other hand, Greek firms have good skill levels, are internationally embedded, and design- focused. They lag, however, terms of technological upgrade. In this sense their human potential is underutilized. In this sector the issue of skills is highly related to local embeddedness.

In the High Tech sector, the Israeli firms proved to be the best performers to be followed by the Italian and Scottish firms. The UK firms stand somewhere in the middle whilst Greek firms are lagging well behind. As far as the Asian countries concerned, the analysis shows that the Taiwanese firms score better than Korean firms. The success of Israeli firms appears to be related to international embeddedness and internal effort. Israeli international embeddedness is, by far the highest compared to the rest of the sample. Moreover, high levels of R&D, and a high ratio of scientists and engineers in firms, rather than adoption of process technologies or licensing, also distinguish Israel from the other countries. In this sense the Israeli SMEs exhibit an ability for indigenous production whilst the majority of SMEs in the other countries are mainly technology users.

The analysis shows that policy lessons for the Garments sector can best be drawn from the Asian and Italian cases, while the performance of Israeli IT sector can become a point of reference for the other countries under consideration.

The more detailed research results are summarised below, firstly by industry, and then by individual country. The country summaries also include country-specific policy recommendations, whilst the transnational policy recommendations at industry level are summarised in section 1.3.

Electronics industry summary

Global structure of industry	• Rapid technical change • Changing market boundaries • Large global firms in stabilised (mature) segments • SMEs in small specialised niches, or as subcontractors to larger firms • R&D located in US / Japan

Cross-country comparisons

Government strategy	• Most focused / targeted : Korea • Implicit : Israel (army / defence industry); Greece (telecoms); UK (defence, clustering); Scotland (foreign direct investment, clustering, Project Alba); Taiwan (SMEs)
R&D	• Japan : strongest (within firms) • Korea : strong in chaebol, weak in SMEs • Israel : mainly in med/large firms and highly targeted • UK : strong but declining • Scotland : good in large firms and high-tech SMEs, otherwise weak • Taiwan : problematic in SMEs • Italy / Greece : low levels of R&D
SME dynamism	• Israel : high • Korea : high, with government support • UK, Japan, Taiwan : moderate • Italy, Greece, Scotland : weak
Workforce skills	• Generally high skill levels • Labour shortages in Taiwan • Some vocational training problems in Japan, UK and Scotland
Financing of firms	• Israel : strong • Korea : strong, with government support • Japan : various schemes, but still problems • Taiwan : shortages for capital-intensive expansion and start-up, although established VC markets • UK / Scotland : shortages for start-ups, VC fair • Italy / Greece : weak
Institutional links	• University linkages - UK / Scotland / Israel : strong; Taiwan : good; Japan / Korea : weak; Italy / Greece : very weak (seen as irrelevant to industry) • Other R&D institutions - Japan / Korea / Taiwan : strong institutions, good links; UK : good links with govt. labs (spin offs), but funding cuts, future problematic; Israel : links unclear, but strong in defence; Taiwan : Scotland : links unclear; Italy / Greece : weak
Networking	• Geographical clustering mainly involves universities, R&D institutions and defence industry

	• Large firm - SME links : Japan : very strong; Taiwan : strong; Korea : stronger recently (govt. policy); Scotland : component supply to MNCs / LNFLs • International networking - UK / Israel : strong; Scotland : strong in instrumentation / opto-electronics; Korea : linkages beginning

Policy recommendations

• Measures to create and strengthen the in-house R&D capabilities of SMEs
• Improvements to systems for financing start-up and growth
• Support for international networking and export activities
• Create strategic and industry-specific policies for electronics

Software industry summary

Global structure of industry	• Rapid industry growth (both SMEs and Large firms) • Rapid employment growth • Substantial difference between top and average industry performers • Links with international markets important • Successful firms have shortage of excellent graduates • Average firms have difficulty moving into very profitable new products

Cross-country comparisons

Government strategy	• Generally insufficient government support, except in Israel and Korea
R&D	• Korea : strong in chaebol, weak in SMEs • Israel : highly targeted • UK / Scotland : strong in product-oriented SMEs, but difficult to measure • Japan : weak • Taiwan : problematic in SMEs • Italy / Greece : low levels of R&D
SME dynamism	• Very high in Israel; generally high in Taiwan; Korea : improving; mixed in UK / Scotland; Japan : dependent on large firms; very low in Greece / Italy
Workforce skills	• Generally high, except Italy / Greece which have skill shortages
Financing of firms	• Venture capital markets work well in Israel, less well in other countries
Institutional links	• University linkages - UK / Scotland / Israel : strong; Taiwan : good; Japan / Korea : weak; Italy / Greece : very weak (seen as irrelevant to industry) • Other R&D institutions - Japan / Korea / Taiwan : strong institutions, good links; UK / Scotland : links fair; Israel : links unclear, but strong in defence; Taiwan : links unclear; Italy / Greece : weak
Networking	• Large firm - SME links : Japan : very strong; Taiwan : strong; Korea : stronger recently (govt. policy); UK / Scotland : some, otherwise weak; Israel : M&A linkages • International networking - UK / Israel : strong; Scotland / Korea : linkages beginning; Taiwan : developing with China; Italy / Greece / Japan : weak

Policy recommendations

• Improve venture capital systems and start-up funding
• Support for international networking and international market links
• Increase support to firms for innovation
• Cluster establishment (UK and Scotland) and consolidation (Israel) policies needed

Garment industry summary

Global structure of industry	• Increasing competition, both in high-quality/high-cost and low-quality/low-cost markets • Strong geographical agglomeration • De-localisation and outsourcing • Declining sectoral share of manufacturing GDP • Increasing importance of marketing

Strengths and weaknesses

Strengths	• High quality inputs and transformation processes • High quality outputs • Strong local networks (inter-firm; user-producer)
Weaknesses	• Low marketing capabilities • Low levels of international networking • Low skillbase (high craft skills in Scotland and Italy) • High costs • Gap between firm production and technological institutions (especially Israel) • Little use of ICTs

Policy recommendations

• Measures to improve quality control
• Upgrade skills and professional competence
• Support for international networking
• Encourage business - technology institution collaboration
• Structural measures to upgrade infrastructure
• Improve diffusion of business services

Country summaries

Greece

	Hi-tech	**Garments**
Structural factors	• Demand-driven • State market-dominated • Needs EU structural policies • New service markets	• Decline in sectoral share of Greek manufacturing GDP • Domestic and international competition • Geographical agglomeration • Outsourcing • 2-speed growth
Strengths	• Founders' capabilities • Employment growth • Adaptation / development	• Strategic partnerships between firms • Firm flexibility • Improved production capabilities
Weaknesses	• Oligopolistic market structure • Fragmented IT policy • Structural skills mismatch • Metropolitan concentration	• Short-sighted market vision • Lack of strategic inter-firm collaboration • Lack of infrastructure and ICTs in N. Greece

Policy recommendations	• Central authority planning
	• Technical education - in skills to meet demands
	• Regional plan for N.Greece
	    • networking
	    • infrastructure
		• Regional planning
		    • Train in marketing skills
		    • Build software infrastructure
		    • Promote forward inter-firm linkages

Italy

	Hi-tech	**Garments**
Structural factors	• Sharp decline in consumer electronics components and PCs • Few electronics firms respond to public sector demand • Software firms produce for national demand	• Positive restructuring in 1980s (Marshallian model) • De-localisation • Firms stay small (with large distribution chains) • Strong geographical agglomeration • Technological changes adopted
Strengths	• Protected local market • Potential demand for software from advanced manufacturing SMEs • Diffused entrepreneurial culture	• Design • Increased product quality • Strong local links • Leader firms emerging in some Industrial Districts
Weaknesses	• No large global companies • Weak research institutions • Weak financial institutions (including VC) • Weak industry-academia links	• Little presence in global networks • Weak marketing, retail and distribution • Large number of low-tech, low quality producers • Few industry-academia links • Excessive vertical disintegration
Policy recommendations	• Competition and liberalisation policies • ICT infrastructure needed • Attract foreign direct investment • Strengthen and restructure research policy • Support innovation in financial services	• Support for network / market internationalisation • Improve business services to firms • Provide new financial services

UK

	Electronics	**Software**	**Garments**
Structural factors	• Dualistic structure : high-tech niche firms, lower-tech subcontractors • Weak geographical clustering • Strong university links	• Very dynamic • Minority of firms very high-tech • Weak geographical clustering	• Strong currency • Low wages > firm survival • Fragmented institutional support • No industry strategic policy
Strengths	• Strong science base links • Innovation culture • Specialised niche : design work for large firms	• Support services capabilities	• Asian business linkages • Strong survival spirit
Weaknesses	• Poor access to finance • Weak marketing of specialist products • Organisational change needed	• Weak links with major firms • Focus on local market • Skills shortage	• Low design capabilities • Low-tech production • Cut and sew only • Low profitability • Limited entrepreneurial vision
Policy recommendations	• Development (NPD) finance for innovative firms (not VC) • Less emphasis on clusters • Strengthen market capabilities	• Development (NPD) finance for innovative firms • Provide coherent industry strategy • Assist skills development • Less emphasis on clusters	• Define industry strategy • Provide coherent institutional support • Financial support for Design Centres

Scotland

<table>
<tr><th></th><th>Electronics</th><th>Software</th><th>Garments (mainly knitwear)</th></tr>
<tr><td rowspan="2"><u>Structural factors</u></td><td>• Strong universities, but currently weak vocational training
• Dominance of MNCs
• Heterogeneity of sector
• Lack of support for capital investment</td><td>• Strong university research base and provision of graduate workforce
• Over-dependence on resale and services (though not in sample firms)
• Lack of support for established firms</td><td rowspan="2">• Overseas competition re price and quality
• Successful shift into niche market
• Contracting industry, aging workforce</td></tr>
<tr><td colspan="2">• Weak venture capital system
• Low business birth rate</td></tr>
<tr><td><u>Strengths</u></td><td>• High quality graduates
• Good international networks
• Good product innovation in industry subsectors</td><td>• High quality graduates
• Successful large-firm spin-outs / MBOs
• Some ability to develop locally yet tap into international markets</td><td>• Skilled, experienced workers
• Quality products, niche market
• Design and production engineering expertise in-house or through networks
• Good networks (local and international)</td></tr>
<tr><td><u>Weaknesses</u></td><td>• Dependence on MNCs that may relocate
• Weak vocational training
• Lack of product innovation in some subsectors (esp. subcontractors)</td><td>• Some lack of NPD capability (though not in sample firms)
• Limited local demand for sophisticated products
• Long development lead</td><td>• Lack of market and business capabilities (many firms)
• Lack of funding for capital investment
• Lack of external training courses</td></tr>
</table>

		times	• Tradition - firms rather slow to respond to change
<u>Policy recommendations</u>	• Make better use of MNCs • Encourage more university and large firm spin-offs • Less emphasis on physical and local geographical clusters, more on creation of national / international networks • More information on schemes to assist industry-academia R&D partnerships	• Further encourage international marketing and exports • Support for R&D + NPD • Incentives for firms to upgrade from services to NPD • Less emphasis on physical and local geographical clusters more on creation of national / international networks	• Continue to foster emphasis on design • Strengthen market skills • Improve capital funding • Foster ICT awareness (incl. Internet) • Use regional-level initiatives

Israel

	Electronics (comms)	Software	Garments
Structural factors	• Technological competition generates new firms • Technological convergence within and between sectors • Spin-offs from universities • Mergers and acquisitions • Strong role of army and universities • Importance of personal networks • No production in Israel	• Pioneering firms • New firms at all stages : start-up, growth, consolidation • Role of the army and universities • Successful firm founders' backgrounds : army, university, hobbyists	• Relatively high levels of fashion and design • High level technological infrastructure (industry college) • Fast liberalisation of cheap imports • Low awareness of technological innovation in firms • Lack of trust and co-operation between firms • High, rising wage levels

Policy recommendations	• Encourage mergers and acquisitions
	• Foster R&D co-operation
	• Strengthen university-industry linkages
	• Shift market focus to Europe
		• Assist creation of global firms
		• Improve R&D, provide incentives to firms
		• Consider low-tech and services policies as well as high-tech
		• Enhance emphasis on product exploitation
		• Recognise importance of institutional changes and authorised enterprise
			• Concentrate on high quality products
			• Increase outsourcing
			• Increase use of industry college (Shenhar) through
			    • Seminars and visits to local manufacturers
			    • Sewing seminars in Palestinian towns

Korea

	Electronics	Software	Garments
Structural factors	• Korea ranked 3rd in global electronics parts production • Fairly good profit margins • Demand-side proximity advantage	• Fast growing industry • Fairly good profit margins • Strong horizontal networks • Supply-side proximity advantages	• Profitability declining (but margins higher than Europe) • Competitiveness declining • Demand-side proximity advantages
Strengths	• Design excellence • Specialist areas of technological expertise • Emphasis on in-house R&D • Good local graduates • Knowledge linkages with customers • High levels of institutional support	• Useful assistance from government programmes • Government financial support • Good local graduates • Knowledge linkages with similar firms	• Aiming for high-quality products • Increasing emphasis on design • Fast turnaround times • Emphasis on in-house R&D
Weaknesses	• High level of import dependence re components • Generally low exports • Institutional support for exports lacking	• Fairly low major product innovation • Growth does not harness technological capabilities	• Rising labour costs • Shortage of skilled workers • Little institutional support, apart from information
Policy recommendations	• Increase export support • Increase levels of financial support • Shorten and simplify support application processes	• Incentives for product innovation • Develop support measures to enhance technological capabilities	• Increase government support, especially in technological areas • Inform firms of support measures • Shorten and simplify support application processes

Japan

	Electronics	**Software**	**Garments**
Structural factors	• SME partnerships with large firms (subcontracts) • Business and industrial associations • Japan ranked 2nd in global electronics parts production	• Competitive market • Market segmentation and specialisation • Many SME subcontractors • SME spin-offs from large firms	• Separation between production (manufacturers) and distribution (design / branding) • Manufacturers are subcontractors and located in rural areas
Strengths	• Business partnerships with large firms • Ownership of original technologies arising from in-house R&D	• Low capital barriers to start-up • Spin-offs from large firms • Partnerships with large firms	• Fast product cycles • High quality products • Ability to buffer employees from fluctuations in orders
Weaknesses	• Recruitment of trained and experienced engineers difficult for SMEs • Lack of continuous R&D in firms • Almost no industry-academia linkages	• Recruitment of trained engineers difficult for SMEs • Lack of NPD and product planning capability in firms • Almost no industry-academia linkages	• Cost pressures from Asian competitors • Design competition from European firms • Almost no industry-academia linkages
Policy recommendations	• No policy recommendations were made by the Japanese partners		

Taiwan

<table>
<tr><th></th><th>Hi-tech</th><th>Garments</th></tr>
<tr><td rowspan="2"><u>Structural factors</u></td><td>• Significant foreign direct investment by Japan and MNCs
• Networks of specialist SME subcontractors to large firms</td><td>• Subcontracting of production overseas
• Increased capital-intensity of domestic production</td></tr>
<tr><td colspan="2">• Appreciation of New Taiwan dollar
• Severe labour shortages
• Rising wage levels
• Rising real estate prices
• Competition with Korea
• Increasing competition from China (funded by Taiwanese FDI)
• Cluster formation
• Inter-firm networks and subcontracting
• Growth in size of SMEs
• Government support focused on SMEs</td></tr>
<tr><td><u>Strengths</u></td><td>• Increased emphasis on R&D and NPD
• Search for new markets and market niches</td><td>• Increasing emphasis on high-quality products</td></tr>
<tr><td><u>Weaknesses</u></td><td colspan="2">• Lack of marketing expertise for new products
• SMEs have difficulty funding R&D and capital-intensive operations</td></tr>
<tr><td><u>Policy recommendations</u></td><td colspan="2">• No policy recommendations were made by the Taiwanese partners</td></tr>
</table>

1.3. Transnational policy implications

1.3.1. Electronics

•	Measures to create and strengthen the in-house R&D capabilities of SMEs
•	Improvements to systems for financing start-up and growth, including VC
•	Support for international networking and export activities
•	Create strategic and industry-specific policies for electronics

1.3.2. Software

•	Improve venture capital systems and start-up funding
•	Support for international networking and international market links
•	Increase support to firms for innovation (including R&D and NPD)
•	Cluster establishment (UK and Scotland) and consolidation (Israel) policies needed

1.3.3. Garment industry

•	Upgrade skills and professional competence
•	Support for international networking and marketing, as well as local focus
•	Strengthen market and business capabilities of firms
•	Promotion of downstream inter-firm linkages
•	Support initiatives for the adoption by SMEs of ICTs, email and e-commerce
•	Encourage business - technology institution - design college collaboration
•	Structural measures to upgrade infrastructure
•	Improve diffusion of business services

2. BACKGROUND AND PROJECT OBJECTIVES

2.1. Rationale for the project

This project aims to meet several of the research objectives under Area I of the TSER Work Programme for 1996. The particular themes it addresses are

- the role of networks in technological progress
- comparative analysis of SME innovation systems within selected European countries and with Asian countries
- benchmarking of SMEs in Europe vis-a-vis competitors in Asia;
- policy analysis of S&T policies at the European, national and local levels as they affect SMEs, and comparisons of these to practice in East Asia
- the development of an information base on SMEs in the two regions
- the role of government in the evolving structures of SMEs at different technological levels
- the implications of all the above for S&T policy in Europe.

2.2. Objectives

The project objectives can be organised under four broad themes:

1. Benchmarking SME technological performance and competitiveness in Europe and Asia.
2. Analysis of networking aspects of SME technological development in Europe and Asia.
3. Analysis of the role of financial institutions in supporting innovation by SMEs.
4. Improving upon the conceptual framework for the analysis of SME support policies and drawing implications for future policies.

2.3. Reorientation of project

The Japanese partner, NISTEP, under the Science and Technology Agency, was, unfortunately, unable to deliver the full set of data and information that we had originally expected, due to internal reasons. However, alternative arrangements were made with a Japanese researcher, which provided an overview of the role of SMEs in the national economy, and the various national and regional support initiatives. In addition, interviews were carried out with the Director of MITI's SME Agency, and some key staff. In addition, interviews were held with internet start-up companies in Tokyo's now famous Bit Valley. This material is presented in the country study for Japan.

However, although this has affected the scale of the data set, it has not entailed a change in the objectives or scope of the project.

3. METHODOLOGY and RESULTS

3.1. METHODOLOGY

The research examined small and medium firms within and institutional support for three industry sectors, the first two exemplifying high-tech industries, and the other an industry which is not necessarily high-tech :

- **Software development**
- **Electronics**
- **Garments**

Surveys were undertaken of the literature on SME technology development and support policies and their efficacy, together with surveys of material relating to SME support and networks. This provided both an academic framework, and a knowledge of government initiatives aimed at assisting SME performance in each of the partner countries, including Asia. The empirical work included questionnaires aimed at a sizeable sample of SMEs in the three industries, together with in-depth interviews with firms, institutions and government agencies involved in SME support.

Quantitative material from the questionnaires was subjected to econometric analysis, resulting in benchmarking of SMEs in Europe vis-à-vis competitors in Asia. The qualitative data will provide the basis for building a future bank of case studies. Much of these data are novel and unavailable elsewhere. Questionnaire data was gathered from firms, and interview material from firms, and a significant number of institutions and government agencies.

Comparisons were undertaken between the European countries, and between the European and Asian countries at the level of each industry, as the three sectors studied had different characteristics (structures, strengths, and weaknesses). These comparisons were used to analyse the current situation and its implications, and to suggest improvements to Science and Technology, and SME support policies in Europe. These have also been concentrated at industry level, rather than for countries in general, as the country and industry results indicate substantial differences between the three sectors (especially between the two hi-tech industries and the lower-tech garments industry). It thus appears that industry-specific policy recommendations would be most useful and relevant.

3.2. RESULTS

The main research results are reported below, firstly at country level, and secondly at the level of cross-country comparisons between the three industries. Specific issues are then discussed, including benchmarking countries for innovation and competitiveness, and the importance of networking for SMEs.

3.2.1. Country summaries

For an account of the full results for each country, please refer to the appropriate annexe. Each country study is bound separately.

<u>Executive summary - Scotland</u>

1. Electronics

The electronics industry in Scotland during the period under review was extremely varied. Its SMEs undertook a wide range of activities, from subcontract manufacture of electronics and computer components, to PCB design and assembly, to the design and manufacture of stand-alone systems and instrumentation aimed at diverse markets and groups of users. In Scotland, some areas of the industry were expanding rapidly, such as telecoms equipment and systems. Others were growing steadily, such as analytical instrumentation and systems. SMEs were important in both these areas, as well as in specialised components. On the other hand, the semiconductor segment of the industry had recently been contracting, as several large inward investor firms shifted production to countries where manufacturing costs were cheaper.

Some firms, regardless of product, operated at the 'high-tech' end of the industry; others could be considered 'medium-tech'; and some even quite 'low-tech'. Even firms engaged in the design and manufacture of 'whole systems' products might not use 'cutting-edge' technologies, but were nevertheless able to combine existing technologies to develop innovative new products. Firms in mature markets often manufactured products and product ranges that were incrementally innovative

Most firms in the sample were long-established. They had often started because of the founder's idea for a new product. There was a tendency for firms to have been financed in the initial stages from multiple sources, including founder's savings, but more usually and substantially by external organisations, such as government agencies, banks, and external corporate investors.

On average, sample firms were experiencing considerable growth during the period, although this was not as spectacular as the growth in the software industry, where there were more recent start-up firms. Between 1995 - 1997, employment in the sample electronics and related firms grew by more than 25%, sales increased by 32%, and the value of exports almost doubled, rising by 96%. Profitability increased by 56%, but only to an average of 6% in 1997.

About half the sample firms reported major product (56%) or organisational (50%) innovation during the period, and about one-third (31%) had undertaken major process innovation. However, 50% of firms (mainly component manufacturers) reported having no formal R&D budget. Firms were concerned with product and systems quality, and 63% had gained ISO9000, including most component manufacturers. Producers of high-tech, specialised systems relied on establishing a reputation for quality with their customers.

There were fewer science graduates working in the sample firms than in software, but a higher number of technical diploma-holders. There were also significant numbers of highly-skilled shopfloor workers who had undergone apprenticeships. Again, the more high-tech the product, the more graduates and diploma-holders were likely to be employed. This was particularly the case with 'whole-product' firms producing standalone instrumentation or other products.

By far the most important sources of technological knowledge were the firms' own in-house R&D and other technological activities. External knowledge linkages were rated as less important, although links with local universities, national equipment and other suppliers, industry associations and trade fairs were also seen as significant. Firms' most frequent and intense connections were with customers and suppliers, considered significant at all levels - local, national and international, but with national connections considered particularly important. Interactions with local government support agencies were also mentioned in this context.

Geographical clustering did not appear to be especially significant for the sample electronics firms. Whilst physical proximity was important for knowledge transmission, it was less crucial for business relations, and many firms were using the new ICTs to maintain world-wide contacts with suppliers, subcontractors, distributors and customers.

All the sample firms had experienced some contact with government support agencies and funding bodies, in contrast to the software firms. They had benefited from a wide range of support initiatives, including start-up capital funding; and assistance with premises, training, quality awards, business development, market research, NPD and exports.

Characteristics of successful Scottish electronics SMEs

Successful SMEs in this sector tended to have the following characteristics :

Founders / managers	• Not necessarily graduates, but with sectoral experience, industry and local business contacts, and the credibility and connections to raise start-up capital where necessary • Ability to negotiate the succession process from original founder to other family members or external candidates • Ability to manage growth (organic or stepwise)
Knowledge flows	• Technical knowledge and know-how within management • Educated and qualified technical staff (such as designers), especially in hi-tech firms • Stable, experienced, skilled and knowledgeable workforce, with a steady stream of new entrants and apprentices • Good management-employee relations • Close links between in-house design and manufacturing • Customer and user feedback (for 'whole-product' firms) • Market awareness and industry contacts
Products	• Investment of time (and money) in R&D, where relevant • High quality products, with some specialisation • Branding of the product or range of products (for 'whole-product' firms). • Willingness to explore innovative products and new market sectors, however different to existing ones
Networking	• Ability to collaborate with and manage relations with large firms (as equity partners, venture capital providers, or distributors) • Good industry networks (especially suppliers and subcontractors) • Contact with local universities (for a variety of reasons : technological, business/management, recruitment) • Ongoing contact with local (and perhaps national) government support agencies

	• High profile with customers and users
Technology	• Investment in modern production technologies and production management methods, resulting in lower unit costs of production or higher quality, more complex outputs • Use of current information and communications technologies to interface with customers

Policy recommendations

Given that Scottish Enterprise is committed to a policy of encouraging industrial clustering in this industry, the apparent present lack of new entrant SMEs to the electronics industry may or may not be problematic. There are two issues. Firstly, geographical clustering did not appear to be crucial to the performance of many of the sample firms, other than for recruitment and knowledge transfer. Proximity advantages and local networking were more frequently reported by subcontractors. Even knowledge flows occurred at national as well as local level. Whole-product firms tended to be specialist in their operations, with only a few potential collaborators (commercial or academic) located globally. It would seem that as new communications technologies facilitate collaboration at a distance, physical proximity becomes less important. However, the development of wider networks of potential customers based on personal contact may well be useful for component manufacturers.

Secondly, current start-up assistance may not provide sufficient inducement for entrepreneurs, engineers and scientists to enter the industry, by comparison with software which is less capital- intensive and possibly more profitable. There seems to be a lack of support mechanisms suitable for electronics start-ups, including access to capital funding and equipment, and funding for new product development at start-up. The initial impetus for going into business seemed often to be a new product concept, and it is perhaps worrying that many of these may never be developed because of lack of resources.

Few firms had participated in any EU-funded initiatives, including those with academic partners, and there appeared to be a lack of knowledge about the existence of such schemes. Given the significance of firms' knowledge-related interactions with local universities, this is perhaps an opportunity that is being missed by both parties. It might also benefit firms to develop international knowledge linkages, both for the potential technological benefits, and for the possibility of opening new export markets.

Networking and clustering	• Review the effects to date of industry 'cluster development' policies on electronics SMEs in Scotland, including the Alba Centre as an incubator for start-ups • Introduce electronics and related SMEs to large firms with subcontract requirements at a more personal level than via a trade directory • Encourage further electronics SME contact with universities for graduate recruitment, management education, research and technological knowledge transfer, and as potential customers, particularly for specialist equipment, components and materials
Information flows	• Encourage more firms to contact their local government support agency • Provide more information to firms on EU funding and

	arrangements for research partnering with universities, perhaps through newsletters and seminars, with speakers from Scottish SMEs that have successfully made use of these schemes.
Workforce issues	• Review usefulness of Modern Apprenticeships and Skillseekers for the electronics industry • Address apprenticeship and trade union recognition issues for plastics engineering companies
Market capability support	• Continue and extend export support initiatives • Create / extend initiatives by LECs to encourage electronics SMEs to utilise electronic communications and the internet for business
Technical capability support	• Review support for capital investment in electronics and related industries

2. Software

The software industry in Scotland was growing rapidly during the period 1995 to 1997, with new firms entering the industry, recent start-ups growing in size, and established firms consolidating and also growing. Their activities and the markets they served were extremely varied, ranging from computer games software to public sector systems, and from business systems to educational software. Some firms developed packaged software for global markets, others concentrated on software tailored for specific customers in niche markets. In most cases, applications software was being developed, although a few firms were working close to the hardware elements of computing.

Most firms in the sample had been set up in the previous 5 years, although a substantial majority had been in existence for rather longer. They had been set up for diverse reasons, most often the founder's desire to run their own company, but also as a result of the founder's redundancy or wish to conduct a MBO from a previous larger employer. Firms had usually been financed at start-up by a combination of founders' savings, an income stream from guaranteed future work, and organic growth, although bank overdrafts and low wages also featured. These sources did not require external support from government agencies.

On average, sample firms were experiencing spectacular growth during the period, perhaps due to the rapid expansion of more recent start-up firms. Between 1995 - 1997, employment in the sample electronics and related firms grew by more than 58%, sales increased by 76%, and the value of exports rose by 153%. Profitability actually decreased over the period by 1% to an average of 6.5% in 1997, although the profitability of individual firms varied widely (from -20% to +20%), depending on their stage in the product lifecycle.

Most the sample firms (84%) reported major product innovation during the period, reflecting an overall concern with NPD. Several had undertaken major process (26%) or organisational (37%) innovation, but this was less likely as less scope was seen for such changes in software businesses. Amounts spent on formal R&D varied widely, from $nil to $3.5m. It was generally very difficult for firms to calculate how much was spent on this activity and its less formal counterparts, since some was charged to individual projects, and some was not accounted for at all. All firms were concerned with product and systems quality, although only firms with more than 25 employees had gained ISO9000.

Employees were predominantly scientific and engineering graduates, although there were also subject matter and user industry experts, artists and designers involved, as well as administration staff. Recruitment was mainly from within Scotland, and several firms had ongoing links with universities for this purpose. There was also a pool of suitable experienced labour in the Central Belt of the country, although skill shortages were more marked outside that area.

By far the most important sources of technological knowledge for software firms were their own in-house R&D and other technological activities, together with the knowledge brought into the firms by employees recruited locally. Also significant were customers at all three levels - local, national and international, with the emphasis on the latter two, and national and international software and computing publications. Most business inputs were locally sourced, but outputs were split evenly between the three levels. Firms' most frequent and intense connections were with their customers, again at all three levels. They had very little contact with competitors, nor did they tend to collaborate with other similar firms. Other significant links for some firms included universities (mainly but not always in Scotland, depending on specialist area). Geographical clustering in terms of inter-firm linkages did not appear to be especially significant for the sample software firms. However, the presence of a skilled local labour market was important, and local industry-academia linkages were significant and could doubtless be further fostered, for R&D collaboration, recruitment and management education. As in the electronics industry, the new information and communications technologies appeared to dissolving distance, and since there was often no tangible product, physical proximity was less relevant for the exchange of knowledge.

Sample firms' experience of government support initiatives varied widely. 37% of firms had experienced little or no contact with a government agency. Others had benefited from several schemes, including those covering business planning and development, recruitment, office premises and exports.

Characteristics of successful Scottish software SMEs

Successful SMEs in this sector tended to have the following characteristics :

Founders / managers	• Graduates or subject matter experts, with previous experience in large UK firms or SMEs • Ability to generate industry and local business contacts, and with the credibility and connections to raise capital for growth where necessary • Ability to manage growth (organic or stepwise)
In-house capabilities	• High in-house technical and managerial capability for the software development process • Market capability and business administration ability as well as technological expertise
Workforce	• Enthusiastic workforce, committed to maintaining and updating technical skills and industry knowledge • Recruitment of good quality new graduates and more experienced staff (staff turnover is not always a problem, as recruitment brings fresh knowledge and ideas into the firm) • A good in-house sales person (not necessarily full-time in very small firms)
Products and markets	• Innovative products, probably for niche markets • A constant new product stream (R&D and NPD planning) • Ability to develop existing products for new market sectors • Possibility of developing new export markets (though not essential)

	• Distribution contracts for export markets, where firm does / can not distribute itself • A manageable product / service combination
Networking	• Contact with local universities (for a variety of reasons : technological, business/management, recruitment) • Ongoing contact with local (and perhaps national) government support agencies

Policy recommendations

As with electronics, software is also a subject of the current Scottish Enterprise clustering policies. However, there seems to be limited evidence from this research that geographical clustering is at present important to SME competitiveness in software.

In encouraging firms to approach government agencies for support, selection criteria appear to operate, involving both the type of software and its market, and also the expected rate of growth of the firm. However, all product-focused sectors of the industry (as opposed to services or value-added re-sellers) were currently doing well, and firms experiencing organic growth were more consistently profitable in the longer-term, so that attempting to pick rapidly rising 'stars' may not be the only approach to assisting the industry in Scotland. Even some of those firms expanding quickly found that they encountered difficulties for which agency support is currently not available. The emphasis on start-up assistance could be extended further into a software firm's product lifecycle, as problems often arise later on when significant growth eventually does occur.

Few firms had ever applied for EU funding. As in the case of electronics firms, this may be an opportunity that Scottish software firms and universities are missing.

Clustering and networking	• Review the effects to date of industry 'cluster development' policies on software SMEs in Scotland, and consider what kind of clustering would be most useful, and how to develop it. • Further support industry-academia collaboration for technological knowledge transfer, management and business education, and recruitment and work placements
Information	• Encourage more software firms to contact their local government support agency • Provide information to firms on EU funding and arrangements for research partnering with universities (see electronics) This information could be centrally based at Scottish Enterprise, and made available as a set of web pages with links to EU sites.
Firm growth	• Develop better support mechanisms for firms undergoing rapid growth and expansion (including for business management and organisation) • Examine support provision for firms wishing to grow more organically • Tailor assistance to the needs of the firm's product development lifecycle, not just at start-up
Market capability support	• Continue and extend export support mechanisms
Recruitment	• Continue and extend recruitment initiatives such as 'Graduates into Software'

LECs	• 'Inter-trading' of subsidised course places between neighbouring LECs, depending on local specialisms and funding priorities

3. Garments and knitwear

During the period under review (1995-1997), the Scottish garment and knitwear industry was (and still is) under considerable pressure. This was both from competition by lower-cost producers in less-developed countries, including Scottish firms subcontracting their manufacturing overseas, and from the collapse in many of its traditional export markets due to the Asian financial crises, US tariff disputes, and the strength of sterling. In the Borders, many established firms in the knitwear industry had exited from the industry, amalgamated / been taken over, or had contracted the scale of their operations.

At the same time, new entrant firms were springing up, run by local people with experience in the industry who could see market niches which larger concerns had ignored or judged uneconomic. They had access to a local pool of skilled labour, and relatively cheap secondhand machinery bought from exiting firms throughout the UK. Sample firms tended either to be more than 15 years old, or established within the previous five years.

These surviving firms were characterised by a shift towards luxury yarns and fabrics, a renewed emphasis on design, and the development of new product ranges selling under different labels to different market segments. Firms used various combinations of in-house designers and links with British and international designers. There was a constant tension between maintaining traditional 'classic' styles and tracking (to some extent) more ephemeral trends in fashion.

Between 1995 and 1997, firm fortunes were mixed, with 1996 showing a decline in sales (11%), exports (12%) and profitability(down to <1%), and 1997 a recovery (5.5%; 6.5%; up to 3% respectively), although not yet a return to 1995 levels. Exports remained constant as a percentage of sales (79%), and the number of countries served increased, particularly in new markets in the 'rest of the world'. Total employment in this sector declined overall by 5% during the three years.

Almost all firms, even the smallest, carried out design and development work, although they typically spent less than 5% of sales revenue on these activities. About half the sample firms reported major product (46%) or organisational (46%) innovation during the period, and about one-third (31%) had undertaken major process innovation. Product innovation tended to be incremental, and was undertaken by all firms. Firms were concerned with product quality, given their target markets, but none had gained ISO9000. Instead, they preferred to authenticate the yarns and fabrics used under various industry association schemes.

In the sample firms in this industry, there were no science and technology graduates employed. However, some (but not all) firms did employ fashion and design graduates in the design area. Almost all founders / directors had an industry background and many years of experience, but the vast majority were not graduates. Firm employees tended to have very high levels of craft skills and experience, and had usually undergone apprenticeships. Engineering matters were dealt with either by skilled production workers or by external firms.

By far the most important source of technological knowledge was recruitment from the skilled and experienced local labour pool. The firms' own in-house D&D and other technological activities were also thought very important. Other external knowledge linkages, including national and international level customers, trade fairs and publications were also rated highly. National and international level equipment and materials suppliers were also seen as significant sources of technological knowledge, as was the local Design Centre. Firms' most frequent and intense connections were with customers and suppliers, considered significant at national and international levels. However, local connections on the supply side in general were also significant, including those with other similar firms, industry associations and government support agencies.

It is clear that knitwear and garment firms in the Borders region had technological knowledge and other networks that were not only locally clustered, but also national and international. Of the three industries, this one most closely matched the geographical clustering concept, even though it was clear that firms needed much wider connections to compete successfully. Use of new ICTs to dissolve distance was limited, although a few of the larger SMEs had websites promoting their product ranges.

Almost all the sample firms had received assistance from government support agencies and funding bodies, including both start-up and more established firms. They had benefited from various support initiatives, most commonly for training, but also including assistance with premises, design development, and exports. However, participation by start-ups in business planning and administration support schemes was low.

Characteristics of successful Scottish garments / knitwear SMEs

Successful SMEs in this sector tended to have the following characteristics :

Founders / managers	• Extensive industry knowledge and a network of contacts
In-house capabilities	• Technical expertise, especially for the use of new yarns and the production of new designs • Market capabilities, including identification of a viable high-quality market niche in an internationally competitive environment • Business administration skills, and use of current ICTs as relevant
Design and markets	• Contact with British or international designers • Contact with the British fashion establishment and press • Sales outlets in high quality fashion retail stores, designer stores, or own outlets in quality metropolitan shopping areas
Products and innovation	• Emphasis on the design of products (various methods for achieving this) • Changing product range, in tune with overall trends in fashion, whilst retaining 'classic' image • Emphasis on traditional high product quality and Scottishness • Incremental product innovation
Production	• Co-operation between designers and production at development stage (turning the design into a manufacturable product) • Use of modern production technologies, except where traditional craft methods provide a selling point
Workforce	• Skilled and experienced local workforce, but with new workers also being trained
Networking	• Presence at international trade fairs and exhibitions, both as seller (of garments) and buyer (of equipment and

	materials) • Contact with and assistance from government support agencies (LECs) • Good supplier and subcontractor networks • Loose contacts with industry trade associations

Policy recommendations

The Borders knitwear industry is particularly strong in terms of technical capabilities. Although market capabilities are being accumulated, this is an area in which it is crucial for firms to achieve an equal degree of excellence because of external competitive pressures. Support policies therefore need to continue addressing this issue, and to extend it in novel ways. Some start-up firms appear to lack business and administrative capabilities (including the use of ICTs), and uptake of existing support schemes is low. There are some issues connected with the financing of capital expenditure, and also premises, that could benefit from being addressed.

Although clustering is a characteristic of the industry in this region, both start-up and established SMEs would benefit from ongoing development of their national and international networks. This is also linked to the issue of exports, since one of the most important factors for survival and success is the ability to compete in global markets for luxury knitwear and garments. At the same time, the diverse local organisations that have dealings with garment and knitwear firms might also derive benefit from increased collaboration with each other. At some time in the future, as the local skilled labour force ages, there may be shortages of staff, and training of new workers may need to be reviewed by colleges, firms and government agencies together.

<u>Market capability support</u>	• Continue, and extend export support initiatives to established garment firms, including support for attendance at trade fairs, and marketing assistance • Create initiatives to help introduce garment SMEs to editors and style feature writers in the general newspaper and magazine press, and the more specialist fashion press, and aim to build ongoing relationships. This might include conferences and open days, and could also include an indirect promotion of other businesses and tourism (the Scottish Borders as a location for fashion photoshoots). • Create / extend LEC initiatives to encourage more garment SMEs to use electronic communications and the Internet for business. • Establish a regional or national agent dealing with e-commerce on behalf of small knitwear and garment firms. This could be linked into the planned 'Ossian' e-commerce system (a centralised ordering / booking system) for Scottish tourism and events. This could also be extended to food-oriented SMEs (local producers or restaurants). • Build contacts with art and design and fashion colleges in Scotland (and the rest of the UK) to bring in fresh design talent for short-term assignments. • Encourage firms to attend fashion degree shows to meet students and scan trends.

Business capability support	• Review current LEC provision for business, computing and finance-oriented start-up support, extending facilities to more garment SMEs, in a user-friendly way appropriate to the needs and abilities of people in the region
Innovation	• Further encourage innovation in the garment industry, and establish support initiatives for new product development which take into account the importance of incremental (rather than radical) innovation for industry competitiveness
Networking	• Encourage garment SME contact with local (or Edinburgh-based) colleges and universities for business and management education • Build contacts with art and design and fashion colleges in Scotland (and the rest of the UK), to make links with students who will be the British designers of the future. • Encourage greater networking and co-operation between support agencies and other organisations in the region
Recruitment	• Review the longer-term future staffing and training needs of the industry in collaboration with firms and local colleges • Build contacts with art and design and fashion colleges in Scotland (and the rest of the UK) at staff and student levels, to further encourage and publicise the Graduate Placement Scheme for knitwear firms (and the grants available to firms).
Capital equipment and premises	• Grants, loans and other support for investment in capital equipment are an issue (though this may improve from 2000, when the region gains EU Assisted Area status) • Support for refurbishing part of *rented* premises as a showroom would be welcome
Assisted Area status	• If not already planned, publicise new initiatives in the Borders under Assisted Area status, and examine the 'lessons learned' for SME provision by other areas that have already experienced this form of EU support.

Executive Summary - Oxford

Summary: the UK Software Industry

1. Main Findings

- The software industry in the UK is young and fast-growing in comparison with other industries in the country. It employs about 1 million people and represented 10 per cent of new employment generation in the country during 1993-8. It is predominantly made up of small- and medium-sized enterprises involved in diverse activities, from sophisticated software developers to service providers and sellers of software packages developed by others.

- The Oxfordshire and Berkshire counties in the UK, where the survey for this research was held, both possess a thriving and substantial IT and software sector. The average size of software firms in our sample is about 28 workers with an average gross value of plant and equipment of £269,000, which is fairly small. The strongest performing firms in the sample seem to be those which are able to develop technologically complex software packages. Other firms derive their competitiveness from their ability to customise standard products to the needs of clients. Our findings suggest that in this so-called high-tech sector there are many lower-tech companies whose competitiveness is based more upon good networking and marketing capabilities than on highly advanced software development expertise.

- The economic performance of our sample firms is illustrative of the good performance of the sector as a whole in recent years. Firms' average net profitability is 11 per cent of total sales and their average value added per employee is £33,095. Although their export competitiveness is still low (exports only account for 26.5 per cent of total sales), exports grew by 3.25 per cent during 1995-97. Sales and employment also grew by 2.9 and 2.4 respectively. The respondents opined that the main sources of their profitability are established reputation, high quality of products and services, excellence in design and specialised expertise, while price competition and delivery time of products do not seem to play a significant role.

- Most of the companies reported having accomplished at least one major innovation in products and organisation of work during the three years preceding the interviews, and moreover all of them had effected incremental innovations. In the perception of the respondents, major product innovations are considered to be the most important source of profitability for their companies. However, as already pointed out, the modest average ranking on our innovativeness score (average of 2 on a scale ranking of 1 to 5) confirms that although the sample firms display substantial innovative activity, most of those innovations are not technologically complex and highly original.

- A lot of the technological effort in software and IT companies is informal in nature. For instance, most of the expenditure on training (an average of £1,436 per employee) is associated with informal in-firm training. Formal R&D is comparatively less important as source of knowledge/ideas for innovation. In addition, non-technological activities such as relation-building with customers and marketing are important.

- Having an academic degree is a crucial success factor in software companies. Eighty-two per cent of the firms is led by an entrepreneur with a degree in science or engineering. Respondents also report that having worked for large national and multinational firms has constituted the most important learning ground to set up a small-size company in the software industry.

- External linkages are also an important component for the innovation capacity of the software firms, particularly the advice obtained from customers, and the informal partnerships with other companies involved in complementary activities. However, only a minority of the sample firms indicate that their innovation processes benefit from being located close to these network sources. The fact that many software firms cluster in Berkshire and Oxfordshire appears to have more to do with the availability of a large pool of qualified workers and the nice living environment. These findings give only modest support for the validity of the government's current policy of promoting geographical clusters of SMEs in "high-tech" industries, which is inspired by the idea that clustering would foster technological dynamism through inter-firm linkage-building and collaboration.

- Government assistance agencies do not show up as important network links for the sample firms. Fifty-nine per cent of the firms interviewed had not received any assistance ever. Only one had managed to obtain a government award and two others had obtained money from the EU for innovation purposes. Opinions vary with regard to the usefulness of public support. The two technically most advanced firms in the sample have made extensive use of institutional support (including EU grants), indicating that it had enabled them to boost their R&D capacity. Several medium tech companies with some ambition to grow also indicate that Business Link has been fairly useful to them for obtaining consulting and financial support for ISO introduction, establishing contacts with other parties and so on. In contrast, the technologically least advanced firms point out the deficiencies of the SME support for this particular sector, arguing that Business Link offers services that are irrelevant to their needs.

2. Conclusions and Policy Recommendations

Some clear policy conclusions and recommendations emerge from this write-up.

- First, it appears from our preliminary investigations about the nature of the software SMEs in Oxfordshire and Berkshire that the majority are medium-tech rather than high-tech firms. Their competitive advantage lies in a good combination of useful but not radically innovative products with excellent service, long-term and active customer relations and an in-depth knowledge of their requirements. Most of these firms require 'standard' institutional support services such as help with introduction of ISO, information provision, linkage building with other network parties and consulting related to effective management of their innovation processes. To the extent that we are able to judge from this small sample, it appears that the regional BLs and TECs are fairly effective in delivering this kind of support.

- However, there are also science-based software firms, especially in the Oxfordshire area, which do have considerable R&D capabilities and whose main source of competitiveness clearly lies in the technological sphere. There were two such firms in our sample. These firms have higher than average 'linkage capabilities' with a variety of private companies and public bodies, which is clearly associated with the academic background of their founders / managers. They are active networkers and are able to attract considerable R&D funding. It is these kinds of companies that appear to have the best prospects for growing into larger entities and becoming international players in due course. While considerable financial support possibilities exist for *established* firms of this kind, an adequate financial institutional support base for *start-ups* of this type appears to be lacking. The UK government appears to believe that the private sector (venture capital, business angels) will fill this niche. However, considering the high risks and uncertainties involved in backing such ventures, it is to be foreseen that problems with attracting start-up capital will persist. Some degree of public support should be provided to overcome these problems of market failure. Also, by establishing a record of success, a public support scheme might help to attract private investors to these kinds of investment opportunities in due course.

- Second, there is only limited support for the validity of the premise, underlying current institutional assistance by DTI, that geographical clustering will lead to the emergence of Silicon Valleys with lots of spill-overs and collaborations. To the extent that clustering is considered important by the respondents in our sample, it appears that it is mainly driven by the need to be close to important customers and the need to be able to recruit (and release) qualified workers. Closeness to firms in complementary activities appears sometimes to confer an advantage for informal collaborations, but the supporting evidence is cerrtainly not overwhelming. Several firms in the sample also had important foreign or distant national collaborators. It is possible that the increasing ease and speed and decreasing cost of long-distance communication will to some extent erode the advantages of geographical proximity.

- This finding has clear implications for current UK government policy. Whereas the latest government Competitiveness Report (1999) emphasizes the government's role as a catalyst to promote dynamic regions based on creative collaborations, our research indicates that networking as such, rather than geographical proximity of the network sources, contributes to technological dynamism and competitiveness. This suggests that, rather than promoting regional clusters of SME, government policy should focus on stimulating networking in all its dimensions, including not merely local and regional linkages and collaborations, but also national and indeed international networks with firms and institutions. Indeed, it is to be expected that the importance of non-local linkages will increase relative to local ones, as new possibilities for effective long-distance communication possibilities are opening up at great speed. Government policy should encourage and facilitate the utilization of these new possibilities. This will require more than financing networking initiatives through the regional BLs and TECs. Timely provision of adequate capacity of electronic communication infrastructure will be an even more crucial prerequisite.

Summary: the UK Electronics Industry

1. Main Findings

- The electronics and precision instruments sector in the UK contributed 2.4 per cent to GDP and employed about 343,000 people in 1998. The sector is very diverse. Some segments rank among the fastest growing industrial activities in the country (especially telecoms equipment and computer hardware) while other segments have been doing very badly in recent years (semiconductors). Although the presence of foreign investors is quite substantial in some segments of the industry, SMEs play an important role particularly in the electronic parts, industrial process control equipment and precision instrument sub-sectors. As much as 54 per cent of precision engineering employment in 1996 was in SMEs.

- As in the case of the software firms, our electronics SME survey was concentrated in Oxfordshire and Berkshire counties which are home to hundreds of high-tech electronics companies. The average firm size in our sample is 40.6 and the value of plant and equipment £1,022,270 (higher than the software firms). While some firms concentrate on design and manufacturing for a limited number of corporate clients, others produce standardised components or gadgets for a larger number of customers. Even more than in the software sample, the competitiveness of the electronics sample companies appears to be related to the founder/manager's niche technological expertise and the specialised skills of a highly-educated workforce. In the companies with the most advanced capabilities, product design plays the key role while the manufacturing process itself is subcontracted out.

- The economic performance figures show the intra-sectoral differences among electronics companies in the sample. Some companies are low value added component assemblers which try to minimize production costs, while others are design-intensive science-based precision instrument makers with an international focus. Overall, the average net profitability of our sample companies is 5 per cent and the value added per employee is £21,120 (lower than the averages for the software companies). Exports, sales and profits show a modest growth during the recent past, (3 per cent, 2.9 per cent and 2.1 per cent during 1995-7, respectively). The respondents point out that the competitive advantage of their companies mainly lies on established reputation, high quality of products and services, excellence in design and specialised expertise.

- The average company ranking on our innovativeness score (2.2 on a scale ranking from 1 to 5) hides substantial intra-sectoral differences in our sample. The large majority of firms in the sample (75 and 81 per cent) report having implemented at least one major product innovation and process innovation respectively between 1995 and 1997. Several of these are highly technologically complex and leading-edge innovations, particularly among the instrument makers. In contrast, in the software sample only two firms had come up with significant R&D-based product innovations. In the respondents' view, major product and process innovations are considered to be crucial for the profitability of their companies. Another indication of technological excellence is the fact that 12 out of 16 companies expressed a positive attitude towards ISO accreditation, arguing that customers increasingly demand it.

- In contrast to the software firms, where technological efforts were predoninantly informal in nature, the electronic firms emphasise the vital importance of formal R&D expenditure (average of £8,124 per employee) giving less importance to the informal activities associated with training on the spot. The expenditure on total training was £711 per employee, which is only half of the training investment by the software firms. As much as 19.4 per cent of the workforce in the electronics companies are involved in R&D operations.

- There is a prevalence of academic degrees, but the percentages are not quite as high as for the software companies. It is evident that a degree in science or engineering is crucial in the science-based firms, but not necessarily so for the component assemblers. Seventy-five per cent of the companies had an entrepreneur with a degree in science and engineering. Like in the case of the software companies in the sample, large national and multinational companies have also been important learning sources to set up a high-tech electronics firm in the country. Government laboratories have also been relevant, particularly for the R&D-intensive companies.

- External sources are to some extent important for innovation but not as crucial as in-house R&D. The most important external sources that generate knowledge/ideas for innovation are trade fairs and conferences, the advice from customers and the information from suppliers of materials and components. Vertical co-operation is a common practice, but unlike software firms, horizontal partners (informal collaborations) do not seem to play a significant role. Moreover, the majority of the respondents point out that there is no a clear advantage derived from geographical proximity of important network partners. The only relevant proximity factor appears to be the advantage associated with the case of recruiting a suitable skilled labour force.

- Although government agencies were not considered to be important network links by the electronics firms, 44 per cent of the interviewed companies currently receive institutional support of any sort. Moreover, 30 per cent of the sample firms have received public financial support especially for innovation purposes (either through SMART, the Queen's Innovation Award for Innovation, or LINK), and 22 per cent of the companies have attracted EU funding. The main beneficiaries have been the science-based instrument makers, while the component assemblers have not received any support and did not show much interest either.

2. Policy Conclusions and Recommendations

- SME electronics firms in the UK range from low value-added component assemblers to technologically highly complex companies involved in designing major innnovations for the world's leading companies. The competitive prospects for the former are clearly unfavourable, as they are increasingly under threat from lower cost producers overseas. However, there are also a number of highly promising high-tech electronics firms. In the Oxfordshire and Berkshire areas, several of these companies have spun off from public laboratories or universities at a time when the Thatcher government started to put pressure on these institutions to commercialise their innovations. Ultimately, several of the public laboratories were themselves privatised, and they were no longer in a position to pursue research in non-core areas that would not contribute to substantial profit. It would seem that this has given rise to several spin-offs at the time. Several of these spin-offs have grown into promising knowledge-based companies which are capable of developing world-class innovations and which are international in outlook. These are precisely the sort of companies that the UK government seeks to promote, since they contribute and strengthen the country's competitive advantage in high-skill occupations and new areas of scientific knowledge.

- However, it is questionable whether the spin-off process that we have seen in the past will be sustained at the same rate in the future. The public science base has shrunk considerably, and with it long-term public funding for fundamental research. This makes it more difficult for scientists who wish to become self-employed to devote time and resources to pre-competitive research on projects that could become commercially viable in the longer run. Therefore, it is all the more necessary that support mechanisms need to be put in place to help such people in other ways. In the past, the start-up process of science based ventures was implicitly subsidised by scientists continuing to work in a public laboratory or university at least part of their time while at the same time setting up their own unit. Various public financial support mechamisms for start-ups were also available in the 1970s and early 80s. All this support has now largely dried up, and no new initiatives have taken its place. There are some public schemes for innovation finance in SME such as SMART, the Queen's Award for Innovation and LINK, but these are not suitable for new ventures. And while the BLs and TECs appear to be reasonably effective new-style support institutions for several *established* companies, they do not provide support to new start-ups. In any case, provision of financial assistance is not their mandate. There is a clear weakness in the UK institutional support structure in this area which needs to be addressed.

- As in the case of the software industry, there is only very limited support from our research for the idea that geographical clusters of electronics SME will lead to increased dynamism, innovation and international competitiveness. To the extent that the firms found clustering important, it appeared that they were motivated mainly by the ability to recruit skilled people and by their interest in living in a nice area. The fact that several founders were already living there at the time when they started their ventures is also a factor. They indicated that this, and perhaps the proximity to their former employers with whom they still maintained contacts (e.g., the university of Oxford or University College London) largely appears to explain the clustering of instrument makers in the Oxfordshire area. Their links with other firms appear to be primarily vertical (with customers and suppliers), and proximity is hardly an advantage for the maintenance of these contacts.

- Given these findings, it is likely that the current government policy centred mainly around geographical clustering is going to backfire. Linkage promotion and facilitation is important, but in the case of the science-based high tech companies in this industry, it should go well beyond stimulation of regional hubs. In fact, non-local links with customers, other private companies and research institutions are likely to contribute much more to the international competitiveness of these firms than local ones, and the BLs and TECs would do well to give priority to the development of the latter. Even less than in the case of the software firms, which do appear to share enough common interests to be able to exploit some complementarities in skills and knowledge in some instances, electronics SME are such a diverse lot of specialists in completely different areas that the sort of Silicon Valley type of informal collaborative networks are probably very hard to create.

Summary: the UK Clothing Industry

1. Main Findings

- The clothing industry in the UK has been squeezed by the expansion in mass production exports of catching-up countries, which have taken advantage of their low-skilled and low-paid labour force. Thus, between 1985 and 1996, almost 30 per cent of jobs in this sector were lost and the number of garment-related firms declined by 35 per cent. The British Apparel and Textile Confederation (BATC, 1995/96) estimates that the apparel industry in the UK employed a total of 217,000 people in approximately 6,000 firms in 1996. Those firms are mainly family-run and according to BATC, at least 95 per cent of enterprises employ fewer than 100 workers, and 81 per cent less than 25 workers.

- In order to achieve a representative sample, we interviewed garment SMEs involved in different industrial activities, from design-oriented firms to CMT (cut, make and trim) subcontractors, in the West Midlands and Nottinghamshire. The former county hosts the bulk of the low-value clothing companies in the UK whereas many of the design-oriented firms locate themselves in Nottinghamshire and London. The average firm size in our sample is 25 and the value of the plant and equipment is £64,000 (much lower than that for software and electronic companies). The competitive advantage of final producers primarily lies on their in-house design and development capabilities, the innovative use/adoption of new technologies and their specialised expertise in particular market segments. On the other side of the spectrum, the high dependency of subcontractors lead them to concentrate on prompt order to delivery, price competitiveness and attention to customers as their main sources of profitability.

- The economic performance findings show clear inter-sectoral differences between final producers and subcontractor in the clothing industry. Taking the sample as a whole, clothing firms´ profitability is only 2.6 per cent of total sales, a tiny net margin when compared to that of electronics and software companies in this study. The average value added per employee is also relatively smaller (£9,059) and only 3 out of the 17 firms interviewed report to have exported their products over the last 3 years. However, firms that finalise products and have in-house design capabilities have performed more consistently than those subcontracting firms with none or limited technological capabilities. For instance, net profitability levels of final clothing producers double those of subcontracting firms in the sample. Major differences are also found in the value added per employee category with final producers acquiring three times more value added than subcontractors.

- The average innovativeness score for the garment firms in our sample is 0.67, which is very low in comparison with that for the electronic and software firms. If we split the sample between subcontractors and final producers, the score for the latter group is just above 1 – substantially higher than that for the subcontractors – suggesting that although all final producers report having achieved innovation of products, most of those innovations are not complex technologically and do not require high investments in R&D. In the respondents' own view, product innovation is considered to be the most important factor affecting the company's profitability.

- Taking the sample as a whole, it is rather clear that garment firms do not have strong internal capacities for innovation. However, it is also rather evident that final producers perceive their internal design capability as a very important tool for innovation whereas subcontractors do not think so. The average R&D expenditure per employee in our garment firms sample is £1,105, which is rather poor if we compare it with the figures of £5,586 and £8,124 for software and electronics firms respectively. Most garment firms do not spend resources on technology licenses or training of workforce, with only 3.8 per cent of their employees being engaged in design-oriented activities.

- Almost thirty-five per cent of the founders/managers running design-oriented companies have university degrees in science or engineering and seventeen per cent in other fields. On the other hand, only ten per cent of the CMT businesses had an entrepreneur with university degree in science or engineering. As far as prior working experience is concerned, most founders/managers running garment firms report that their previous working experience has been in family business or another small business in the UK.

- Garment firms use external sources more frequently than software and electronics firms do. This might be due their limited internal capacity, therefore searching outside the firm what cannot be found inside. Vertical co-operation with clients and suppliers of raw materials is frequent and intense but there is not a clear proximity advantage derived from such an interaction. Horizontal co-operation links with other firms in similar production stages are unimportant, and this is mainly due to the firms' high degree of dependency on a limited number of clients or final producers. Garment firms seem to interact quite substantially with the local industry association and the closest clothing centre, and there is a proximity advantage attached to it.

- The clothing industry in the UK counts with an active bunch of sector-specific government and semi-government agencies located in the main geographical clusters of clothing firms in Britain. These Clothing and Design Centres provide services such as product design and development, counselling and vocational training, and are complemented at national level with the British Apparel and Textile Confederation (the umbrella organisation for the trade associations representing the interests of the UK's apparel, knitting and textile manufacturing industry). Fifty-six per cent of the garment firms interviewed report to receive institutional support from local clothing centres at present moments. Overall, they seem to be pretty satisfied with these clothing centres although they consider that the impact on their economic performance is very limited (most firms agree that the Centres' services have contributed nothing or just a little to their exports, sales and profitability). In the respondents' perception, such services have rather contributed to the development of their internal technological capabilities (that is to say, technological upgrading and skill upgrading of workers). The most attractive features of these clothing centres are their location (close to the firms), their specialised expertise (only providing services for the clothing sector and not others) and the long and trustworthy relationship that companies have with them. As far as the EU and UK innovation schemes are concerned, none of the garment firms interviewed reported to have been awarded.

- It is evident that the garment industry in the UK is going through an ongoing crisis since the mid-eighties mainly due to increased low-cost foreign competition. However, it would be unfair to say that all UK garment firms are in the same position. The main conclusions derived from the garment study, and relevant for policy, is the fact that CMT (cut, make and trim) businesses – characterised by their weak internal technological capabilities and highly dependent on wealthier firms – are facing more problems than those final producers who consider innovation, in the form of design and fashion, as an important component of their competitiveness. Some UK clothing firms have actually enjoyed success in new-emerging markets upon continuous style development and rapid response to market demands. On the other hand, the subcontracting businesses – highly represented by Asian garment producers – lack skills, experience and especially financial resources to become "high road" firms, their main market strategy being the production of low-medium/quality garments. These are the real strugglers of the industry and where policy should be put to work.

2. Policy Recommendations

There is a general consensus about the sort of structural constraints that the British clothing industry is facing at the moment. Most of those problems do not have to do with the industry itself but rather with external pressures resulting from globalisation. Internal policies, such as the Sterling exchange rates and minimum wage legislation, have also affected the competitiveness of the whole manufacturing industry in the UK, but especially those low-tech firms that still seek price competitiveness as main source of comparative advantage. In this sort of matters, the government has little to say and we cannot ask for unrealistic policies to change the whole economic setting in order to favour the development of a particular industry. However there are some other issues where both the government and the private sector could play an important role:

- There is an urgent need to redefine the industrial strategy that the British clothing sector should follow. Although some British companies have repositioned themselves in higher value-added markets, the productivity of most garment-related SMEs in the UK trails behind that of German, French or Italian companies. The government does not seem to be doing much about this, and at the present moment, there is not evidence that the Department of Trade and Industry (DTI) intends to put means to enhance greater competitiveness in this sector. In our view, the government could start committing itself by doing an analysis of the strengths, weaknesses, opportunities and threats of the British clothing industry in order to provide guidance for the firms operating in the sector. If DTI's industrial development strategy does not involve the upgrading of companies in low-tech sectors, this should be left clear right from the beginning.

- It is rather clear that there is a lack of co-ordination between the Clothing Centres, manufacturers' associations, training organisations and trade associations representing the interests of the UK's clothing industry. An effective support system does not rely as much on the number of institutions actively functioning as on their networking and appropriate co-ordination. For this reason we believe that there should be an umbrella organisation to unify efforts and foster co-operation linkages among institutions. Garment-related companies in the UK would definitely benefit from institutional interaction at different operational levels.

- The Clothing and Design Centres should adopt a business-like and demand-led approach to ensure their sustainability. Many of these centres are highly dependent on external resources, which in a way determines the sort of services that they can provide. Due to financial constraints, most of the services supplied are technologically simple and with no relative impact on firms' design capabilities. These centres should provide services that encourage garment-related SMEs to move towards more innovative and therefore higher value-added products. They should also act as intermediary agencies contributing to the technological diffusion and upgrading of garment companies.

- At the firm level, emphasis should be put on design and fashion. This would help firms to obtain higher value products, which are less vulnerable to external competition. In most cases, it is not economically viable to employ a full-time designer. However companies should consider the use of a final year design undergraduate to design compatible garments using up-to-date materials. The cost of employing a part-time designer would be relatively minimal.

- Reducing the dependency on a limited number of final producers is a crucial condition for survival. Subcontracting businesses should aim at becoming final producers themselves in a progressive way. This is tough and risky because companies do not have the internal technological capabilities and financial resources to do so, but unfortunately this seems to be the only way to achieve higher value added and increase benefits.

- Companies should also look at the commercial/marketing aspects of their business. This is one of the main weaknesses of the clothing companies in our sample. Companies should consider producing a small leaflet to promote their product and to present to a potential customer the professional way that they conduct business. When they eventually engage an agent this will be a good sales tool in the promotion of the company.

ITALY - EXECUTIVE SUMMARY

Paolo Guerrieri, Simona Iammarino, Carlo Pietrobelli

SUMMARY

The rising technological and knowledge content of manufacturing, the growing role of the (immaterial) service sector and the increasing complexity of technology are characterising most economic activities. This evolution exerts a pressure to internationalise economic activities, not only in search of new and more dynamic markets, but also to source technology and knowledge globally. In turn, this has an effect on enterprise strategies and inter-firm linkages.

The central aim of this research, that is pursued throughout theoretical empirical appraches, is the relationship between the pressure that enterprises are increasingly facing to internationalise their knowledge and production activities, and their strategy of geographical location and inter-firm linkage creation.

The case of Italy, characterised by an industrial structure where Small and Medium-sized Enterprises (SMEs) are heavily represented, offers an excellent and promising case-study to explore this issue in details.

The question of clustering and geographical agglomeration of production activities has been a classical theme of economic research, already explored by Alfred Marshall in the XIX century.[1] In the late 1970s, some Italian scholars revitalised the debate focusing on several Italian experiences of ‘industrial districts’ (ID) defined as “socio-territorial entities characterised by the active presence of both a community of people and a population of firms in one naturally and historically bounded area. In the district, unlike in other environment, such as manufacturing towns, community and firms tend to merge”. [2]

During the last two decades, the internationalisation of markets and production and the globalisation of technology have interacted in urging firms to set up a variety of linkages with other firms, and notably linkages having a technological nature.

However, clustering and networking may take many different forms, and within the emerging technological paradigm the geographical dimension of clustering may alter its central role emphasised in the Marshallian literature.

The aim of Part 1 of the Italian Report is to investigate some plausible models of evolution of IDs and clusters, and provide an explanation in light of the peculiar features of technology and technological change. We shall notice how little attention has been paid to the transformation of IDs, and to models geared to explaining their shift from one pattern of internal organisation to another. This contrasts with the increasing evidence of cluster reorganisation in response to a changing environment of globalised economic and financial activities.

The divide in the empirical evidence and in theoretical approaches appears to be between traditional forms of inter-firm organisation and relationships *versus* more dynamic forms of restructuring with product diversification, upgrading of the

---

1 Marshall A., 1896, Principles of Economics, London: Macmillan.

2 Becattini G., 1990, ‘The Marshallian Industrial District as a Socio-economic Notion’, in Pyke F., Becattini G., Senbenberger W. (eds.) Industrial Districts and Inter-firm Co-operation in Italy, Geneva: International Institute for Labour Studies.

technological system, and improvements of more complex relationships with local institutions.

A first and insightful explanation of this difference may be provided by the strand of literature that emphasises the link between industrial organisation and technological change and innovation, and focuses on the concepts of '*technological régimes*'.[3] Within this interpretative framework, we test the following hypotheses:

§ The different opportunities offered by each technological area may be better exploited with a specific form of industrial organisation, and the prevailing form of the 'Marshallian' ID may not be the most adequate for the technological areas promising faster and more sustained demand in world markets.

§ The shift in the technological trajectory - and in particular the Information and Communication Technologies (ICTs) revolution - that applies to all sectors, requires a substantial industrial reorganisation. Again, firms traditionally operating within IDs need to learn to source their technological knowledge from the most convenient locations outside the ID, and to reorganise their knowledge linkages from a locally-based approach to a global and broader approach.

The evidence and case-study chosen to empirically test these interpretative hypotheses is provided by some enterprise clusters in Italy. However, the field work, reported in Part 2 of the Report, was mainly carried out with reference to the Textile and clothing sector, since the ID does not turn out to be a representative configuration of spatial organisation in the case of more technology-intensive sectors - such as the other two considered by the Project, i.e. Electronics and Software - which are instead geographically dispersed and, usually, located nearby big urban areas. The latter sectors, moreover, are rather weak for the country as a whole, as also confirmed by the interviews carried out for a small group of high-tech firms and reported in Part 2 of the present Report, justifying the choice of our team to focus more in particular on the traditional production.

As far as the clusters specialised in traditional sectors are concerned, they represent successful experiences of competitiveness in international markets. However, their patterns of success differ in several important respects, and may be portrayed, in very broad terms, as :

§ A process of deepening of product specialisation and upgrading, essentially following the same (traditional) organisation of production and of inter-firm relationships, or

§ A process of diversification into different products and sectors, with reorganisation of production and new relationships with firms, local institutions, and factor markets, that (inevitably) reach out into international markets.

As already stated, the empirical evidence on the Italian case is presented in Part 2 of the present Report, which includes also the results gathered from the interviews to Electronic and Software firms, only briefly commented due to the very limited size of the sample. In the case of textiles and clothing, three IDs were identified on the basis of the relevant literature as well as of considerations such as: (i) the identification of the "dominant" industry in the specialisation pattern of the district, i.e. textiles or

---

3 Malerba F., Orsenigo L., 1996, 'The Dynamics and Evolution of Firms', Industrial and Corporate Change, Vol.5 No.1; Nelson R.R., Winter S., 1982, An Evolutionary Theory of Economic Change, Cambridge MA : Harvard University Press.

clothing; (ii) the variety of historical backgrounds, with both ‘old’ and ‘young’ IDs; (iii) the variety of characteristics and performance; (iv) the successful export performance. Thus, Prato and Modena (the district of Carpi) were chosen among the ‘old’ districts, whilst Teramo (the ID of S. Egidio Val Vibrata) as a ‘young’ district.

A survey questionnaire was carried out in the Summer-Fall of 1998 - with interviews to 48 textile and clothing firms, and 16 high-tech firms operating in Software and Electronics - by means of a structured questionnaire. During the interviews the respondents were asked in particular to evaluate the factors related to both innovation in technology and organisation and the ‘cluster effect’ - i.e. the perception of the advantages and disadvantages of being localised in the ID while opening to national and international relations.

With reference to the traditional sectors’ SMEs, the results of our survey provide some support to the hypothesis of different paths of IDs dynamics according to the different capacities to react to global and technological challenges and the consequent restructuring of the ID competitiveness. Overall, the survey seems to confirm the importance of the “industrial atmosphere” and the strength of the Marshallian model in canonical Italian IDs, such as Prato and Carpi. These Marshallian IDs, in the main, derive their competitiveness from the use of flexible and multipurpose technologies (either “traditional” or electronic), craft ability and product adaptability, rather than from the generation of new products.

Sectoral trends, however, are showing univocal signs towards radical organisational changes, geared towards an organisation of economic activities in IDs of a post-Marshallian kind, that is, less locally confined and less vertically disintegrated.

The evidence hints that in the Italian IDs specialized in traditional sectors, the exploitation of the potential offered by the global networks to strengthen communication and information has been rather weak. The limited knowledge of new global technological languages, as well as the lack of substantial organizational changes required by the new technologies to be effective, may progressively cut out geographical clusters and, as a result, “industrial atmosphere” might not be anymore sufficient to stay ahead in the global economy.

Executive Summary - Greece

a. SMEs in the Greek Context

As Greece has the lowest company size and highest company density in Europe the economic role of SMEs is extremely important much more than in any other E.U country. Nonetheless, Greek SMEs manifest competitive disadvantages vis-a-vis E.U wide competition in aspects such as production technology and the quality of their products.

Large general government deficits and mounting public debt combined with inflationary pressure had been features of the Greek economy until the early 1990s. Industrial Policy had been relying excessively on expansive macro-economic measures that involved negative real interest rates, and a "crawling-peg" system for fixing the value of the drachma. Since 1994 fiscal efforts have been undertaken and price developments have been the main area of concern. The exchange rate system and the restrictive monetary policy were to become the pillars of the macroeconomic policy. At the same time structural interventions that complement the macroeconomic policy concern: the liberization of capital markets, the emergence of producer services, the creation of new technology infrastructures and the consolidation of a technology policy. Nonetheless, liberization of capital markets and the monetary policy have created difficulties to SMEs in their access to finance. "Soft Actions" still face obstacles to reach SMEs because they are no sectoral priorities and competencies to intermediate and regional bodies have been only but recent.

The Greek report refers to two sectors: a *low tech sector*, garments, and a *high tech sector* which includes software, IT services, manufacturing of computers, and telecommunication equipment. Our research is limited within the two central regions of Greater Athens area, in the South, and the Greater Salonica Area in the North. The sector of Garments is developing within the urban tissue of Salonica in a dynamic fashion that contrasts its decline in Athens agglomeration. The sector of software and IT services shows a faster development in the metropolitan area of Athens.

Garments have been one of the most important industries in Greece. However, during the last decade, the sector has experienced the effects of increased competition at international level as reflected in negative rates of output and exports growth. Historically, the sector was labor intensive but its growth has been sustained by saving labor technologies. Positive technological progress of the sector was associated with increasing returns to scale. Textiles have experienced a serious decline since 1985 and only large textile companies that have adopted technological modernization strategies succeeded to survive international competition. Small clothing firms have responded to the challenge by adopting "defensive strategies" aiming to retain labor costs at a low level. Such defensive strategies have been proved successful in cases of production networks that have extensively utilized subcontracting, however at the expense of high social costs.

In comparison with other EU countries the diffusion of IT in Greece appears to be relatively low. There are approximately 400 companies in the IT market. The majority of them employ less than 100 persons (excluding a number of about 2000 small retailers). The representatives of international IT Suppliers are increasing their market share. Over the last years the gap between the large and the small providers has increased. Large IT companies have been growing stronger from one year to the next improving their market shares and profitability in contrast to the large base of small local companies, which experience rapid decline in their sails and profits. The public sector plays an important role in the market; a role that has been strengthened by structural interventions with EU financial support. The largest part of the market is made up of hardware sales while services are quite low compared to the European Average. Software production is significant and holds a major part of the market. The rapid growth of telecommunication services is opposed to the slow growth of the software and IT services. There are in fact only five manufacturing companies of Greek personal computers. Those five companies are involved in software development and operate as commercial representatives of well-known international vendors.

b. *Competition, Capabilities and Performance*

Over the period 1995-1997 sample firms in the two industries followed opposite trends in terms of sales growth, pre tax profits to sales, and employment. The garments industry has contracted whilst the HT industry has expanded. Exports of garments firms have dropped whilst the exports of HT sector have increased. Nonetheless, the average value of exports of H-T firms sector is lower than the average value of exports in the garments sector. It can be argued that HT firms have not yet found their way in the international market whilst the garments firms were heart by liberization.

Despite the presence of large IT companies, a degree of competition on the supply side of the market has been secured in both sectors. On the demand side a higher concentration of demand in the garments sector may reflect the fact that firms operate under subcontracting.

The founders of HT firms are on average much more educated compared to those of garment firms and have a wider range of work experience beyond family business. The ratio of engineers to total employed individuals has increased by much more in garments than in the HT sector. This trend points to two different manpower strategies to adapt to technological change. In the high tech sector employment growth is equated with growth of science and engineers. In garments unskilled labor and subcontracting out is utilized to put out variable production costs but engineers are utilized as fixed asset. Very limited amounts are allocated to training, particularly amongst small firms, which is not seen as upgrading the firms' technological capabilities.

R&D expenditures and employees can be considered rather high in both sectors reflecting a rather intense internal knowledge effort. Nonetheless, in the garments sector reported figures mainly refer to expenditures on design whilst in the high tech sector to development rather than to "research" activities.

Almost half of HT firms introduce some type of product or process innovation as against approximately one fourth of garments firms. None of the innovations are unique or radical innovations. They are mostly new to the firm or to Greek competitors. HT firms innovate mostly on products. This type of innovation often concerns the development of customized products as a strategy to compete stadardized products of international vendors. Garment firms attach higher importance to process innovations compared to other types of innovations.

c. Networking and Collaboration

Quantitative and qualitative findings reveal a lack of collaboration spirit and serious administrative deficiencies, which hinder inter-firm collaboration and institutional linkages for firms in both sectors. The volume of networking at local and international level does not vary significantly between the sectors. However, high tech firms exhibit a higher volume of national exposure. This is probably due to the concentration of the private and public research and science base in Athens, where the vast majority of HT firms are located.

Findings also suggest that for both sectors producer consumer interaction is the prime force of collaboration. Moreover, despite differences in the utilization of the research base the main differentiation between the two sectors refers to the variety of local and international collaboration. That which is different is the chain of links developing from local to international reach. Garments firms collaborate with local suppliers and finance institutions to reach both local and international customers, whilst hi- tech firms collaborate with international suppliers and national suppliers, and less with research institutions, to meet needs of local customers. Furthermore, formal and informal partnerships equally develop at local, national, and international level. The emerging picture is that of an extension of the geographical range of networks by new contractual technologies, such as licensing, particularly for HT firms.

The weak networking effort can be contrasted to a rather intense internal effort for both sectors. Findings do not suggest a correlation between internal effort and local or national networking. Yet a positive relation of moderate strength is shown between international exposure and internal effort. This picture confirms with the idea of weak international ties making for learning results.

d. Policy Case Studies and Lessons for Policy Support

Policy lessons can be drawn by comparing the external constraints and the enabling factors that we identified through policy case studies in the sectors of High- tech and garments.

External Constraints refer to:

- High Public Transaction costs
- Finance of RD on a project basis encourages ad hoc responses rather than strategic development
- Lack of a sector specific industrial policy
- The centralized character of Greek Innovation System and the lack of technological infrastructures
- Nonetheless, the following policy factors were found enabling successful utilization of capabilities:
- Monetary policy has rationalized business behavior
- Structural Measures concerning both development of infrastructure and producer services

Thus, Policy guidelines for further enhancing firm capabilities can be summarized:

- Establishment of central authorities with sectoral orientation
- Independent science and technology institutes should continue to have state support. Sector policies should be based on long term rather than ad-hoc project partnerships.
- The location of those institutes and agencies in both metropolitan and non metropolitan regions is a crucial factor for the creation of spill over effects. The Northern part of Greece is lagging behind in terms of infrastructure.
- Clusters and networks would be more likely to succeed and indeed would be more beneficial if they promote “forward inter-firm linkages”.

EXECUTIVE SUMMARY - Israel

The objective of the TSER project was to measure, for three different sectors, the relative performance of SMEs, and to interpret performance differences in terms of underlying country specific factors. Our analysis adopted an Innovation System and Policy perspective with a focus on Technology, Innovation and Industrial Policy. The three sectors chosen were for Information Technology/ Hi-Tech industry Software and Electronics - Data Security and Communications Equipment, respectively; and for Low-Tech industry - the Garments sector.

The microeconomic work undertaken in these sectors has strengthened our belief that significant changes should occur in the Technology, Innovation and Industrial Policy of Israel. For high National Economy impact these changes should strengthen SME formation & growth, as well as strengthening spillovers of private firms. The above holds both for the Hi-Tech sectors and Mid/Low Tech sectors. However the nature of the changes in policy differ substantially in both cases.

The Data Security segment was pretty well defined in terms of its boundaries with other segments of Software. This sector had experienced remarkable growth and Israeli firms were leaders in several of the major innovations in the field - it is an 'area of excellence' of this country. Moreover, we could aspire at almost 'full' coverage i.e. our sample almost coincided with the Universe of companies.

The Communications Equipment\Software sector was the sector with probably the highest rate of growth within Israel's high tech during the 90's. It was also at the forefront of the *reconfiguration* of the last decade in the country's high tech cluster--a process involving deepening of the external links of the system and the appearance of Venture Capital. Israeli companies in this segment including those interviewed were active in *Leading Edge Technologies* in a number of Broadband Access areas.

Contrary to the others, the Garments sector represents an industry in crisis. Having been defined by the TSER project there were no degrees of freedom concerning sub-markets or sub-areas, at least within Israel.

In the Data Security sample we identified Very Successful companies (4 out of 19) according to Sales and/or Market Capitalization. We identified within these companies a generic *growth profile*, one involving phases of growth **and** 'strategy'. Success was correlated with it and with 'initial conditions' such as Background of Entrepreneur. Moreover, such a profile involved a *main sequence*, where IPOs are undertaken very early in the second phase of company growth. The main sequence led to two very successful companies, which remained indigenous and became global companies in the full sense of the term. A third company was acquired during the consolidation phase by a major software multinational; and a fourth was acquired very early in its growth and prior to its IPO. Identification of these profiles is important for policy because, among other reasons, 'social impact' varies from profile to profile.

In the high tech communications equipment sample we also identified a group of Very Successful companies (5 out of 21) using similar criteria to those used in Data Security. The findings strengthened what we identified in Data Security and clarified the importance of Policy and Innovation on the evolution of the Industry.

In the Garments sector, the sample included 21 companies without specific distinctions. The industry is representative of Low-Tech industry and is in a state of decline. Our challenge was to develop a policy perspective that could bring Hi-Tech and Low tech issues together within a unified framework.

The *Interviews of companies,* much more than the filled questionnaires themselves, have helped crystallize a number of potentially important priorities for Innovation and Technology Policy in Israel. This confirms the importance of the type of policy-oriented research represented by the TSER programs. One desirable goal of such approach should take care of two factors, private performance and its "social" (economy wide) impact.

Our research highlights the importance of the existing Israeli Hi-Tech cluster in creating conditions for the growth of very successful companies; of the international links with the outside world; and of policy. One important aspect is the background of the entrepreneurs\founders of these successful companies. Both Hi-Tech segments have highlighted a rich background in “other Hi-Tech companies” – especially foreign; as well as an Army background. Another factor is the Education of Entrepreneurs with formal degrees being more important in Communications Equipment companies relative to what they are in Data Security Companies. The Data Security Sector study has emphasized also the role of a Hobbyist background for success.

We mentioned the issue of a *social impact and interactions* of the very successful High Tech companies. Our analysis of Data Security shows the high social impacts of large companies and the importance of indigenous global companies and of the Hi-Tech cluster more generally. A number of well known, as well as non-conventional spillovers account for this, particularly the *demonstration* that local indigenous companies may thrive and become global even in very dynamic and competitive areas, without the need of being acquired by foreign multinationals. This justifies a focus on the conditions for the generation of such companies and is one reason for our suggestion that an important priority for High Tech is the "creation of indigenous global companies".

In the Garment industry a number of conclusions must be emphasized, as they may be indicative of Mid and Low Tech industries. High minimum wage rates compel manufacturers to concentrate much more than previously on high quality and exports, mainly for specialty markets. Labour intensive operations must be outsourced to the low-wage neighboring countries. But even there, only high quality work is going to be acceptable for quality products to survive competition in export and local markets. An awareness and information gap was identified, where manufacturers do not search for means to upgrade their technology, manpower and products.

At a very fundamental level, the policy change required is a shift to an *Evolutionary and Systems of Innovation Perspective to Technology and Innovation Policy*. This approach differs substantially from the (implicit) perspective of nowadays, which largely conforms to a Neoclassical Perspective.

Existing policies are too narrowly focused on High Tech Industry and too narrowly focused on R&D (and on Physical Investments). There are important gaps as far as Mid/Low Tech Industry is concerned and in the stimulation of the non-R&D elements of the Innovation Process.

A major component of the new perspective is a new Technology \ Innovation and Industry Strategy, which is more explicit than previously. In addition, the *policy process* today could be viewed as a truncated process and should be changed significantly in several ways/

Most important it should become a more *fully integrated* process involving not only decisions about budgets of existing programs; but also a renewed effort at **setting priorities**; their **translation** into programs and other policy actions; **implementation**; and **feedback** to priorities and programs. Existing priorities (and their translation into the existing set of programs) were set years ago before the changes that occurred during the 90s in Israel's National System of Innovation took place. They do not fully reflect National Objectives, nor the current and future needs of the Business Sector, which are strongly affected by the Globalization Process. Moreover, initiating a process of setting new priorities requires extensive *Search & Research,* partly Academic work with a broad perspective in mind and with a true policy orientation. Thus a "bona fide" shift in policy requires that the *policy process be much more knowledge intensive* than what it has been traditionally in this country.

Our research has also shed considerable light on desirechanges in the Program Portfolio for Technology\Innovation and Industry Policy, as well as means to enhance the effectiveness of the backbone to R&D promotion--Office of the Chief Scientist R&D Grants (an horizontal and largely neutral promotion scheme). Significant complementarities in some areas have been identified between these grants and Venture Capital, while also a presumption exists that in other areas private Venture Capital could take over from the Government. Thus OCS grants are still important for seed finance, for biotech projects and to provide smoothness, continuity and uncertainty reduction in the financing of start up companies. However, improvements might be done in the way this program is implemented, including potential program design improvements (e.g. a shift from the promotion of R&D to promotion of "innovation" as a whole) as well as in OCS screening of projects.

Last but not least, it is impossible to consider changes in incentives in isolation from institutional changes and changes in taxes pertaining to non-R&D activities or actions. Creating a 'level playing field' with the US on matters such as M&A, options to employees, regulations such as the Encryption Law, etc. All these are probably the most important changes one could do, in order to promote effective transition of hi-tech companies to the post start-up phase; and in the stimulation of large, Israeli, global companies.

In mid\low tech industry the Garment study suggests the need for significant upgrading of products & technologies as well as in managerial capabilities. Moreover a hands-on approach to new program implementation should be adopted in order to break the vicious cycle of decline and counteract the lack of awareness of many SME manufacturers.

Our final conclusion concerns the methodology for this kind of research. Policy relevant research in new and dynamic areas, such as those considered in this project, requires an integrated approach with microeconomic work involving interviews, no less than quantitative questionnaires; Elements of conceptual or appreciative theory; some econometric analysis (but only after sufficient in depth understanding of the new phenomena has been attained); and theory-based policy analysis. There is no other way than to proceed with a multi-methodological perspective, which includes case studies and conceptual theory. This because the basic process are still unknown, so there seems to be little pre-existing capacity to ask relevant research and policy questions. Note that policy analysis, is not 'application without theory', on the contrary, it cannot be performed without theory (in our case the *Evolutionary & Systems Perspective* and the *Policy Process\Framework).* There is mutual interaction between the microeconomic work and these theoretical elements of policy. On the one hand successful interviewing requires at least the rough outlines of 'theory'. The results of the microeconomic work would then effectively feed back into the policy framework and the policy process relevant to the country in question.

EXECUTIVE SUMMARY - Republic of Korea

1. Software Industry

The Korean software industry is new and has grown rapidly. According to our survey, the average profitability was 11.5%. The competitive advantage of software companies is very much based on “specialized expertise” and “excellence in design”, with an average rank higher than 4. But its growth was not based on its technological capabilities. Only a small portion of companies responded that they generated product, process, and incremental innovations. Major product innovation was reported only by 35% of sample firms and incremental innovations by 40% of firms.

In particular, the firms that did business for final customers recognized that product innovation was the major source of their competitive advantage, while incremental innovation was important for bespoke firms. Nevertheless their innovativeness was relatively low, by having a score of 0.97. The reason would be that most of S/W innovations are not complex and do not require original technological changes.

The reason why software firms could not accumulate their technological capabilities is that they tend to regard their main activities not as to develop new products but to provide services to other companies. Therefore many software companies, especially bespoke companies, had interest in incremental innovations as mentioned above.

However, it seems that Korean software companies have been under the pressure of innovation activities. They mentioned that the importance of innovation activities for their business was very high. It implies that these companies were in need of internal and external R&D activities.

Technological achievements of software firms are driven mainly by firms’ internal R&D efforts (score: 7.70) and non-technological activities (score: 7.35) such as marketing and delivery of service for customers.

However, Korean software firms reported that external network was important for securing their technological capabilities. The most important advantage was the capability of recruiting skilled programmer (score: 7.9) in their locations. Formal and informal horizontal partnerships with other firms (score: 6.7) are considered as important external sources that could be acquired from proximity advantage. We can observe the phenomena that software firms are concentrated in some regions.

Korean software companies reported that public institutions, including local governments and national assistance agencies, were important network links. About 95% of software sample companies received institutional supports from diverse organizations. In addition, more than half of sample companies reported that these institutional helps were very helpful. The most helpful type of support was financial supports. In fact, several ministries have prepared their own programs of financial supports for software companies.

2. Electronic Parts industry

As of 1999, the Korean electronic parts industry was ranked at the third place in the world electronic parts production, following USA and Japan. With regard to major products, Korea ranked at the first place in D-RAM, CRT, and monitor production, and at the second place in TFT-LCD and CD-ROM production. However, the Korean electronic parts industry shows a rather high level of import dependency, especially in high value-added high-tech products It indicates that the Korean electronic components industry has weakness to a certain level in core technologies.

According to our analysis, the average profit/sales ratio of electronic parts companies is about 10.6%. About 18.8% of sample companies' production are exported. It indicates that sample companies target rather domestic market. However, there are several companies in our samples that are fully export-oriented.

With regard to the source of competitiveness, most companies reported that their competitiveness came from "specialized expertise" (score: 4.47) and "excellence in design" (score: 4.06). Due to the characteristics of this industry, non-quality factors like price and delivery have no significant influence on company's competitiveness. It implies that technological capabilities play an important role in securing their competitiveness

Most of sample firms achieved their technological capabilities through incremental, product and process innovations. No sample company reported organizational innovations. With 80 percent of sample firms, incremental innovations were the most important source of competitiveness. However, product innovations were also very important, as about 47% of firms reported them.

However, by having an average score of 1.08, innovation score of electronic parts firms is relatively low. By reporting an average score of 7.07, internal technological efforts have been absolutely crucial for above mentioned technological achievements of sample firms. It implies that SMEs in electronics industry have poured great effort in internal R&D activities. Informal technological activities (score: 5.40) and other informal activities (score: 6.04) are moderately important.

External sources of innovation had played a quite important role for electronic firms. However, external sources complement internal sources of innovations. The most crucial driver of innovation is clearly internal R&D. Important external sources were recruitment of skilled worker (score: 7.2) and information and advice from customers (score: 7.1). The proximity advantages associated with these external network links do not appear to be important. Proximity matters only in case of the recruitment of skilled workers and the relationship with customers, 93% and 87% respectively.

A majority of companies (about 93%) responded that they get institutional support currently. Most of institutional help are concentrated on financial support, which is followed by information support. It implies that sample companies are in need of financial support and information, as they are active in high-tech areas. Most sample companies regard these institutional supports as very important for their business.

However, export-oriented companies are not so satisfied with these supports. It implies that more advanced companies require rather sophisticated supports.

Electronics companies identified several barriers of institutional supports. They hoped that proposal request should be simplified, evaluation process of these proposals should be shortened, and the volume of financial supports should be increased. Some companies requested “cautious selection”, because unqualified company can possible receive institutional supports.

3. Garment Industry

Economic conditions around the Korean garment industry were deteriorated since the beginning of 1989. Because of the strong increase in labor cost, together with an acute shortage of skilled manpower, profitability of this industry fell dramatically and it lost its competitiveness. The garment industry could no longer rely on expanding low-cost exports. This industry had to increase design capabilities and promote in-house brand names.

According to our analysis, there are two types of companies in the Korean garment industry: companies that have their own brands (final producers) or companies that have not (subcontractors). The profit/sales ratio of garment companies in our samples was about 9.5 per cent. It is lower than high-tech industries in our analysis. Korean garment firms could not accumulate competitive advantages, compared to the firms in other industries. They made a great effort to minimize labor costs and to renovate their companies.

The major sources of profitability in garment industry are "high quality of product" (score: 4.47), "prompt order to delivery times” (score: 3.93), and "excellence in design" (score: 3.80). In particular, high quality of products is reported the most important source of profitability in both types of firms. There are some differences in the source of profitability between final producers and subcontractors, especially in excellence of design and delivery times. Final producers considered both as very important sources of profitability.

Compared to other industries in our analysis, garment firms did less appreciate technological capabilities as important sources of their competitiveness. However, technological capabilities of final producers depend on product innovations, while those of subcontractors on incremental innovations. It is common that subcontractors should control the quality of products in order to enforce their reputation and avoid rejection rates.

However, average innovativeness score for the garment firms in our sample is 1.59, which is higher than high-tech industries. Subcontractors’ score is much higher than that of final producers. The reason for it is that lots of incremental innovations were reported as innovativeness in subcontractors.

Korean garments firms regard both in-house R&D and informal R&D as very important for attaining their technological capabilities. Average score for formal in-house R&D and informal activities is 7.57 and 6.0 respectively. In particular, final producers take formal in-house R&D activities into account very seriously. Final producers also appreciate informal R&D activities to a larger extent, while subcontractors do not have enough interest both in formal and informal R&D activities.

Garment firms identified two most important proximity advantages: ability of recruiting skilled workers (score: 7.6) and contact with their customer in their locations (score: 7.3). The importance of these two factors was very high for both final producers and subcontractors. Frequent contacts with equipment and part suppliers and information from competitors were reported relatively important.

Institutional supports were not so important for garment companies, as about half of the total sample answered that they have never received any institutional helps. With regard to types of institutional helps, information service was the most frequent support for garment companies. Such information supports were provided by local and national associations.

It is interesting to notice that traditionally representative institutions are not active in supporting garment firms. Garment firms did not mention the Korea Fashion Association and the Korea Apparel Industry Association as important institutional supporters. Therefore, we think that types of institutional supports for garment companies should be more sophisticated and extended, the information on these supports should be widely diffused. If possible, more supporting institutions should be established for enhancing technological capabilities of Korean garment firms. Furthermore, application and evaluation process for institutional supports should be simplified and shortened.

COUNTRY REPORT: TAIWAN

Chaw-Hsia Tu and Jiann-Chyuan Wang, Chung-Hua Institution for Economic Research

SUMMARY

In line with the Italian Country Report, the present Report is aimed at exploring some aspects concerning the relationship between the competitive pressure that firms are increasingly facing - which urge them to internationalise their innovative and productive activities - and their strategy of geographical location and inter-firm linkages.

Italy and Taiwan, both characterised by an industrial structure where Small and Medium-sized Enterprises (SMEs) are heavily represented, offer an excellent and promising case-study to explore such issues in detail.

The evidence hints that in the Italian IDs specialised in traditional sectors - namely textiles and clothing - the exploitation of the potential offered by global networks to strengthen communication and information has been rather weak. The limited knowledge of new global technological languages, as well as the lack of substantial organisational changes required by the new technologies to be effective, may progressively cut out geographical clusters, in spite of their successful performance due to typical comparative advantages. The future challenge for Italian local systems of SMEs, therefore, will be how to keep pace with the fast technological change getting actively involved in the ICTs revolution, as the traditional «industrial atmosphere» might not be anymore sufficient to stay ahead in the global economy.

For the purpose of confronting the Italian and the Taiwanese cases, the concepts of Global Production Networks (GPN) and of international knowledge linkages prove especially useful. To this aim, the comparison with the Taiwanese experience of SMEs and industrial clusters in textiles and clothing and electronics (with particular reference to information technology) highlights rather different paths of evolution. On an *a-priori* basis, it would seem self-evident that small firms from a small country would not be competitive in the electronic industry. However, despite the dominance of SMEs, Taiwan today has the most broadly based electronic industry in Asia outside of Japan, and it also has been less affected than other countries by the Asian financial crisis.

Contrary to the Italian case, the co-evolution of domestic and international knowledge linkages has been a major factor of Taiwan’s success: a continuous upgrading of international knowledge linkages was predicated on the development of a dense and flexible network of domestic knowledge linkages. An especially important feature is the diversity of such linkages: both the SMEs and the government have pursued many different approaches in parallel, rather than concentrating exclusively on one particular type of linkage. Common to all these different arrangements is that they are attempting to complement the speed and flexibility of smaller firms with the advantages of scale and scope that normally only large firms can reap.

The same methodology and survey questionnaire employed in Italy was also utilised in Taiwan. Enterprises were interviewed in the Summer-Fall of 1999, in the textile and clothing and in the electronic sectors. The evidence from the Taiwanese survey, presented in this Report, confirms the different evolution of Taiwan's clusters of SMEs - highlighted also in the recent literature - which have been facing particularly severe challenges over the last decades in terms of competitive pressure.

In general terms, the structural changes brought about by the sharp appreciation of the New Taiwan dollar, the severe shortage of labor and the consequent escalation of wages, the loss of the GSP (Generalized System of Preference) status, the rise of real estate prices and the aggressive competition from the Korean Chaebos occurred in the late 1980s, were all factors that have tremendously affected SMEs operating in traditional labour-intensive industries. Many of them were thus compelled to shift production abroad (mainly to South-east Asia and mainland China) to maintain competitiveness. The remaining enterprises had to redirect their business towards more skill-intensive, R&D-oriented products, searching for new product niches and new market areas to survive. This pressure has resulted in both a gradual upgrading and an actual diversification of the overall industrial structure towards cutting edge fields of activity.

However, the development of Taiwanese SMEs in each industrial sector turned out to be quite differentiated. The textile and clothing industry – explored in Section 1 of the present Report - received few foreign direct investment, whilst the electrical and electronic industry – whose main features and survey results are reported in Section 2 - was firstly propelled by Japanese joint-venture investment and by the investment of semiconductor multinational firms like General Instrument, Texas Instrument and Philips, or TV producers like RCA, Zenith and Philips.

Therefore, the textile and clothing sector has undergone a process of upgrading from a few traditional spinning and weaving products to capital and technology intensive man-made fibres and fashionable clothing, along with an intense relocation of productive activity abroad, particularly into mainland China. On the other hand, the rapid expansion of the information industry provided many more opportunities for existing and new SMEs operating in high-tech sectors. TV cable, sockets and wire producers, which were active in the electrical industry, have shifted their production to electronics, becoming more and more specialised in integrated circuits, multimedia products and other computer parts and components. A significant structural change occurred in the product mix of both electronics production and exports, due mainly to abundant human capital, large participation in global information and technological networks, flexible and specialised production systems based upon vertical and horizontal subcontracting and relying on domestic and foreign trading firms or chain stores for marketing support.

All these substantial transformations and constant competitive pressures have clearly affected both firm's size – with many successful Taiwanese SMEs growing into medium-sized or large firms - and cluster' conformation – resulted in stronger agglomeration and geographical shifts according to sectoral specificities.

Though, with regard to the issue of industrial agglomeration, the evidence from Taiwan's industrial development is mixed and rather different from that emerged in the case of Italian IDs. Although it is evident that some kind of agglomeration exists in every industry – and it has also changed over time, according to specialisation’s shifts - it is not so clear to what extent geographical concentration (in a narrow sense) has been affecting the development of Taiwanese SMEs.

Yet, the overall change and the restructuring process in Taiwan differ to a large extent from those intervened in the Italian case, where the actual diversification towards the strengthening of high-tech sectors and ICTs has so far failed to be achieved. The emergence of Taiwan's SME in the new information technologies may be attributed to several factors, among which: 1) the design of government policy created a fair and competitive business environment, enabling SMEs to survive (for example, in the case of Korea, the government promoted industrial development by fostering big Chaebos, whilst Taiwanese public support focused more on the growth of small and medium enterprises); 2) the subcontracting system provided infra-firm flexibility through the adoption of existing technology and inter-firm flexibility through the exchange of information and handling OEM contracts; 3) the absorption-type export-oriented networks also facilitated the rise of SMEs. These combined factors allowed Taiwan’s SMEs to operate effectively with a large degree of independence. This situation differs from the situation in most other countries where SMEs are numerically dominant, but usually in a subordinate position with respect to large enterprises.

The comparison of the Italian and Taiwanese experiences thus has shown that the industrial and technological development of geographical systems of SMEs can by no means be categorised in one simple strategy. As a result, the policy lessons which can be drawn is that no single approach exists - neither for enterprises nor for governments - to rebuild the reaction capacity of local systems and to address the challenges posed by globalisation processes and technological change to SMEs’ competitiveness.

Furthermore, notwithstanding all the achievement and success in fast-growing sectors, also Taiwanese SMEs are facing, and will face, severe new challenges. Because of higher labour costs, more and more Taiwanese firms are shifting their production bases to China to utilise cheap labour resources there. Although many remaining firms have been able to upgrade their technologies and find new market niches so far, it is becoming more and more difficult to move up the ladder because Taiwanese firms are now competing with the best firms from all over the world, and because it is increasingly difficult to have technological breakthroughs in highly advanced products. The need for more capital-intensive and R&D-intensive activities make it more difficult for SMEs to survive and grow. Diversified applications and designs may be a good way out, but how to market the designed products is a big challenge to Taiwan's SMEs.

There are still good opportunities existing in each industry. But as the competitiveness of China is becoming stronger and stronger, with the help of Taiwanese direct investment, SMEs in Taiwan have to work hard to find their way out.

3.2.2. Industry summaries

Cross Country Comparison for Electronics

Introduction

The electronics sector is very diverse. While normally regarded as ‘high technology’, activities can range from very scale and technology-intensive products like semiconductors to sophisticated and specialised components made in small batches to relatively simple items essentially involving assembling components. Processes can also vary in technological sophistication and scale within particular activities: the production of semiconductors includes the high-tech end of designing new products or making wafers, and a low-tech segment of final assembly. Nevertheless, on average the electronics industry is certainly technology intensive, with high levels of R&D spending at the industry level, rapid product innovation and very demanding skill needs. It has become increasingly based on scientific advance (rather than simply on engineering). Parts of the industry are at early stages of their technology development cycle, with unsettled industrial structures, rapid entry and exit, absence of accepted standards and high uncertainty.

SMEs have a number of advantages in such a setting. The unsettled and fragmented nature of the technologies, the ability to specialise in small segments, the potential for innovation in particular new niches – all allow considerable space for them to enter and grow. There are many requirements of SME success, of course: they have to find the right technological and market niche, specialise *vis-à-vis* the right set of large firms (as subcontractors), access the necessary skills and technologies and establish the right links with the science and research base. Technological turbulence and skill needs mean that the ‘natural’ comparative advantage of SMEs is less marked than in parts of the garment industry. Nevertheless, the prominence of SMEs in parts of the electronics industry (notwithstanding the dominance of giant transnationals) shows that many firms have been able to seize or create such an advantage.

Not only this, but SMEs are the leading innovators in many segments of the industry. Their innovations sometimes compete directly with those of large firms, but they are often in different technological niches, where R&D and marketing requirements are of a different magnitude. Thus, surveys of the *values* of innovations produced (measured by the sales of innovative products … years after introduction) show that large firms dominate high value innovations **[source and figures to be provided]**. This does not capture the value of SME innovations that feed into innovation or production by large firms; this appears to be very significant.

Let us now consider various aspects of electronics SME performance in our project.

Government policies

Israel: The main government impact on electronic SMEs in Israel has been implicit and indirect: high levels of defence spending and the strategic objective of developing an indigenous armaments and security industry have encouraged local producers enormously. In addition, the skill base in Israel has attracted a number of international companies like Intel to establish large facilities there. The large-scale defence and electronics industry has had massive spillover benefits to SMEs in terms of skills and information; most successful SMEs in the sample have a prior background in national or multinational firms.

The direct policies of the Israeli government to support electronics have been rather narrowly focused on pure research rather than commercial development. There has been little effort to assign priorities, translate them into programmes and implement them with appropriate adaptations to feedbacks. The government has not paid sufficient heed to the threats posed by globalisation. It needs to provide conditions or inducements for local SMEs to strike links or partnerships with world class MNCs. It also needs to link successful local electronics companies with new start-up SMEs to create and exploit technological spillovers.

England: The government in England has placed considerable emphasis on promoting knowledge-intensive, high-tech SMEs. One of the main planks of policy has been support for dynamic regional clusters of SMEs around leading universities by the creation of science parks. At the same time, the government has relied on market-based support measures, with strong encouragement to inward FDI in electronics, exposure to international competition (the defence sector sources internationally) and full cost provision of support services. Business Links and TECs charge for most of their support. Venture capital is mostly from private sources and the government provides relatively little finance.

The effectiveness of government support for electronics SMEs in England is not evident. The emphasis on supporting local clusters and linkages may be helpful in some instances but in many others international networks are becoming more important. Electronics SMEs are engaged in such diverse activities that putting them into clusters often does not catalyse joint action or technology development. The science base on which the industry relies does not receive sufficient government funding, and many feel that the base is losing its international competitive edge. The electronics industry in general in England is dominated by MNCs, and much of the technology in use originates in other countries.

Scotland: The general policy thrust is the same as in England, but Scotland has emerged as a major assembly centre for electronics MNCs and the local authorities are trying to stimulate SMEs into supporting design, subcontracting and other activities. The local firms are not in the technology intensive segments of electronics activity. There is little funding for manufacturing start-ups. The cluster promotion strategy has the same problems as noted in England, with the additional handicap that the Scottish industry lags behind that in England in the science and manufacturing base. The government needs to encourage greater links with international firms and markets.

Greece: There is no specific set of government policies in Greece to support high technology activities. The industry as such is very weak by European standards, with a relatively few firms engaged in technologically simple activities like final assembly. Research institutions are weak and government support is *ad hoc* and short term.

Taiwan: Taiwan's dynamic SME sector, with its intense export orientation and strong international linkages, thrives in a climate of strong and extensive support services and institutions. This applies to electronics as to other industries. The government encourages industrial networks where SMEs act as subcontractors to large firms in centre-satellite systems. Many of the lead firms are MNCs, but many are domestic, often spin-offs from government research laboratories like ITRI and ERSO. Government built science parks like the main one at Hsinchu, along with its promotion of engineering and scientific skills and R&D, have led to vibrant nodes of activity. The government has actively encouraged local firms to relocate lower value activities in less developed countries. However, competitive pressure from China and others means that SMEs have difficulties in keeping a sufficient technological lead. They face problems in raising sufficient finance to fund larger scale investments.

Korea: The Korean government has strongly targeted the promotion of SMEs, providing financial and other support for technological upgrading, R&D and technology import. The general policy of massive increases in technical education and training also help greatly. The main objective is to indigenise the production of advanced components and promote R&D capabilities.

R&D

Israel: R&D is strong and broad-based over a spectrum of electronics technologies covered in the sample. Technological success varies: five are very successful while another ten are less so.

England: The SME sample in England is fairly strong on R&D, with around 20% of the workforce in R&D work and high R&D expenditures per employee. Internal sources of technology are reported to be more important than external sources, but with large variations. There are several science based firms conducting advanced R&D and doing little or no in-house manufacturing, essentially functioning as private research laboratories. At the other end are component suppliers with little R&D work. In between are process control equipment makers.

Scotland: The sample has moderate levels of R&D effort with high firm level variations. Around half the sample has produced significant product innovations; component suppliers tend to be the least innovative. As in England, internal sources of knowledge tend to be more important than external sources.

Taiwan: Most of sample electronics SMEs work as subcontractors. They conduct some R&D but the level is relatively modest. Most technological effort goes into incremental improvements. Yet, internal technological efforts, rather than external sources, are the main source of competitiveness in the sample firms.

Korea: The profile is similar to that in Taiwan, with many subcontractors and much incremental innovation. Around half the sample also reports major product innovations, with several patents taken out. The electronics industry as a whole is quite research intensive, with R&D accounting for 10% of sales. SMEs also report internal R&D as the main source for competitive technologies.

Enterprise dynamism

Israel: SME dynamism is high with many new start-up enterprises. The electronics industry as such has a very high growth rate, and has established international OEM links. Many SMEs have foreign IPOs (mainly in NASDAQ), some have acquired firms abroad or been acquired by foreign firms. Domestic VC industry is very active. Several have developed leading edge technologies by world standards and are acknowledged as technological leaders.

England: Dynamism performance is very diverse, reflecting the mixed performance of the industry as a whole in England. SMEs in low technology component manufacturing are relatively stagnant while those specialising in high-tech design and precision instruments are contracting to world leaders. Instrument manufacture is a niche activity in which UK SMEs have a strong competitive edge with around 25% of sales exported.

Scotland: There are few new start up enterprises but a great deal of growth and diversification among existing SMEs. Many are exporters, and on average over 20% of sales are exported. On the whole dynamism is moderately high.
Italy: Very weak dynamism, with no clear competitive edge. Electronics only account for 1.4% of Italian exports.
Greece: Very weak. Very few electronics manufacturing companies apart from 5 computer assembly operations. Competitiveness nil.
Taiwan: Very dynamic, with several SMEs growing into large multinational firms over time. Many have also died out in the keenly competitive atmosphere. Exports account for bulk of activity, directly and indirectly by supplying large firms that export.
Korea: High dynamism recently but still lagging in high technology components. Exports high overall but most sample firms produce for local chaebol, which then export final products.

Skills

Israel: Main sources of skills in sample SMEs are experience with MNCs and large national firms, university training and technical background of founders. Skill levels are more important in explaining success of 5 leaders than of 10 less successful firms.
England: As with Israel. Science and engineering background most critical to success of high-tech science based firms. On average, as many as 30% of employees have technical university degrees.
Scotland: Previous working experience in larger firms (local and foreign) very important; Scottish sample has relatively few owners with technical degrees, same true of employees. Weaker skill base may explain lack of cutting edge technological innovation compared with England.
Italy and Greece: There are a few reasonably well-performing firms with an educated workforce and relevant prior woring experience of the management, but the skill- and experience base in the sector as a whole is very narrow.
Taiwan: Specialist engineering and electronics background, previous work experience and family business experience important sources of skills. 17 founders had engineering degrees.
Korea: Employment in *chaebol* most important, followed by university employment – this reflects the fact that the government has recently begun to support spin-offs by university staff with incubator schemes.

Finance

Israel: VC most important source of finance for electronics SMEs. Government R&D grants exist but do not give sufficient support at seed stage. Gap between seed funding and VC stages. VC companies do not cover all necessary areas, focus on 'hot' areas to neglect of others.
England: VC industry is highly developed but does not cover needs of high-tech start-ups fully. Some government support at this stage through R&D funding for universities and laboratories, but diminished over time. Other government innovation support schemes exist but limited in volume and much used. Need to be expanded because of effective administration.

Scotland: VC industry exists but lags behind that in England. Government grants from regional bodies widely available earlier but now dried up. Significant financial gap.
Taiwan: Local financial institutions and VC companies main sources of finance. Seems adequate for SME needs. Government support for technology and overseas relocation.
Korea: Many government financing schemes with grants, loans and subsidies. Substantial dynamic VC industry is emerging.

Institutional support

Israel: OCS support for SMEs is extensive, but needs to adjust to needs of globalisation. Institutional funding is uncertain. Bureaucratic procedures, inadequate screening of applicants, bias towards larger firms, bias against non-R&D technological activities. Links with universities and research institutions not clear from evidence.
England: BL and TEC networks function efficiently but may not be as effective for very new or small companies. University and R&D institute links important for several SMEs (particularly university spin-offs) but future uncertain because of science spending cuts by government. Some firms made extensive use of EU funds.
Scotland: Most of sample had financial or other support from local (LEC) or national (Scottish Enterprise or DTI) institutions. Public funding is declining. Abolition of national apprenticeship affecting skill base, alternative of NVQs considered inadequate because of lack of practical manufacturing skills.
Taiwan: Strong institutional support network, also strong cooperative system (Alliance for the Joint Development of Notebook Computers) for IT exchange and training. Industrial Development Bureau subsidises product development. Hsinchu Science Park provides many forms of support, including two universities and Industrial Technology Research Institute (ITRI). Institute for Information Technology does research and Market Intelligence Centre provides market research. Government also organises research consortia in strategic areas, highly successful in organising SMEs (together with large firms) to tackle emerging technologies.
Korea: Strong government institutional support through Electronics Technology Research Institute, also from industry association (EIAK) and private collective research institutes (KITA). Links with universities weak but government is trying to improve through funding incentives. Several science parks and towns exist; also extensive general extension support for SMEs.

Networking

Israel: One strong geographical cluster in Israel, but it does not seem to be crucial to technology development.
England: Strong regional clusters have formed in several areas e.g. around Oxford, mainly for drawing to skill pool and attractive environment. Technological networking however appears weak, links with university important for only some spin-off firms. International networking much more important than regional. Links with suppliers and customers very important.
Scotland: No obvious clustering in electronics industry (apart from one cluster which formed historically around the oil and gas industry). Local links with customers and

universities are important for some, but such ties are also national. Local networking among SMEs in electronics is not significant. Equipment and other suppliers and trade fairs are important sources of information, but these sources are primarily non-local.

Italy: No strong clusters in electronics (in contrast to garments and other industries). Links with customers, suppliers and industry associations important. No importance attached to inter-SME networking. Proximity does not emerge as a factor of importance for competitiveness.

Greece: Most firms located around Athens, but the industry is too small to speak of a cluster. Links with customers are most important.

Taiwan: Clustering is prominent for electronics in Northern Taiwan. Research collaborations with other SMEs are very important source of innovation locally. Important foreign links are with equipment suppliers, customers and licensors.

Korea: Most clusters are around large *chaebol*. Geographical clusters considered important for accessing skilled labour and contact with customers, but not for technology development. International networks emerging through export activity.

Conclusions

The samples show electronics SMEs of very different technological levels and dynamism. Those in Israel, Korea and Taiwan seem the most dynamic. Some English SMEs are cutting edge innovators, along with several Israeli sample firms. SMEs from Korea and Taiwan are also building advanced technological capabilities, often with extensive linkages with technology institutions and other firms orchestrated by the government. Active government support is most marked in Korea and Taiwan, while the extensive impact of government policies in Israel is largely indirect. England and Scotland traditionally have good SME support systems but these do not seem as active or dynamic as those in East Asia. The cutting back of science research in the UK is affecting the knowledge base that high-tech SMEs need to thrive.

By contrast, the electronics industries in Greece and Italy are very underdeveloped. They are not active in international markets, have low technological capabilities and receive little assistance from their governments.

SMEs cluster in each country but seem to gain surprisingly little in terms of technological spillovers from each other. In a high-tech activity like electronics, most linkages seem to be international rather than local, though some local linkages are important for particular SMEs that have strong historic links with universities.

Cross Country Comparison for Software

General

Across most countries in the research project, the software industry is characterised by rapid growth in both SMEs and larger firms, as capital barriers to entry are low, and market and profit potential are currently high. The exceptions are Italy and Greece, where the software industry is underdeveloped, and (to a lesser extent) Korea, whose industry recently experienced recession because the country's economic crises dampened domestic demand. There is a considerable difference within countries between the top performing and the average firms in each country. For example, average firms experience difficulties in developing new products that will be highly profitable. The most successful firms have links with international markets, as an outlet for their globally competitive software. However, they may also have a shortage of the 'excellent' graduates needed for firm growth.

In Israel, Scotland and the UK, there exist fast growing, dynamic software sectors, much more than can be surmised from firms in the Greek and Italian studies, which tend to concentrate on local or perhaps national markets. Whether because of the sector as a whole or because of the specific sample of firms considered, there seem to be important differences between software SMEs in Israel on the one hand and in Korea, Scotland and Oxford on the other.

Differences between the country samples are twofold. Firstly, there is a difference between countries' sample firms in terms of the balance between products and services. The Israeli and Korean samples explicitly included only companies involved in "software products", both packaged and customised. The Scottish sample included companies involved in "software products", including some very "customised software". Some of these firms offered ancillary services to their product customers, as not all products were sold 'shrink-wrapped'. On the other hand, the Oxford sample included firms involved in "products", "customized software" and "software services". Secondly, all Israeli firms exhibited market homogeneity, despite the variety of software products developed and sold, belonging to a fairly well specified Area (Data Security); a much greater degree of area/market and even technological heterogeneity can be found within the samples of the other regions. No such tightly-specified group of companies could be identified in the Scotland and Oxford cases, and so both countries included a cross-section of SMEs from the industry in their samples, in terms of both products and markets. The Korean sample was similarly diverse.

The Israeli sample consists of the Universe of companies comprising a specific software segment where that country developed a clear comparative advantage--Data Security. Within this sample of 19 companies a group of four (4) Very Successful companies has been identified. These companies were Start Up, SME companies initially which grew substantially both in terms of employment and in terms of other variables. Some have outgrown their SME status at least in terms of what seems to be reasonable as far as sales/market capitalization is concerned, if not in terms of employment.

Effect of Government Programs and Venture Capital Initiatives

These seem to be significant differences in the extent of Government involvement in the Software industry, with Israel and Korea revealing substantial intervention and Scotland/Oxford less and possibly less successful intervention. Greek policies towards the IT industries were fragmented, with a need for an overall strategy. In the Israeli case practically all companies received either Government subsidies to R&D (including three out of four very successful companies); Government incentives to Investment or both. Company perception about the importance of both types of incentives was in general positive, although there was criticism concerning some aspects of the design and implementation of the R&D subsidy scheme. This was felt to focus too narrowly on R&D rather than on innovation more generally. There were also problems of bureaucracy, which strongly affected SMEs applying for support. 95% of sample firms in Korea had received government assistance, and the majority had found this useful. Financial support measures were most popular, although their economic impacts seemed unclear. Other forms of government support, such as technology transfer, function less effectively.

In contrast to the above, a significant proportion of the companies interviewed in Scotland and Oxford had not made use of any direct Government assistance. In the case of Scotland, 37% of the companies had no contact at all with Government Agencies, and in the Oxford sample, 59% had never received government assistance. Moreover opinions varied concerning the effectiveness of Government support of the industry. It must be pointed out that in neither of these two geographical areas does Government support include a policy of subsidizing R&D as is the case in Israel. However, since 1999, the UK government has moved towards the introduction of tax concessions for R&D expenditure in SMEs.

In addition some fast growing companies in Scotland complained of difficulties encountered in growth, beyond the Start Up phase, rather than of difficulties during Start Up. These were not addressed by current government support initiatives. Some complaints of this kind were also found in the Israeli case, especially as far as institutional arrangements and taxation practices concerning Mergers and Acquisitions, distribution of options to employees, and the outdated Encryption Decree. On the other hand some Israeli companies were very satisfied with the tax advantages conferred by the Law for the Encouragement of Capital Investments, which resulted in less bureaucracy than R&D subsidies and were relevant at both Start Up and post Start Up phases of company growth.

Moreover, Israeli companies frequently made use of private Venture Capital finance. This was a consequence of Yozma--a Government program (and initially a Government owned Venture Capital company, founded in 1992) widely perceived to have triggered the emergence of a significant Venture Capital Industry in Israel. A final point concerning the Israeli software sector researched concerns the role of the Technological Incubator program. Only two firms out of the 19 in the Data Security Area made use of this program--one a failed firm and another a non-successful, struggling company.

Firms in the UK, Scotland, Italy and Greece experienced a certain lack of Venture Capital resources (or else did not wish for them). This may indicate either the lack of a VC infrastructure (as in Italy and Greece), or a lack of Government programs directed to inform firms about VC advantages and possibilities, and programs to generate Venture Capital, as well as the shortcomings of the private venture capital market. This situation contrasts markedly with the Israeli experience. Korean software SMEs did not have sufficient access to VC. This can be contrasted with the situation in Taiwan, where the government first set up a venture capital fund in the 1980s. Since then, the venture capital market has grown, with private companies entering the VC sector, and it has become a dynamic force for assisting SMEs to expand.

Cluster and Cluster Effects (excluding Universities)

Significant differences seem to exist between the Israeli case and those of Scotland and Oxford. In the latter cases no significant ongoing inter-firm linkages with potential competitors or collaborators were identified, either during interviews or in the survey. In some cases, inter-firm linkages were viewed negatively. The significant cluster effects recorded for the two UK areas concerned the importance of having some customers in close geographical proximity and the advantages that a geographical concentration of firms (and universities) confers in terms of the availability of a pool of skilled and trainable labour. It seems that the Cluster Policies undertaken in Scotland have not so far been successful given that no clear cluster of R&D performing companies has yet successfully emerged. The most successful firms in the Oxford and Scotland samples tended to have national and international networks, rather than being solely locally oriented. Perhaps cluster policy should also encourage firms to expand their non-local networks.

In Israel emergence of a Start Up & Venture Capital 'intensive' hi tech cluster during the 90s is a widely recognized fact given the enormous numbers of Start Up companies (over 3-4000) and the active operation of more than 50 Venture Capital companies. There has been a qualitative change --what could be termed a process of 'cluster reconfiguration'--from the situation prevailing in the 80s when there were few SUs and only one Venture Capital company in existence. In this connection it is also important to notice that the Israeli cluster is also characterized by massive acquisitions of local R&D performing companies by foreign multinationals such as Computer Associates, Siemens, Intel, Microsoft, Lucent, 3-Com, Texas Instruments, etc.

Among the Data Security companies, a significant 'clustering' aspect is the role of the Army both as a training ground and as a meeting place for future entrepreneurs and engineers and in some cases as incubators of new ideas subsequently implemented in civilian industry. In other countries in the survey, this effect is not apparent, even in those countries, such as Greece, which also have military service. This effect may be unique to the Israeli situation, but the importance of an army for its potential ability to foster high-tech knowledge and create networks for future entrepreneurs is perhaps worth considering further in policy terms. In the UK, the recent history and future part-privatisation of the government Defence Evaluation and Research Agency is one such step. An alternative is to consider which other institutions, for other countries, can play a similar role in producing cohorts with high-tech skills, and entrepreneurial and networking abilities. Universities and large firms (national or MNCs) are perhaps examples.

A second aspect in Israel concerns inter-firm links: there are several cases of Mergers and Acquisitions and/or Investments involving two companies in this area. Successful companies, both indigenous and eventually acquired by overseas multinationals, have generated important 'intangibles' to other younger and/or smaller companies, in particular by providing examples of strategies for growth (marketing strategies and spillovers, IPOs etc) as well as demonstrating the possibility of becoming global, *indigenous*, companies. However, these are not necessarily explicit linkages between firms.

A final point relates to *personal networks* and to mechanisms for *collective learning.* Both have been strong in Israel, in the Data Security industry 'everybody knows everybody'; and meetings of organizations such as the annual meeting of the Israel Venture Capital Association guarantees significant collective learning probably not so different than that reported to exist in Silicon Valley. In the more diverse samples of Oxford and Scotland, with many highly specialised firms operating in niche markets, it was perhaps less likely that such a close-knit community would be found, although industry and commerce associations provided weaker but still valuable forms of local networking. Given the increasing importance and use by UK firms of information and communications technologies that dissolve distance, the creation of national and international linkages appear to provide equally valid and valuable means of networking, especially for firms active in those types of markets. For Israel, international linkages, such as those with the US, also appear to be important.

The case of Korea also contrasts strongly with that of Scotland and Oxford, in that Korean software SMEs have strong horizontal networks and knowledge linkages with similar firms, with geographical clustering occurring in various towns around Seoul. This also enables firms to draw upon a suitable labour market, as is also the case in Taiwan. More recently, in Japan, an internet-oriented SME cluster, known as 'Bit Valley', has emerged in the Tokyo area, and there is also an emerging games software cluster in the Shinjuku district of the city.

Background of Entrepreneurs

Some differences exist between Israel, Scotland and Oxford. While the vast majority of founders of companies had Science or Engineering degrees in Oxford (82%), this was much less so in Israel's Data Security Industry. In that software segment only 50% of successful companies' founders had a Science/Engineering degree and only 75% of the whole sample of 19 companies. In Scotland, 89% of founders were graduates, but only 53% were science and engineering graduates, with a substantial proportion of the rest having business and management degrees. In Taiwan, 74% of founders were Science and engineering graduates, and the Korean founders almost all had a degree, with 75% in science and engineering and 10% in business administration. It appears that in general, founders benefit from having a university degree, but that it is also necessary for some of the firms' key personnel to have a strong scientific and technical background. In very small firms or start-ups, this will usually have to be the founder(s). Given the lack of appropriately skilled and qualified graduates in Greece and Italy, it is not surprising that even though these countries, Italy in particular, have a widely diffused culture of entrepreneurship, there are still so few start-ups in the software industry.

In none of the other countries studied was there anything comparable to the Israeli founders' Army experience, although in Scotland and the UK, a small proportion of founders had at some time worked for large firms with aerospace or defence industry interests. In Taiwan, Scotland and the UK, prior experience in large national or multinational firms was an important element in the founders' backgrounds. In Korea, which has many SMEs, large national firm experience was important, but so was prior employment in SMEs.

Links with Universities

In Scotland, the UK and Israel, Universities played important roles in terms of needs of recruiting high quality graduates in Science/ Engineering. In addition, in all three areas Universities contributed to the ideas that generated some of the successful companies, and in some cases University employed individuals (e.g. Professors) founded Software companies. In Israel the latter 'strong case' characterized three companies involved in Encryption technologies, two successful and one not so. In Scotland, university linkages were important for a third reason : management education, particularly for founders and key staff with high technological capabilities, but lower business and market capabilities. In Japan, Italy and Greece, however, university-industry linkages were weak or largely absent. Greece and Italy were both experiencing graduate skill shortages in software. Italian research institutions were also considered to lack capabilities in the software area. In Korea, linkages with universities appeared absent, but firms often had similar technological capability-building contact with public research agencies. Government research institutions serve a similar function in Taiwan, but with industry-academia linkages also important, for example, through the establishment of the Hsinchu Science-based Industrial Park : close to two major hi-tech universities, but also to a major government research organisation.

Market structures

The software industries in Israel, Scotland and the UK are characterised by having not only local and national, but also international markets for their products. In Italy and Greece, local and national markets prevail, with the Italian local market being government-protected, and the Greek software market being oligopolistically structured. These differences appear to hold back development of the software industry in these countries. For example, the Italian software firms developing specialised software for use by engineering companies could perhaps export their products, were these not so closely tied to the (Italian) context of use. The emerging Korean software industry is fast growing and profitable, but does not yet generally access international markets because firms lack experience in exporting. Taiwanese firms, on the other hand, are mostly export-oriented.

Recommendations

- **Clustering**. In all cases a close look should be given to cluster formation and evolution, and to related policies. The Israeli cluster, while successful in terms of Start Up formation, is much less so in terms of growing larger, global companies which might successfully leverage R&D and generated growth and employment in the national economy. This holds both for the high tech cluster in general, for software and for Data Security (and despite the generation of two very successful indigenous companies in Data Security). This entails a shift from a Neoclassical perspective to policy which focuses on R&D promotion to an Evolutionary and Systems of Innovation perspective which focuses both on R&D and on other factors (such as Management and institutional aspects); and which--from a broader business sector perspective--attempts to assure that hi tech growth become a driver for growth in other sectors as well. A new perspective to policy; a new portfolio of programs (with more targeted programs and more institutional change, all of this based on an explicit strategy) and shift to a more knowledge based and integrated *policy process* is required. The set of priorities for Technology and Innovation policy in this decade should significantly differ from that guiding policy in the 90s.

In Scotland and Oxford the problem (if there is one in this area) seems to lie in *cluster emergence.* In Scotland, the term 'cluster' is understood by government agencies to involve a strong element of geographically *localised* inter-firm links, personal networks, collective learning mechanisms and Venture Capital. If this is the objective, there is still some way to go, particularly with regard to inter-firm linkages. *Cluster reinforcement* may be an issue rather than the *cluster reconfiguration* suggested above for Israel. However, the importance of national and international networking for competitiveness should also be considered, and policy developed to strengthen this rather than fostering a too-inward-looking local focus.

- **University-industry linkages**. A reinforcement or creation of University - Industry links appears important for all areas, a process also requiring a significant element of academic, policy-relevant research. The importance of government / public research agencies for knowledge transfer and innovation to firms in the three Asian countries studied also suggests that these could be a significant source of competitiveness. Although university-industry links are very weak in Japan, and weak in Korea, with government research agencies providing some of the technological knowledge linkages that universities afford in countries such as the UK, this is not the case in Taiwan, where both types of institutional links with SMEs are found.

- **Strategic policy-making**. The adoption by Government or Regional Authorities of a strategic element to policies aimed at improving the competitiveness of countries software industries also appears significant.

- **Venture capital.** In countries where the venture capital infrastructure is weak or otherwise underdeveloped, this needs to be strengthened, as VC provides an important mechanism for firm expansion. Government-funded VC programmes also help stimulate the VC industry, particularly in its early stages. Support for alternative sources of funding to VC might also be considered.

- **Innovation support.** Policies increasing support for innovating firms need to be developed. This might be in the form of tax concessions at the national level for R&D activities, or more locally in terms of support measures encouraging new software product development, for example, through grants and awards, such as already exist in some countries for more tangible products.

- **Linkages to international markets.** In general, governments need to assist firms in creating and strengthening their linkages with international markets, as the development of firms with globally competitive software products appears to be highly significant for industry competitiveness in general. International network creation, the fostering of international marketing skills within SMEs, and increased export assistance would seem to be the main methods of achieving this.

Cross Country Comparison for Garments

1. Main results

As emerge from the summary table, the fieldwork at country level carried out within the Project has highlighted some common features which, beyond the remarkable differences in the national weight and evolution of SMEs operating in the sector, can be summarised in the following points:

STRUCTURAL FEATURES:

- Higher competition coming from less developed and emerging countries which are exploiting their comparative advantages based on low-skilled and low-paid labour force. It has to be noted that the competitive pressure on all the countries analysed in the Project has dramatically increased not only for low quality/low costs products, but also in high quality/high costs market segments (e.g. skills upgrading in emerging countries has been increasing at unexpected rates);
- Strong geographical agglomeration and embeddedness in local socio-economic contexts of production activities for the sector as a whole;
- Decline in sectoral shares of both total manufacturing production and exports, particularly since the half of the 1980s;
- Strong tendency, especially during the 1990s, towards delocalisation and/or outsourcing, as a consequence of the increasing pressure on SMEs to further internationalise their operations;
- Increasing role of marketing and distribution.

MAJOR STRENGTHS:

- High quality of inputs and transformation processes, particularly as far as design is concerned;
- High quality of output;
- Tendency towards the hierarchisation of inter-firm relationships within geographical clusters, i.e. the emergence of leaders, both local and external medium or large sized firms;
- Strong local networks (inter-firm, user-producer, etc.).

MAJOR WEAKNESSES:

- High costs (particularly labour costs);
- Low marketing capabilities;
- Weak international networks;
- Relatively low level of skills;
- Wide gap between production and technological institutions;
- Little use and diffusion of ICTs.

Public policy recommendations

On the basis of the main findings of our research described above and reported more in detail in each country Report, and in observance of the subsidiarity principle, the effort of public policies at both national and Union level should take into account the broad following guidelines:

- Due to the dramatic increase of competitive pressure, it is clear that the competitive advantage of final producers in the sector primarily lies on in-house design and development capabilities, innovative use/adoption of new technologies and specialised expertise in particular market segments. The urgency of sectoral upgrading (higher quality, higher *styling* and design content) should underlie, as a main industrial target, the whole process of competitiveness restructuring of SMEs operating in the relevant field of production. For this purpose, public intervention should encompass in particular:
    - Measures to increase quality control, application of computer assisted design systems and IT to production, documentation of quality standards towards authorities and customers
    - Upgrading skills and professional competence: i.e. whilst design capabilities turned out to be a central tool for competitiveness, most SMEs at present do not devote resources to training, neither internal nor external to the firm
    - Establishing Fashion and Design Centres, providing services that encourage garment-related SMEs to move towards more innovative

and therefore higher value added products, less vulnerable to price competition. They should also act as intermediary agencies contributing to the technological diffusion and upgrading of garment and clothing companies;

§ The emergence of a new kind of relationship between economic activities and space is likely to change both the configuration and role of geographical proximity. Globalisation and the ICT revolution have spurred the reorganisation/rationalisation of the spatial distribution of economic activities, reshaping the relationships between firms and territory, particularly in an economic integrated area such as the Union. The implication is that public intervention for SMEs operating in sectors such as that under observation should have, both at the national and EU level, a strong regionally (and locally) oriented focus, depending on the type of prevailing pattern of subnational agglomeration of sectoral activities (i.e. IDs in Italy, counties/districts in Taiwan, regions in the UK, etc.), yet open to international production and technological networks. The decentralisation of competence is a general requirement to make both planning and implementation of public policies more effective;

§ Supporting international networks and Global Production Networks. The tendency towards hierarchisation of inter-firm relationships may helps boost the merging between local and global networks, which is a crucial mechanism to participate in the worldwide process of creation and diffusion of technological innovation. Public support to internationalisation, in all its modalities (exports, inward and outward FDI, international alliances, etc.) should aim at achieving the integration between internal and external forces, between local firms, the territorial system and the global market;

§ Improving marketing capabilities and the diffusion of business service, particularly new financial services, which could provide ad hoc support, more flexible financial instruments and easier access to capital for SMEs. Furthermore, nowadays the key to success lies increasingly in efficient marketing, rather than in efficient production, particularly as far as low-tech products are concerned. Institutional support to generate commercial interests, to broaden potential markets and to promote media reports and dissemination of information may be crucial, especially for SMEs specialised in traditional sectors such as garments, knitwear and clothing. In such case, indeed, where these activities are often well beyond the capacity of individual actors, marketing consortium and networks can help boosting competitiveness by exploiting inter-firm collaboration. Institutional support can count for the (necessary) long-term vision which seems to be lacking in small and medium productive units deeply embedded in local realities;

- Weakness of forward, commercial and inter-organisational linkages may hamper the competitiveness of the sector as a whole. Clusters and networks would be more likely to be successful if they are able to promote "forward inter-firm linkages". This allows to organise partnerships without the risk of mistrust and opportunism of competing firms and at the same time may help rectify the short term market vision;
- The widespread diffusion of information and communications technologies, as the main "communication challenge", is a necessary prerequisite to cope with the new competitive environment, irrespective of sectors, as all fields of economic activity are knowledge intensive and should be considered as parts of the "learning economy". The adoption of initiatives to encourage garment SMEs to use electronic communications and the Internet for business and to adopt e-commerce may be coupled with centralised ordering/booking systems (e.g. local or regional agents dealing with e-commerce on behalf of small entrepreneurs);
- Encouraging collaboration between business sector and technological institutions and design colleges. As suggested in some country Reports, contacts should be favoured (or created *ex novo*) with art, design and fashion colleges or specialised training institutions at staff and student levels. Design centres and technological institutions in general should receive public support and their location should be encouraged particularly where there is a higher potential for the creation of spillover effects;
- Implementing structural measures to upgrade infrastructure, particularly New Technological Infrastructures specific to the sector. Technological infrastructure consists of science, engineering and technical knowledge for the

private sector and it includes generic and product-specific technologies, technical information, research and test facilities, forums for joint industry-government planning and collaboration, assignment of property rights, etc.

However, as has also been highlighted in the country Reports, the actual policy challenge is to retain an effective balance between the need for a central plan and a sector-specific industrial policy and the need of strengthening the regional dimension of intervention and subnational linkages. Low tech and traditional sectors are often highly innovative, as they are knowledge intensive from a systemic point of view. In other words, the policy approach should look not only at firms' performance as such, but also at the integration of firms into "complex social and economic relationships with their environments" (Smith, 1999), as well as into the global production and technological networks.

The research has also pointed out some interesting differences with Asian SMEs systems operating in the sector. More in particular, as turns out from the Taiwan's Report, the key to both the successful restructuring of low-tech productions and to the diversification of national specialisation patterns towards technologically intensive sectors - starting from a highly "traditional" manufacturing base, with a remarkable share of garment exports - engaged in by firms in Taiwan, lies to a large extent in the institutional environment which shapes their decisions. Technological and industrial institutions (i.e. Industrial Development Bureau, Industrial Technology Research Institute, Institute for Information Industry, etc.) in Taiwan have played a crucial role in driving SMEs towards outward orientation and incessant technological upgrading, shifting the attention away from the aim of competitiveness based on costs minimisation. Public sector industrial and technological institutes have been scarcely concerned with the production of national scientific research, whilst they have been very active in technological scanning and technology transfer. Just to quote an example, R&D and technical consortia are established for short periods of time (normally 1-2 years) to ensure that SMEs remain abreast of major technological developments (Mathews, 1999). Connections and linkages have been valued above all and the attraction of foreign investments has complemented the encouragement of local SMEs.

The analysis of strengths and weaknesses of garments SMEs in Europe has therefore a major general implication for public policy: more than the typical financial incentives, tax benefits and credits, it is decisive to create the right institutional setting able to reinforce the coevolution of government-business-technology/research sector relations as technological capabilities expand and to establish interactions between local systems of SMEs (with their tacit and contextual knowledge) and the codified knowledge generated at the global level.

SUMMARY TABLE : TEXTILES AND CLOTHING

	ITALY	TAIWAN	ENGLAND	SCOTLAND	JAPAN	GREECE	ISRAEL
STRUCTURAL FEATURES	1980s: § Successful restructuring of the Marshallian model of ID § Embodied technological change (machinery and equipment) 1990s: § Delocalisation (East Europe) § Small size still dominant (however, large distribution chains are emerging)	Late 1980s-early 1990s: § Sharp appreciation of New Taiwan $ § Strong rise in wages § Loss of GSP status § Aggressive competition from other Asian producers § Relocation of productive activity abroad, particularly into mainland China § SMEs growth into medium–sized or large firms	§ Strong currency § Low wages § Dominated by Asian producers § Fragmented institutional support	§ Sample firms mainly knitwear and cashmere § Contracting industry, aging workforce § Successful shift into niche markets § Strong overseas competition	§ Separation between distribution (design/brands) and manufacturing (production) § Subcontracting manufacturers, mainly located in rural areas	§ Remarkable decline of sectoral share § Strong domestic and international competition § Currency appreciation § External outsourcing § Strong geographical agglomeration § Two-speeds growth	§ External outsourcing § Strong overseas competition
STRENGTHS	§ Design § Product quality upgrading through decentralisation (at national level) § Hierarchisation of inter-firm relationships in some IDs § Strong linkages with local institutions in some IDs	§ Upgrading from few traditional products to capital and technology intensive goods § Very sophisticated input support network § High Intra- and interfirm flexibility due to subcontracting and OEM	§ Strong Asian business links § Strong survival spirit § Low profit margin	§ Highly skilled, experienced workers § High quality products, niche markets § Good level of design and production engineering § Good networks (local+international)	§ Quick product cycles § High product quality § Higher standard of living for employees	§ Improvement of production capability § Flexibility	§ High level of fashion and design § High level of technical infrastructure

		production						
WEAKNESSES	§ Little presence in Global Production Networks § Weak distribution and marketing § Excessive vertical disintegration § Limited use of ICTs and business services § Large segments of low quality/cost producers § No university-industry linkages	§ Weak designing capabilities § Lack of own market channels § Lack of promotional capabilities and brand image § Role of SMEs diminished by the more capital- and R&D-intensive character of the sector	§ Low design capabilities § Low technological level § "Cut-make-trim" operations only § Limited entrepreneurial vision § Lack of specialised skills	§ Lack of training/college courses § Lack of marketing skills § Lack of financial support for capital investment § Slow capacity of response by firms (too strong tradition)	§ Decreasing cost competitiveness (*vis à vis* other Asian producers) § Decreasing competitiveness on design (*vis à vis* European competitors) § No relationships with Universities and colleges	§ Short-sighted perception of the market § Lack of light infrastructures particularly in Northern Greece § Lack of strategic inter-firm collaboration	§ Too rapid increase of wages § Fast liberalisation of imports (particularly from China) § Low awareness of technological innovation § Lack of trust and co-operation
POLICY IMPLICATIONS	§ Support at national and local level to internationalisation (both active and passive.: i.e. to attract FDI in distribution networks) § Improvement of business services, particularly new financial services § Strengthening the diffusion of information on Global Production Networks	§ Upgrading design capabilities (i.e. by setting up joint training centres, or outsourcing new fashion information) § Supporting collaboration between downstream and upstream firms to improve efficiency and quality	§ Definition of an industrial strategy (sector-specific) § Coherent institutional support § Financial support for design-centres	§ Strengthening marketing skills § Fostering Internet potential awareness § Fostering further design capabilities § Focus on regional initiatives § Improving capital funding		§ Strengthening regional planning: § training for skills in marketing § promotion of forward inter-firm linkages § creation of light infrastructure	§ Strengthening concentration on high quality § Fostering outsourcing of quality § Improving use of technological potential (i.e. by organising professional seminars and visits with local manufactures, particularly in Palestinian Territories)

3.3. Benchmarking (see annexe : BENCHMARKS OF COMPETITIVENESS AND INNOVATIVENESS: AN ECONOMETRIC APPROACH)

The main factors determining SME competitiveness and innovativeness were found to be as follows :

- Levels of product innovation
- R&D expenditure per employee
- Ratio of employed scientists & engineers to total employment in the firm
- The number of technology licences purchased
- Changes over time in the ratio of employed scientists & engineers to total employment in the firm
- Levels of process innovation
- The socio-economic embeddedness of the firm at the international level.

The results indicate that in-house technological effort (R&D expenditures, a minimum standard of skilled employees, and process innovation) and technological transactions (licenses purchased) are the main benchmarks of innovativeness, and are also the indirect factors that determine firms performancec are the direct factors of a firms competitiveness. Given the predictive capacity of the model, the indirect factors can be termed benchmarks of innovativeness and the direct factors benchmarks of competitiveness.

The findings across European and Asian Countries strongly suggest that they share the same benchmarks of innovativeness and competitiveness. It can therefore be argued that the competitiveness of Asian firms does not rely only on low cost strategies, as is widely believed, but also on technological effort, and innovation.

Firstly, firms in the garments sector are less innovative than firms in the “high-tech" sector. In this sense, the low-tech firms can learn from the high tech firms. The second point to be emphasized is that Asian firms score in both garments and high-tech sectors relatively higher compared to the European firms. This is particularly true for garments where European firms appear to be lagging behind Asian firms, in terms of innovation. The differences, however, are not that pronounced in the high tech sector, where the Israeli high-tech firms present the strongest innovation potential.

In the garment industry, in terms of competitiveness, the Asian firms appear to be the best performers, where the Korean firms perform better than Taiwan. Italian Garment firms score better amongst the European, to be followed by the Greek firms. English and Scottish firms are to be found at the bottom of the distribution. The success of the Italian garment firms stems mainly from R&D, whilst in the Asian cases it is skills that play a dominant role. Asian firms on average score higher in process innovation and licensing, implying an extensive process of technological upgrade and adoption of technological changes.

Benchmarks provide pointers for rectifying disadvantages, as well as highlighting national-level advantages. For example, in the garment industry, the main drawback of UK firms appears to be the lack of skilled employees. Even the Italian firms need to upgrade their stock of skills beyond the level of craftsmanship to sustain competitiveness. On the other hand, Greek firms have good skill levels, are internationally embedded, and design- focused. They lag, however, terms of technological upgrade. In this sense their human potential is underutilized. In this sector the issue of skills is highly related to local embeddedness.

In the High Tech sector, the Israeli firms proved to be the best performers to be followed by the Italian and Scottish firms. The UK firms stand somewhere in the middle whilst Greek firms are lagging well behind. As far as the Asian countries concerned, the analysis shows that the Taiwanese firms score better than Korean firms. The success of Israeli firms appears to be related to international embeddedness and internal effort. Israeli international embeddedness is, by far the highest compared to the rest of the sample. Moreover, high levels of R&D, and a high ratio of scientists and engineers in firms, rather than adoption of process technologies or licensing, also distinguish Israel from the other countries. In this sense the Israeli SMEs exhibit an ability for indigenous production whilst the majority of SMEs in the other countries are mainly technology users.

The analysis shows that policy lessons for the Garments sector can best be drawn from the Asian and Italian cases, while the performance of Israeli IT sector can become a point of reference for the other countries under consideration. However, no blueprint for success can be identified, nor can a policy model be transferred wholesale from one country to another.

4. CONCLUSIONS AND POLICY IMPLICATIONS

4.1. Conclusions

The most significant conclusions of the research can be stated by re-examining to the research objectives.

4.1.1. Benchmarking SME technological performance and competitiveness in Europe and Asia.

The project has developed and utilised a new method of benchmarking the innovative capabilities and competitiveness of SMEs. The results indicate that in-house technological effort (R&D expenditures, a minimum standard of skilled employees, and process innovation) and technological transactions (licenses purchased) are the main benchmarks of innovativeness, and are also the indirect factors that determine firms performance. Product innovation, international embeddedness (and particularly interaction with international customers and suppliers), and the effort to upgrade the human potential are the direct factors of a firms competitiveness. Given the predictive capacity of the model, the indirect factors can be termed benchmarks of innovativeness and the direct factors benchmarks of competitiveness.

The findings across European and Asian Countries strongly suggest that they share the same benchmarks of innovativeness and competitiveness. It can therefore be argued that the competitiveness of Asian firms does not rely only on low cost strategies, as is widely believed, but also on technological effort, and innovation.

Firms in the garments sector are less innovative than firms in the “high-tech" sector. In this sense, the low-tech firms can learn from the high tech firms. The second point to be emphasized is that Asian firms score in both garments and high-tech sectors relatively higher compared to the European firms. This is particularly true for garments where European firms appear to be lagging behind Asian firms, in terms of innovation. The differences, however, are not that pronounced in the high tech sector, where the Israeli high-tech firms present the strongest innovation potential.

In the garment industry, in terms of competitiveness, the Asian firms appear to be the best performers, where the Korean firms perform better than Taiwan. Italian Garment firms score better amongst the European, to be followed by the Greek firms. English and Scottish firms are to be found at the bottom of the distribution. The success of the Italian garment firms stems mainly from R&D, whilst in the Asian cases it is skills that play a dominant role. Asian firms on average score higher in process innovation and licensing, implying an extensive process of technological upgrade and adoption of technological changes.

In the High Tech sector, the Israeli firms proved to be the best performers to be followed by the Italian and Scottish firms. The UK firms stand somewhere in the middle whilst Greek firms are lagging well behind. As far as the Asian countries concerned, the analysis shows that the Taiwanese firms score better than Korean firms. The success of Israeli firms appears to be related to international embeddedness and internal effort. Israeli international embeddedness is, by far the highest compared to the rest of the sample. Moreover, high levels of R&D, and a high ratio of scientists and engineers in firms, rather than adoption of process technologies or licensing, also distinguish Israel from the other countries.

4.1.2. Analysis of networking aspects of SME technological development in Europe and Asia.

The networks of firms in all sectors were examined over two dimensions : their importance for technological knowledge flows; and the frequency and intensity of external firm linkages. These aspects of networking were analysed at local, national and international levels, in order to provide information about the importance of proximity advantages and other cluster effects. The results differed between industries and countries, and between Europe and East Asia. Some interesting and perhaps contentious findings emerged from this exercise.

Firstly, SMEs in the garment sector, a long-established and traditional industry, showed strong local geographical clustering across all countries. They were reliant on a skilled local labour pool; engaged in inter-firm contracting (whether as subcontractors or contractors) with local firms, both SMEs and large firms; sourced at least some of their raw materials and capital equipment locally; were likely to be involved in local industry or trade associations; and often had received assistance from local government support agencies. Many also sold their products locally. In England and Scotland, firms also used the services of the local publicly funded design centre.

Garment firms in all countries - including the Asian countries - studied were experiencing similar difficulties and facing similar external environments : intense competition from countries whose SMEs were able to produce low-cost, lower-quality products using low-wage, low-skilled labour. All countries had responded by attempting to move production quality up-market and by emphasising the design element of their products. How far they had been able to achieve this depended on the market perception of their original products. Some countries, particularly in Italy and Scotland, had reacted by moving into very high-quality niche markets. However, all still faced increasing competition even in these new markets from lower-cost manufacturers of high-quality products in newly industrialised and developing countries.

What was notable was that the more successful garment firms were not only utilising local cluster effects, but also developing national and international networks on both the supply and demand side : sourcing raw materials globally, producing for niche global markets, and selling to an international customer base. These connections - external to their local cluster - were crucial for the firms' survival. In some countries, government support agencies had recognised the importance of the international dimension, and offered export assistance. Although this was a start, it was not sufficient, and would need to be expanded. Generally, garment firms lacked broad market capabilities : not just in sales and marketing, but in the very design of products for a wider market. Local clustering may inhibit SMEs from keeping up-to-date with fast changing market and customer requirements. They needed to create linkages with a non-local network of designers, customers, wholesale and retail outlets in order to survive and thrive. In order to do this, they also needed to make use of the new information and communications technologies.

Hence, even in an industry in which clustering has historically been a very important source of competitive advantage, the situation is changing, and firms across Europe need to develop international linkages, as well as making best use of the proximity advantages of local clustering.

Secondly, the position of SMEs in the high-tech sectors - electronics and software - in Europe is even more ambiguous with regard to the proximity advantages of clustering. Firms in the sample were sometimes geographically clustered, as in Scotland's 'Silicon Glen' (electronics - software firms were not locally clustered), or the Oxford area of England, or in the metropolitan districts of southern Greece. This was not always the case - high-tech firms in Italy were not in physical proximity, unlike in garments and many other industries. However, even where firms were in the same locality, they did not always cluster in the sense of inter-firm contracting. This may be partly because many were operating in specialised, often global, niche markets (for specialist instrumentation or software packages, for example), although electronics SMEs that subcontracted from large firms did tend to have inter-firm contacts. These latter firms were not necessarily the most innovative or competitive in the sector, and were vulnerable to competition.

Although Asian electronics and software firms tended to be geographically clustered, particularly in Korea and Taiwan, it is not clear whether the benefits that these countries' firms experience through clustering would be applicable or desirable in Europe. In Taiwan, many SMEs operate as component subcontractors to large firms, with little support for in-house R&D or innovation. In Korea, SMEs have traditionally formed part of the chaebols - local subcontracting networks centred on family firms. However, although clustered, they lag in R&D, and lack international marketing experience. Hence the Asian examples may not be appropriate models for the European electronics and software industries.

The most successful firms in the electronics and software industries in Europe tended to operate in specialised, global, niche markets. In order to do this, they had created national and international networks of customers and suppliers. They also had links with universities, some of which might be local, but might also be international, depending on where the global research expertise was found. Many were using ICTs to dissolve distance between themselves and their international suppliers and customers. In the case of software, it was also possible to interact with product and customers electronically.

Although government support measures in some countries in the study (Scotland and England) had an explicit strategy of creating and supporting clustering in both the electronics and software industries, this did not appear to have created local inter-firm linkages. This was partly because of the diversity of both sectors. Even in Israel, where a strong software cluster has grown up, the technological and innovation spill-over benefits are not at all clear.

Local industry-university links in the UK countries still appeared fairly strong despite the erosion of the UK research base, perhaps because of renewed policy emphasis thereon (encouraging universities to create links with industry). However, in some countries in the study, notably Greece and Italy, the academic research base is weak, and would need to be strengthened before it could make fruitful linkages with industry, local or otherwise.

It would appear that the proximity advantages of clustering may not be of as much use to SMEs in the electronics and software industries as might be thought. Successful, innovative and competitive firms in these industries tend to occupy global niche markets, and would therefore benefit more from developing their international linkages further. In this context, increased government support measures are needed to encourage firms to create and maintain such links (including more export support schemes) and to utilise ICTs to enable them to do so.

4.1.3. Analysis of the role of financial institutions in supporting innovation by SMEs.

In general, the European system for financial support of innovation appears to have many shortcomings, including over-reliance on market mechanisms to assist innovative activity. Both government support and private venture capital investment for R&D and other innovative activities is lacking, particularly in countries such as Italy and Greece, where the VC infrastructure is very weak. In the UK countries, the effects of recent government tax measures for assisting firms which carry out R&D have yet to be seen, but they are likely to prove insufficient. Although both England and Scotland have a VC infrastructure, this is not as supportive as it might be, partly because of over-concentration on high-tech areas which are seen as currently 'hot', and partly because the VC firms are still somewhat conservative in their investments. It is also the case that firms lack information, both about the realities of the VC process, and about alternatives.

Government support for high-tech firms generally, and R&D activities in particular, appear to need improvement. Measures for assistance are often insufficiently industry-specific, and may not take into account either the capital-intensive nature of start-up (electronics, for example), or the intangible nature of the product and the difficulties in assigning costs to R&D that firms experience (software). Software firms may not apply for assistance or awards for NPD, as these may be couched in terms which exclude the producers of intangibles. In the garment industry, where incremental, rather than radical, design innovation is the major source of competitive advantage, firms also appear ineligible to apply for government design (D&D) and NPD assistance and awards.

The Israeli case study demonstrates how a public and private VC system can be made to work well, highlighting the importance of initial government VC funding as a means of later attracting private investors (see Israeli country study Annexe). The same is true of the Korean example (see Korean country study Annexe). The Israeli example in particular might usefully serve as a model within Europe.

4.1.4. Methodology

The final conclusion concerns the methodology for this kind of research. Policy relevant research in new and dynamic areas, such as those considered in this project, requires an integrated approach with microeconomic work involving interviews, no less than quantitative questionnaires; Elements of conceptual or appreciative theory; some econometric analysis (but only after sufficient in depth understanding of the new phenomena has been attained); and theory-based policy analysis. There is no other way than to proceed with a multi-methodological perspective, which includes case studies and conceptual theory. This because the basic process are still unknown, so there seems to be little pre-existing capacity to ask relevant research and policy questions. Note that policy analysis, is not 'application without theory', on the contrary, it cannot be performed without theory (in our case the *Evolutionary & Systems Perspective* and the *Policy Process\Framework).* There is mutual interaction between the microeconomic work and these theoretical elements of policy. On the one hand successful interviewing requires at least the rough outlines of 'theory'. The results of the microeconomic work would then effectively feed back into the policy framework and the policy process relevant to the country in question.

4.2. Implications for future research

In the light of the research results, further research would be useful in the following areas

- To examine the relationship between technological benchmarks and labor cost factors, and the policy implications arising
- To account for the apparent lack of competitive advantage accruing to firms arising from local clustering by comparison with the national and international dimensions of socio-economic embeddedness, and the policy implications arising

4.3. Policy implications

The policy implications of the research findings, and the policy recommendations based thereon are diverse.

Firstly, they include country-specific recommendations, often at industry level. This is because of the variations in innovation and competitiveness between countries, and because of specificities in the different national contexts within which policy recommendations can be made. There are also variations in innovation and competitiveness between industries within individual countries, particularly between the more high-tech electronics and software industries, and the lower-tech garments industry. Our findings indicate that different policies are needed for each country, and that at this level, sector-specific policies are needed.

Secondly, the policy recommendations include industry-level recommendations across national boundaries, where these can be made because of the similarity of industry structure, strengths and weaknesses between countries in this study. This is particularly the case for the garments industry, in which all countries in the study (including the Asian countries) faced broadly similar issues. However, there are also some major issues, such as financing and networking, on which broad policy recommendations can be made with transnational applicability.

4.2.1. Country-specific policy recommendations

Scotland

Electronics

Networking and clustering	• Review the effects to date of industry 'cluster development' policies on electronics SMEs in Scotland, including the Alba Centre as an incubator for start-ups • Introduce electronics and related SMEs to large firms with subcontract requirements at a more personal level than via a trade directory • Encourage further electronics SME contact with universities for graduate recruitment, management education, research and technological knowledge transfer, and as potential customers, particularly for specialist equipment, components and materials
Information flows	• Encourage more firms to contact their local government support agency • Provide more information to firms on EU funding and arrangements for research partnering with universities, perhaps through newsletters and seminars, with speakers from Scottish SMEs that have successfully made use of these schemes.
Workforce issues	• Review usefulness of Modern Apprenticeships and Skillseekers for the electronics industry • Address apprenticeship and trade union recognition issues for plastics engineering companies
Market capability support	• Continue and extend export support initiatives • Create / extend initiatives to encourage electronics SMEs to utilise electronic communications and the internet for business
Technical capability support	• Review support for capital investment in electronics and related industries • Review support for R&D activities

Software

Clustering and networking	• Review the effects to date of industry 'cluster development' policies on software SMEs in Scotland, and consider what kind of clustering would be most useful for the future, and how to develop it. • Further support industry-academia collaboration for technological knowledge transfer, management and business education, and recruitment and work placements
Information	• Encourage more software firms to contact their local government support agency • Provide information and assistance to firms on EU funding and arrangements for research partnering with universities (see electronics) This information could be centrally based at Scottish Enterprise, and made available as a set of web pages with links to EU sites.

Firm growth	• Develop better support mechanisms for firms undergoing rapid growth and expansion (including for business management and organisation) • Examine support provision for firms wishing to grow more organically • Tailor assistance to the needs of the firm's product development lifecycle, not just at start-up, including support for R&D activities
Market capability support	• Continue and extend export support mechanisms
Recruitment	• Continue and extend recruitment initiatives such as 'Graduates into Software'

Garments

Market capability support	• Continue, and extend export support initiatives to established garment firms, including support for attendance at trade fairs, and marketing assistance • Create initiatives to help introduce garment SMEs to editors and style feature writers in the general newspaper and magazine press, and the more specialist fashion press, and aim to build ongoing relationships. This might include conferences and open days, and could also include an indirect promotion of other businesses and tourism (the Scottish Borders as a location for fashion photoshoots). • Create / extend LEC initiatives to encourage more garment SMEs to use electronic communications and the Internet for business. • Establish a regional or national agent dealing with e-commerce on behalf of small knitwear and garment firms. This could be linked into the planned 'Ossian' e-commerce system (a centralised ordering / booking system) for Scottish tourism and events. This could also be extended to food-oriented SMEs (local producers or restaurants). • Build contacts with art and design and fashion colleges in Scotland (and the rest of the UK) to bring in fresh design talent for short-term assignments. • Encourage firms to attend fashion degree shows to meet students and scan trends.
Business capability support	• Review current LEC provision for business, computing and finance-oriented start-up support, extending facilities to more garment SMEs, in a user-friendly way appropriate to the needs and abilities of people in the region
Innovation	• Further encourage innovation in the garment industry, and establish support initiatives for new product development which take into account the importance of incremental (rather than radical) innovation for industry competitiveness
Networking	• Encourage garment SME contact with local (or Edinburgh-based) colleges and universities for business and management education

	• Build contacts with art and design and fashion colleges in Scotland (and the rest of the UK), to make links with students who will be the British designers of the future. • Encourage greater networking and co-operation between support agencies and other organisations in the region
<u>Recruitment</u>	• Review the longer-term future staffing and training needs of the industry in collaboration with firms and local colleges • Build contacts with art and design and fashion colleges in Scotland (and the rest of the UK) at staff and student levels, to further encourage and publicise the Graduate Placement Scheme for knitwear firms (and the grants available to firms).
<u>Capital equipment and premises</u>	• Grants, loans and other support for investment in capital equipment are an issue (though this may improve from 2000, when the region gains EU Assisted Area status) • Support for refurbishing part of *rented* premises as a showroom would be welcome
<u>Assisted Area status</u>	• If not already planned, publicise new initiatives in the Borders under Assisted Area status, and examine the 'lessons learned' for SME provision by other areas that have already experienced this form of EU support.

<u>Oxford</u>

Electronics

- SME electronics firms in the UK range from low value-added component assemblers to technologically highly complex companies involved in designing major innnovations for the world's leading companies. The competitive prospects for the former are clearly unfavourable, as they are increasingly under threat from lower cost producers overseas. However, there are also a number of highly promising high-tech electronics firms. In the Oxfordshire and Berkshire areas, several of these companies have spun off from public laboratories or universities at a time when the Thatcher government started to put pressure on these institutions to commercialise their innovations. Ultimately, several of the public laboratories were themselves privatised, and they were no longer in a position to pursue research in non-core areas that would not contribute to substantial profit. It would seem that this has given rise to several spin-offs at the time. Several of these spin-offs have grown into promising knowledge-based companies which are capable of developing world-class innovations and which are international in outlook. These are precisely the sort of companies that the UK government seeks to promote, since they contribute and strengthen the country's competitive advantage in high-skill occupations and new areas of scientific knowledge.

- However, it is questionable whether the spin-off process that we have seen in the past will be sustained at the same rate in the future. The public science base has shrunk considerably, and with it long-term public funding for fundamental research. This makes it more difficult for scientists who wish to become self-employed to devote time and resources to pre-competitive research on projects that could become commercially viable in the longer run. Therefore, it is all the more necessary that support mechanisms need to be put in place to help such people in other ways. In the past, the start-up process of science based ventures was implicitly subsidised by scientists continuing to work in a public laboratory or university at least part of their time while at the same time setting up their own unit. Various public financial support mechanisms for start-ups were also available in the 1970s and early 80s. All this support has now largely dried up, and no new initiatives have taken its place. There are some public schemes for innovation finance in SME such as SMART, the Queen's Award for Innovation and LINK, but these are not suitable for new ventures. And while the BLs and TECs appear to be reasonably effective new-style support institutions for several *established* companies, they do not provide support to new start-ups. In any case, provision of financial assistance is not their mandate. <u>There is a clear weakness in the UK institutional support structure in this area which needs to be addressed</u>.

- As in the case of the software industry, there is only very limited support from our research for the idea that geographical clusters of electronics SME will lead to increased dynamism, innovation and international competitiveness. To the extent that the firms found clustering important, it appeared that they were motivated mainly by the ability to recruit skilled people and by their interest in living in a nice area. The fact that several founders were already living there at the time when they started their ventures is also a factor. They indicated that this, and perhaps the proximity to their former employers with whom they still maintained contacts (e.g., the university of Oxford or University College London) largely appears to explain the clustering of instrument makers in the Oxfordshire area. Their links with other firms appear to be primarily vertical (with customers and suppliers), and proximity is hardly an advantage for the maintenance of these contacts.

- Given these findings, it is likely that the current government policy centred mainly around geographical clustering is going to backfire. Linkage promotion and facilitation is important, but in the case of the science-based high tech companies in this industry, it should go well beyond stimulation of regional hubs. In fact, non-local links with customers, other private companies and research institutions are likely to contribute much more to the international competitiveness of these firms than local ones, and the BLs and TECs would do well to give priority to the development of the latter. Even less than in the case of the software firms, which do appear to share enough common interests to be able to exploit some complementarities in skills and knowledge in some instances, electronics SME are such a diverse lot of specialists in completely different areas that the sort of Silicon Valley type of informal collaborative networks are probably very hard to create.

Software

- First, it appears from our preliminary investigations about the nature of the software SMEs in Oxfordshire and Berkshire that the majority are medium-tech rather than high-tech firms. Their competitive advantage lies in a good combination of useful but not radically innovative products with excellent service, long-term and active customer relations and an in-depth knowledge of their requirements. Most of these firms require 'standard' institutional support services such as help with introduction of ISO, information provision, linkage building with other network parties and consulting related to effective management of their innovation processes. To the extent that we are able to judge from this small sample, it appears that the regional BLs and TECs are fairly effective in delivering this kind of support.

- However, there are also science-based software firms, especially in the Oxfordshire area, which do have considerable R&D capabilities and whose main source of competitiveness clearly lies in the technological sphere. There were two such firms in our sample. These firms have higher than average 'linkage capabilities' with a variety of private companies and public bodies, which is clearly associated with the academic background of their founders / managers. They are active networkers and are able to attract considerable R&D funding. It is these kinds of companies that appear to have the best prospects for growing into larger entities and becoming international players in due course. While considerable financial support possibilities exist for *established* firms of this kind, an adequate financial institutional support base for *start-ups* of this type appears to be lacking. The UK government appears to believe that the private sector (venture capital, business angels) will fill this niche. However, considering the high risks and uncertainties involved in backing such ventures, it is to be foreseen that problems with attracting start-up capital will persist. Some degree of public support should be provided to overcome these problems of market failure. Also, by establishing a record of success, a public support scheme might help to attract private investors to these kinds of investment opportunities in due course.

- Second, there is only limited support for the validity of the premise, underlying current institutional assistance by DTI, that geographical clustering will lead to the emergence of Silicon Valleys with lots of spill-overs and collaborations. To the extent that clustering is considered important by the respondents in our sample, it appears that it is mainly driven by the need to be close to important customers and the need to be able to recruit (and release) qualified workers. Closeness to firms in complementary activities appears sometimes to confer an advantage for informal collaborations, but the supporting evidence is certainly not overwhelming. Several firms in the sample also had important foreign or distant national collaborators. It is possible that the increasing ease and speed and decreasing cost of long-distance communication will to some extent erode the advantages of geographical proximity.

- This finding has clear implications for current UK government policy. Whereas the latest government Competitiveness Report (1999) emphasizes the government's role as a catalyst to promote dynamic regions based on creative collaborations, our research indicates that networking as such, rather than geographical proximity of the network sources, contributes to technological dynamism and competitiveness. This suggests that, rather than promoting regional clusters of SME, government policy should focus on stimulating networking in all its dimensions, including not merely local and regional linkages and collaborations, but also national and indeed international networks with firms and institutions. Indeed, it is to be expected that the importance of non-local linkages will increase relative to local ones, as new possibilities for effective long-distance communication possibilities are opening up at great speed. Government policy should encourage and facilitate the utilization of these new possibilities. This will require more than financing networking initiatives through the regional BLs and

TECs. Timely provision of adequate capacity of electronic communication infrastructure will be an even more crucial prerequisite.

Garments

- There is an urgent need to <u>redefine the industrial strategy</u> that the British clothing sector should follow. Although some British companies have repositioned themselves in higher value-added markets, the productivity of most garment-related SMEs in the UK trails behind that of German, French or Italian companies. The government does not seem to be doing much about this, and at the present moment, there is not evidence that the Department of Trade and Industry (DTI) intends to put means to enhance greater competitiveness in this sector. In our view, the government could start committing itself by doing an analysis of the strengths, weaknesses, opportunities and threats of the British clothing industry in order to provide guidance for the firms operating in the sector. If DTI's industrial development strategy does not involve the upgrading of companies in low-tech sectors, this should be left clear right from the beginning.

- It is rather clear that there is a lack of co-ordination between the Clothing Centres, manufacturers' associations, training organisations and trade associations representing the interests of the UK's clothing industry. An effective support system does not rely as much on the number of institutions actively functioning as on their networking and appropriate co-ordination. For this reason we believe that <u>there should be an umbrella organisation to unify efforts and foster co-operation linkages among institutions</u>. Garment-related companies in the UK would definitely benefit from institutional interaction at different operational levels.

- The Clothing and Design Centres should adopt a <u>business-like and demand-led approach</u> to ensure their sustainability. Many of these centres are highly dependent on external resources, which in a way determines the sort of services that they can provide. Due to financial constraints, most of the services supplied are technologically simple and with no relative impact on firms' design capabilities. These centres should provide services that encourage garment-related SMEs to move towards more innovative and therefore higher value-added products. They should also act as intermediary agencies contributing to the technological diffusion and upgrading of garment companies.

- At the firm level, <u>emphasis should be put on design and fashion</u>. This would help firms to obtain higher value products, which are less vulnerable to external competition. In most cases, it is not economically viable to employ a full-time designer. However companies should consider the use of a final year design undergraduate to design compatible garments using up-to-date materials. The cost of employing a part-time designer would be relatively minimal.

- <u>Reducing the dependency on a limited number of final producers</u> is a crucial condition for survival. Subcontracting businesses should aim at becoming final producers themselves in a progressive way. This is tough and risky because companies do not have the internal technological capabilities and financial resources to do so, but unfortunately this seems to be the only way to achieve higher value added and increase benefits.

- Companies should also look at the commercial/marketing aspects of their business. This is one of the main weaknesses of the clothing companies in our sample. Companies should consider producing a small leaflet to promote their product and to present to a potential customer the professional way that they conduct business. When they eventually engage an agent this will be a good sales tool in the promotion of the company.

Italy

- The Italian Marshallian IDs, in the main, derive their competitiveness from the use of flexible and multipurpose technologies (either "traditional" or electronic), craft ability and product adaptability, rather than from the generation of new products. Firms need to become more active in new product development (NPD) to raise their innovation levels, especially in the high-tech sectors. They also need to develop products that reach global rather than national markets. In order to do this, they need support for network and market internationalisation. At a fundamental level, the mechanisms for stimulating and supporting R&D in firms need to be reviewed, including the strengthening and restructuring of research policy, the creation of effective university-academia linkages (especially in the high-tech arena),

Sectoral trends, are showing univocal signs towards radical organisational changes, geared towards an organisation of economic activities in IDs of a post-Marshallian kind, that is, less locally confined and less vertically disintegrated. Again, the creation of international networks would assist in this transition. One way of achieving this would be through a policy of attracting foreign direct investment by large global companies, but this would need to be coupled with the development of competition and liberalisation policies.

The evidence hints that in the Italian IDs specialized in traditional sectors, the exploitation of the potential offered by the global networks to strengthen communication and information has been rather weak. Ways of improving this situation would be for government to assist in the provision of an ICT infrastructure, and to improve business services to firms.

Finally, the financial support systems for Italian SMEs are currently very weak, and need to be considerably strengthened in order for firms to develop new products and grow. New financial services, including VC markets, need to be developed, and in order to achieve this, government support will be needed to assist innovation in these financial services.

The limited knowledge of new global technological languages, as well as the lack of substantial organizational changes required by the new technologies to be effective, may progressively cut out geographical clusters and, as a result, "industrial atmosphere" might not be anymore sufficient to stay ahead in the global economy. Italian policy-making needs to take into account changes that are occurring, or need to occur, in its current Marshallian model of industrial organisation.

Greece

Lessons for Policy Support

Policy lessons can be drawn by comparing the external constraints and enabling factors that we identified through policy case studies in the sectors of High- tech and garments.
External Constraints include :

- High Public Transaction costs
- Finance of R&D on a project basis, encouraging ad hoc responses rather than strategic development
- Lack of sector-specific industrial policies
- The centralized character of the Greek Innovation System
- The lack of technological infrastructures

Nonetheless, the following policy factors were found to have enabled successful utilization of capabilities:

- Monetary policy has rationalized business behavior
- Structural Measures concerning both development of infrastructure and producer services

Thus, Policy guidelines for further enhancing firm capabilities can be summarized:

- Establishment of central authorities with sectoral orientation
- Independent science and technology institutes should continue to have state support.
- Sector policies should be based on long term rather than ad-hoc project partnerships.
- The location of those institutes and agencies in both metropolitan and non metropolitan regions is a crucial factor for the creation of spill over effects. The Northern part of Greece is lagging behind in terms of infrastructure.
- Clusters and networks would be more likely to succeed and indeed would be more beneficial if they promote "forward inter-firm linkages".

Israel

At a very fundamental level, the policy change required is a shift to an *Evolutionary and Systems of Innovation Perspective to Technology and Innovation Policy*. This approach differs substantially from the (implicit) perspective of nowadays, which largely conforms to a Neoclassical Perspective.

Existing policies are too narrowly focused on High Tech Industry and too narrowly focused on R&D (and on Physical Investments). There are important gaps as far as Mid/Low Tech Industry is concerned and in the stimulation of the non-R&D elements of the Innovation Process.

A major component of the new perspective is a new Technology \ Innovation and Industry Strategy, which is more explicit than previously. In addition, the *policy process* today could be viewed as a truncated process and should be changed significantly in several ways.

Most important it should become a more *fully integrated* process involving not only decisions about budgets of existing programs; but also a renewed effort at **setting**

priorities; their **translation** into programs and other policy actions; **implementation**; and **feedback** to priorities and programs. Existing priorities (and their translation into the existing set of programs) were set years ago before the changes that occurred during the 90s in Israel's National System of Innovation took place. They do not fully reflect National Objectives, nor the current and future needs of the Business Sector, which are strongly affected by the Globalization Process. Moreover, initiating a process of setting new priorities requires extensive *Search & Research,* partly Academic work with a broad perspective in mind and with a true policy orientation. Thus a "bona fide" shift in policy requires that the *policy process be much more knowledge intensive* than what it has been traditionally in this country.

Our research has also shed considerable light on desirable changes in the Program Portfolio for Technology&Innovation and Industry Policy, as well as means to enhance the effectiveness of the backbone to R&D promotion--Office of the Chief Scientist R&D Grants (an horizontal and largely neutral promotion scheme). Significant complementarities in some areas have been identified between these grants and Venture Capital, while also a presumption exists that in other areas private Venture Capital could take over from the Government. Thus OCS grants are still important for seed finance, for biotech projects and to provide smoothness, continuity and uncertainty reduction in the financing of start up companies. However, improvements might be done in the way this program is implemented, including potential program design improvements (e.g. a shift from the promotion of R&D to promotion of "innovation" as a whole) as well as in OCS screening of projects.

Last but not least, it is impossible to consider changes in incentives in isolation from institutional changes and changes in taxes pertaining to non-R&D activities or actions. Creating a 'level playing field' with the US on matters such as M&A, options to employees, regulations such as the Encryption Law, etc. All these are probably the most important changes one could do, in order to promote effective transition of hi-tech companies to the post start-up phase; and in the stimulation of large, Israeli, global companies.

In mid\low tech industry the Garment study suggests the need for significant upgrading of products & technologies as well as in managerial capabilities. Moreover a hands-on approach to new program implementation should be adopted in order to break the vicious cycle of decline and counteract the lack of awareness of many SME manufacturers. Labour intensive operations in the garment industry must be outsourced to the low-wage neighbouring countries. But even there, only high quality work is going to be acceptable for quality products to survive competition in export and local markets. An awareness and information gap was identified, where manufacturers do not search for means to upgrade their technology, manpower and products.

Korea

Electronics

A majority of companies (about 93%) responded that they get institutional support currently. Most of institutional help are concentrated on financial support, which is followed by information support. It implies that sample companies are in need of financial support and information, as they are active in high-tech areas. Most sample companies regard these institutional supports as very important for their business.

However, export-oriented companies are not so satisfied with these supports. It implies that more advanced companies require rather sophisticated supports, including for <u>export assistance</u> and the <u>creation of international networks</u>.

Electronics companies identified several barriers of institutional supports. They hoped that proposal request should be simplified, evaluation process of these proposals should be shortened, and the volume of financial supports should be increased. Some companies requested “cautious selection”, because unqualified company can possible receive institutional supports.

However, the Korean electronic parts industry shows a rather high level of import dependency, especially in high value-added high-tech products It indicates that the Korean electronic components industry has weakness to a certain level in core technologies.

According to our analysis, the average profit/sales ratio of electronic parts companies is about 10.6%. About 18.8% of sample companies’ production are exported. It indicates that sample companies target rather domestic market. However, there are several companies in our samples that are fully export-oriented.

Software

Major product innovation was reported only by 35% of sample firms and incremental innovations by 40% of firms. The reason why software firms could not accumulate their technological capabilities is that they tend to regard their main activities not as to develop new products but to provide services to other companies.

Korean software companies reported that public institutions, including local governments and national assistance agencies, were important network links. About 95% of software sample companies received institutional supports from diverse organizations. In addition, more than half of sample companies reported that these institutional helps were very helpful. The most helpful type of support was financial supports. In fact, several ministries have prepared their own programs of financial supports for software companies

Garments

It is interesting to notice that traditionally representative institutions are not active in supporting garment firms. Garment firms did not mention the Korea Fashion Association and the Korea Apparel Industry Association as important institutional supporters. Therefore, we think that information on these supports should be widely diffused and that institutional supports for garment companies should be more sophisticated and extended. If possible, more supporting institutions should be established for enhancing technological capabilities of Korean garment firms. Furthermore, application and evaluation process for institutional supports should be simplified and shortened.

4.2.2. Industry-specific recommendations

<u>Electronics</u>

At the cross-country level, the following comments and main policy recommendations can be made with regard to increasing the competitiveness and innovation capabilities of the electronics industry across Europe :

Skills

Taking Israeli firms, and some of the most high-tech firms in England and Scotland as an example, the kinds of background and skills most useful required to compete successfully in the electronics industry can be described as follows : managers' prior experience of the industry in large national or multinational firms; founders with a science or engineering degree; and increased numbers of science and technology graduate employees. Appropriate policy measures might include

- Encouraging SMEs to employ graduates, including financial assistance
- Encouraging students at school and university to consider a career in the electronics industry (equal to software), including the possibility of later entrepreneurial activity
- Further identifying and encouraging university and public research laboratory spin-outs
- Schemes to upgrade the skills of existing experienced non-graduate workers (perhaps through part-time study or distance learning)
- Improving vocational training for the non-graduate workers still needed by the industry

Networking

The research findings on the importance of networking for firm competitiveness will need to be explored in greater depth by further research, as they appear to indicate (for the software and electronics industries at least) that local geographical proximity does not necessarily create technological or competitive advantage through 'cluster effects'.

Whilst there is a strong geographical cluster in Israel, it does not seem crucial to technology development. Likewise, in England, Italy and Scotland, inter-firm networks do not appear significant for SMEs, even though there are some strong geographical clusters in England, and in Scotland, firms are mainly located in the Central Belt ('Silicon Glen'). In Italy, the electronics industry is not physically clustered, unlike many other industries. The main importance of local proximity - where it occurs - seems to lie in the existence of a local labour force and graduate output from local universities. For Italy and Greece, physical proximity to customers and suppliers is significant, but the former may well be because both have under-developed export markets.

For the most successful and innovative firms, often operating as final producers in specialist global niche markets for high-tech products (rather than as subcontractors for components), the most important linkages are with national and international customers and universities (for specialist collaboration), often utilising the latest developments in information and communications technologies. This qualitative finding is further supported by the econometric results of our study, which identifies the international socio-economic embeddedness of firms as a direct factor contributing to firm competitiveness. It is perhaps these types of international technological and market networks which government policies should aim to support in the future, as well as reviewing the emphasis of support measures for local clustering. This could be achieved in a number of ways

- Support for international market research
- Measures to increase international marketing expertise in SMEs
- Support for exporting firms, including trade missions
- Support for firms to locate international R&D partners in universities and other firms
- Support for the adoption of new ICTs by firms
- Less emphasis on physical clustering and more on networking

Financing, including VC

In Korea and Taiwan, government financial support schemes and a growing market of public and private VC institutions play major roles in SME financing. This provides firms in those countries with external support for new product development and growth. In Israel, whose electronics industry is the most innovative and internationally competitive in the survey, there is a well-developed VC industry, built on original government VC provision. However, with hindsight, this system could be improved in a number of ways : by government assistance with seedcorn funding for R&D activities in the initial stages of firm development; by financial measures to bridge the gap between initial seedcorn funding and the VC stage of growth; and by encouraging private VC companies to look beyond the most popular or 'hot' areas for investment. Lessons from these countries can be applied to other European countries:

- Better support is needed for firms and universities / public research laboratories in the early R&D stages, and this will probably need to come from government schemes in the first instance
- Financial assistance at this stage involving industrial and academic partners (for example EU schemes such as BRITE and EURAM) needs to be better publicised within each country, together with details of how prospective partners can locate each other
- In countries where there is little VC activity, the market can be pump-primed by initial government funding of VC, until private VC investors become drawn in.
- At the same time, a funding gap will probably emerge between the R&D and VC stages, and this will need to be addressed by bridging measures
- Private VC investors should be encouraged to spread their support more widely within the industry, not just in currently 'hot' areas

There appears to be a declining level of government financial and other support for R&D and start-up activity in some European countries. Lessons could perhaps be learnt from Korea and Taiwan, where financial support for R&D is provided by government schemes, although in these countries the benefits are perhaps only now being felt, as SMEs increase their R&D activities. If the same measures were applied in Europe, supporting firms that already undertake R&D but struggle to fund it themselves, more new product development might be successfully undertaken.

Software

For the software industry, similar policy recommendations can be made with regard to financing, venture capital and international networking. However there are some important differences between software and electronics.

Firstly, the start-up costs for software SMEs tend to be much lower than for electronics, hence the need for capital investment in the early stages of development may be somewhat less. Nevertheless, there is a need for government support (financial and other) for new product development, since this is where European firms can gain competitive advantage in niche global markets. This is an activity which is vital to firm success, but for which financial assistance is often lacking, partly because the costs of software R&D and NPD are more difficult to calculate than in industries such as electronics that produce tangible products. The examples of Israel, Korea and Taiwan suggest that government financial support measures for R&D in SMEs are worth implementing.

Secondly, the comments and recommendations made for electronics about the importance of international networking and market links apply with even greater force to the software industry, where even the product itself can be transmitted electronically from the producer to the customer or end user, whether for use, feedback or the provision of upgrades, services and maintenance. Local cluster effects were noted, but were not as significant as expected. In Israel, where a software cluster is well-established, physical proximity did not facilitate the growth and expansion of established SMEs, although it created advantages in terms of encouraging start-up firms. It would therefore seem important that government agencies should review their cluster development policies to take into account the significance for SME competitiveness of wider networks in a fast-changing technological environment.

Garments

The garment industry was the most homogeneous of the three industries covered by this study, and it is therefore much easier to make transnational policy recommendations, given that all countries were experiencing similar issues. On the basis of the main findings of our research described above and reported more in detail in each country Report, and in observance of the subsidiarity principle, the effort of public policies at both national and Union level should take into account the broad following guidelines:

§ Due to the dramatic increase of competitive pressure, it is clear that the competitive advantage of final producers in the sector primarily lies on in-house design and development capabilities, innovative use/adoption of new technologies and specialised expertise in particular market segments. The urgency of sectoral upgrading (higher quality, higher *styling* and design content) should underlie, as a main industrial target, the whole process of competitiveness restructuring of SMEs operating in the relevant field of production. For this purpose, public intervention should encompass in particular:

- Measures to increase quality control, application of computer assisted design systems and IT to production, documentation of quality standards towards authorities and customers
- Upgrading skills and professional competence: i.e. whilst design capabilities turned out to be a central tool for competitiveness, most SMEs at present do not devote resources to training, neither internal nor external to the firm
- Establishing Fashion and Design Centres, providing services that encourage garment-related SMEs to move towards more innovative and therefore higher value added products, less vulnerable to price competition. They should also act as intermediary agencies contributing to the technological diffusion and upgrading of garment and clothing companies;
- The emergence of a new kind of relationship between economic activities and space is likely to change both the configuration and role of geographical proximity. Globalisation and the ICT revolution have spurred the reorganisation/rationalisation of the spatial distribution of economic activities, reshaping the relationships between firms and territory, particularly in an economic integrated area such as the Union. The implication is that public intervention for SMEs operating in sectors such as that under observation should have, both at the national and EU level, a strong regionally (and locally) oriented focus, depending on the type of prevailing pattern of subnational agglomeration of sectoral activities (i.e. IDs in Italy, counties/districts in Taiwan, regions in the UK, etc.), yet open to international production and technological networks. The decentralisation of competence is a general requirement to make both planning and implementation of public policies more effective;
- Supporting international networks and Global Production Networks. The tendency towards hierarchisation of inter-firm relationships may helps boost the merging between local and global networks, which is a crucial mechanism to participate in the worldwide process of creation and diffusion of technological innovation. Public support to internationalisation, in all its modalities (exports, inward and outward FDI, international alliances, etc.) should aim at achieving the integration between internal and external forces, between local firms, the territorial system and the global market;
- Improving marketing capabilities and the diffusion of business service, particularly new financial services, which could provide ad hoc support, more flexible financial instruments and easier access to capital for SMEs. Furthermore, nowadays the key to success lies increasingly in efficient marketing, rather than in efficient production, particularly as far as low-tech products are concerned. Institutional support to generate commercial interests, to broaden potential markets and to promote media reports and dissemination of information may be crucial, especially for SMEs specialised in traditional sectors such as garments, knitwear and clothing. In such case, indeed, where these activities are often well beyond the capacity of individual actors,

marketing consortium and networks can help boosting competitiveness by exploiting inter-firm collaboration. Institutional support can count for the (necessary) long-term vision which seems to be lacking in small and medium productive units deeply embedded in local realities;

§ Weakness of forward, commercial and inter-organisational linkages may hamper the competitiveness of the sector as a whole. Clusters and networks would be more likely to be successful if they are able to promote "forward inter-firm linkages". This allows to organise partnerships without the risk of mistrust and opportunism of competing firms and at the same time may help rectify the short term market vision;

§ The widespread diffusion of information and communications technologies, as the main "communication challenge", is a necessary prerequisite to cope with the new competitive environment, irrespective of sectors, as all fields of economic activity are knowledge intensive and should be considered as parts of the "learning economy". The adoption of initiatives to encourage garment SMEs to use electronic communications and the Internet for business and to adopt e-commerce may be coupled with centralised ordering/booking systems (e.g. local or regional agents dealing with e-commerce on behalf of small entrepreneurs);

§ Encouraging collaboration between business sector and technological institutions and design colleges. As suggested in some country Reports, contacts should be favoured (or created *ex novo*) with art, design and fashion colleges or specialised training institutions at staff and student levels. Design centres and technological institutions in general should receive public support and their location should be encouraged particularly where there is a higher potential for the creation of spillover effects;

§ Implementing structural measures to upgrade infrastructure, particularly New Technological Infrastructures specific to the sector. Technological infrastructure consists of science, engineering and technical knowledge for the private sector and it includes generic and product-specific technologies, technical information, research and test facilities, forums for joint industry-government planning and collaboration, assignment of property rights, etc.

However, as has also been highlighted in the country Reports, the actual policy challenge is to retain an effective balance between the need for a central plan and a sector-specific industrial policy and the need of strengthening the regional dimension of intervention and subnational linkages. Low tech and traditional sectors are often highly innovative, as they are knowledge intensive from a systemic point of view. In other words, the policy approach should look not only at firms' performance as such, but also at the integration of firms into "complex social and economic relationships with their environments" (Smith, 1999), as well as into the global production and technological networks.

The research has also pointed out some interesting differences with Asian SMEs systems operating in the sector. More in particular, as turns out from the Taiwan's Report, the key to both the successful restructuring of low-tech productions and to the diversification of national specialisation patterns towards technologically intensive sectors - starting from a highly "traditional" manufacturing base, with a remarkable share of garment exports - engaged in by firms in Taiwan, lies to a large extent in the institutional environment which shapes their decisions. Technological and industrial institutions (i.e. Industrial Development Bureau, Industrial Technology Research Institute, Institute for Information Industry, etc.) in Taiwan have played a crucial role in driving SMEs towards outward orientation and incessant technological upgrading, shifting the attention away from the aim of competitiveness based on costs minimisation. Public sector industrial and technological institutes have been scarcely concerned with the production of national scientific research, whilst they have been very active in technological scanning and technology transfer. Just to quote an example, R&D and technical consortia are established for short periods of time (normally 1-2 years) to ensure that SMEs remain abreast of major technological developments (Mathews, 1999). Connections and linkages have been valued above all and the attraction of foreign investments has complemented the encouragement of local SMEs.

The analysis of strengths and weaknesses of garments SMEs in Europe has therefore a major general implication for public policy: more than the typical financial incentives, tax benefits and credits, it is decisive to create the right institutional setting able to reinforce the coevolution of government-business-technology/research sector relations as technological capabilities expand and to establish interactions between local systems of SMEs (with their tacit and contextual knowledge) and the codified knowledge generated at the global level.

5. DISSEMINATION OF RESULTS

During the life of the project, a strategy for dissemination has been adopted at the level of each individual country, depending on the resources available both during the project and after its completion. An overall dissemination strategy was discussed, but it was felt that the needs of each country, and the country-specific mechanisms whereby dissemination could be achieved beyond an academic context, limited the possibilities for joint dissemination during the life of the project. Dissemination of individual country findings by each team has therefore been the primary mechanism utilised during the project. This has taken various forms, including

- presentation of findings in an academic context
- presentation of reports to various government support agencies
- meetings with various government support agencies
- some preliminary feedback to firms

The follow-up of results envisaged after completion of the project builds on this work. It includes

- further presentation of findings in an academic context, including conference paper and journal articles
- presentation of reports to various government support agencies
- meetings with various government support agencies
- feedback of final results to firms
- further use of project methodologies, including the questionnaire
- further detailed inter-country comparisons

Country	**Date**	**Dissemination activity**
Greece	Mar 2000	Presentation of the Project Report, Madrid, (Thematic Network).
Greece	Feb 2000	Presentation of the Project's conclusions for SMEs' Innovations, University of Athens, (Workshop).
Greece	Jun 2000	Working Paper on MNCs and National - Regional Systems of Innovation, Oslo, (Thematic Network meeting)
Israel	2000	Presentation of findings to textile manufacturers' forum
Israel	May 2000	Presentation of garments findings to Director General, Minister of Industry & Trade, and Manufacturers Association representatives.
Other countries	To be agreed	Other future dissemination activities to be notified to the Commission under separate cover

6. ACKNOWLEDGEMENTS and REFERENCES

6.1. ACKNOWLEDGEMENTS

This project was funded by the EU under the 4th TSER Programme.

The members of the project team also wish to acknowledge the assistance provided to them by SMEs in the three industries studied, and by the various government bodies and SME support institutions in each country.

6.2. REFERENCES

Acs, Z. J. and Gifford, S., 1996, “Innovation of Entrepreneurial Firms”, *Small Business Economics*, vol.8, 203-218.
Agelidis M. Et al (1989) “SMEs” Report for the 5-year Economic and Social Development. Plan of Greece No 8, Center for Planning and Economic Research, Athens.
Albino, Garavelli, Pontrandolfo (1996), Local Factors and Global Strategies of the Leader Firm of an Industrial District, Paper presented at at EurOMA Conference on Manufacturing Strategy, London, June.
Albu, M (1998), *Public Policy Towards Small and Medium-sized Manufacturing Enterprises, in the UK and EU*, QEH.
Antonelli C., Marchionatti R. (1998), ‘Technological and Organisational Change in a Process of Industrial Rejuvenation: The Case of the Italian Cotton Textile Industry’, *Cambridge Journal of Economics*, Vol. 22, n°1, pp.1-18.
Arapoglou A. and Serafeimidis V., (1995) , IT Investment Evaluation in the Greek Context, Proceedings of the 6th Greek Conference of Informatics.
Association of Electronic Industries, 1998, Israel's Electronics Industry Profile, May.
Audrech D. (1998), “Agglomeration and the Location of Innovative Activity”, *Oxford Review of Economic Policy*, Vol14, No2, pp18-29.
Avgerouc C., Doukidis G.I (1993) “Information Systems in Greece : the need for Context related research” European Journal of information systems, Vol2, No2, pp 69 – 75.
Avnimelech, G and Y.Margalit 1999: R&D Policy in Israel, BA Seminar Paper, Economics Department, The Hebrew University, Jerusalem.
Bagella M. and Pietrobelli C. (1997), ‘From SMEs to Industrial Districts in the Process of Internationalization : Theory and Evidence’ in van Dijk M.P. and Rabellotti R. (eds.), Enterprise Clusters and Networks in Developing Countries, EADI Book Series 20, London: Frank Cass.
Baptista R., Swann P. (1998), ‘Do Firms in Clusters Innovate More?’, *Research Policy* 27, pp.525-40.
Becattini G. (1990), The Marshallian Industrial District as a Socio-economic Notion, in: Pyke F., Becattini G., Senbenberger W. (eds.).
Becattini G. (ed.) (1987), Mercato e forze locali: il distretto industriale, Il Mulino, Bologna.
Becattini G., Bianchi G. (1987), I distretti industriali nel dibattito sull'economia italiana, in: Becattini G. (ed.).
Becchetti L., Rossi S. (1998), The positive effect of industrial district on the export performance of Italian firms, University of “Tor Vergata”, CEIS Working Paper no.54.
Belussi, F., (1996), “Local Systems, Industrial Districts and Institutional Networks Towards a New Evolutionary Paradigm of Industrial Economics”, *European Planning Studies*, vol. 4, No. 1, pp. 5-26.
Belussi F. and Arcangeli F. (1998), ‘A Typology of Networks: Flexible and Evolutionary Firms’, *Research Policy*, Vol.27, pp.415-28.

Bertini S.(1994), ‘’SME Systems and Territorial Development in Italy’, NOMISMA Working Paper No.6, October.
Bourgault, M., Lefebvre, L. & Lefebvre, E., (1994), *Critical Capabilities and Performance of the Small Subcontracting Firms in the Aerospace Industry,* CIRANO, Montreal.
Braczyk H.J., Cooke Ph., Heidenreich (1998), *Regional Innovation Systems*, London: UCL Press Ltd.
Bridge G. (1997), “Mapping the terrain of time-space compression: power networks in everyday life”, *Envrironment and Planning D: Society and Space*, Vol. 15, pp 611-626.
British Apparel and Textile Confederation (1995/1996), Trendata, 1995 and 1996.
Brouwer, E. and Kleinknecht, A., 1993, “Technology and a firm’s export intensity: the need for adequate innovation measurement”, *Konjunkturpolitic,* vol. 39, 315-325.
Brouwer, E. and Kleinknecht, A., 1996, “Firm Size, Small Business Presence and Sales of Innovative Products: A Micro-econometric Analysis”, *Small Business Economics,* vol. 8, 189-201.
Brouwer, E. and Kleinknecht, A., 1999, “Keynes-plus? Effective demand and changes in firm-level R&D: an empirical note”, *Cambridge Journal of Economics,* vol. 23, 385-391.
Bursi T., Marchi G., Pappalardo G. (1997), *Indagine sulle condizioni economico-finanziarie delle imprese emiliano-romagnole del tessile abbigliamento (1994-96)*, Banca Popolare dell’Emilia Romagna e CITER Carpi.
Bursi T., Nardin G., Pappalardo G. (1996), *Indagine sulle condizioni economico-finanziarie delle imprese emiliano-romagnole del tessile abbigliamento (1993-95)*, Banca Popolare dell’Emilia Romagna e CITER Carpi.
Burt, R.S., (1992), “ Structural Holes”, Harvard University Press, Cambridge M.A.
Callon, M., (1991), “Techno-economic networks and irreversibility” in A Sociology of Monsters: Essays on power, Technology and Domination, Ed. J. Law Routledge London.
Camagni R. (1997), *‘I milieux di alta tecnologia in Italia e nuove riflessioni sul concetto di milieu innovateur*, mimeo, University of Padua.
Cambridge Econometrics (1999) Industry and the British Economy. Analysis and Forecasts to 2010. Cambridge (UK): Covent Garden.
Cantwell J, Santagelo G.D. (1999), “The Frontier of International Technology Networks: Sourcing Abroad the Most Highly Tacit Capabilities, *Information Economics and Policy*, vol 11, No1 , pp 101-123
Cardwell W., Manu M. and Others, 1999: Attracting Foreign Investment Into Early-Stage Finnish Technology Companies, Finland: Sitra's Publication Series.
Carminucci C., Casucci S. (1997), “Il ciclo di vita dei distretti industriali: ipotesi teoriche ed evidenze empiriche, *L’Industria,* XVIII, 2, 283-315.
Castellano F. (1999), Distritos Industriales y Modelos Organizativos de Pymes, Masters Thesis, EU-ALFA Programme, Università di Roma Tor Vergata.
Caves, R.E., 1982, *Multinational Enterprise and Economic Analysis*, Cambridge University Press
Censis (1997), “VIII Forum Nazionale dei Localismi. Distretti industriali e sviluppo economico locale”, in *CENSIS Note e Commenti*, XXXIII No.9, September.
Censis (1998a), *32° Rapporto sulla situazione sociale del paese 1998*, Franco Angeli, Roma.
Censis (1998b), VIII Forum Nazionale dei Localismi. Distretti industriali, infrastrutture e servizi per la logistica, in *CENSIS Note e Commenti*, forthcoming.
Central Bureau of Statistics, 1993: Statistical Yearbook.
Checkland, P. B. (1989): OR and Social Sciences: Fundamental Thoughts. In Jackson, M. C.; Key, P. and Cropper, S. A. (eds.): Operational Research and the Social Sciences. pub. Plenum press, New York.
Checkland, P. B. and Scholes, J. (1990): Soft Systems Methodology In Action. Chichester; John Wiley and Sons.
Christensen, L.J. 1998: Financing Innovation, subproject of TSER Program "Innovation Systems and European Integration"
Christopoulos, D. (1995), Technological Progress and Returns to Scale in Greek Manufacturing, Phd Thesis, Panteio University.

Chronaki Z. et al (1993), "Diffused Industrialization in Thessaloniki: From Expansion to Crisis", *International Journal of Urban and Regional Research*, Vol 17. 1 , pp 178-194
.Computing Services and Software Association (1999) www.cssa.co.uk
Cohen W. , and Levinthal D., (1989), "Innovation and Learning: The Two Faces of R&D", *The Economic Journal*, vol. 99, pp. 569-596.
Cohendet P et al (1999), "Knowledge Coordination, competence creation and integrated networks in globalized firms", *Cambridge Journal of Economics*, vol. 23, pp 225-241
Conti G., Menghinello S. (1996), Territorio e competitivita': l'importanza dei sistemi locali per le esportazioni italiane di manufatti. Un;analisi per province (1984-95), Rapporto ICE 95, 286-303.
Conti G., Menghinello S. (1997), L'internazionalizzazione produttiva dei "sistemi locali", Rapporto ICE 96, Chap. 7.
Conti G., Menghinello S. (1998), Ruolo e peculiarita' delle produzioni meccaniche per le esportazioni di manufatti (1985-97), Rapporto ICE 97, 255-66.
Daly, A., Hitchens, D.M.W.N. and Wagner, K., (1985), "Productivity Machinery and skills in a sample of British and German Manufacturing Plants-Results from a Pilot Study", *National Institute Economic Review,* February, pp. 48-61.
Department of Trade and Industry (1997), *SME Statistics for the UK 1996*, UK Government, Statistical Bulletin, 17 July.
Department of Trade and Industry (1998), Competitiveness White Paper.
Dolev & Abramovitch, The Israel Hi-Tech Guide for the Year 1999, Meida Technologui, Inc.
Doukidis, G.I, Smithson, S. (1995). Information Systems in the National Context. The case of Greece, Avebury, England
EC, European Economy, 1999, Luxembourg: Office for official publications.
Economou, D. (1993), "New forms of Geographic Inequalities and Spatial Problems in Greece", *Environment and Planning D: Society and Space*, Vol 11, pp 583-598
Ernst D. (1998), 'What Permits Small Firms to Compete in Globalized High-Tech Industries? The Co-Evolution of Domestic and International Knowledge Linkages in Taiwan´s Computer Industry' mimeo TSER Project, Istituto di Affari Internazionali, Rome.
Ernst, D. (1997), *From Partial to Systemic Globalization. International Production Networks in the Electronics Industry*, *BRIE Working Paper # 98*, the Berkeley Roundtable on the International Economy (BRIE), University of California at Berkeley, April.
Ernst, D. (1994), "Network Transactions, Market Structure and Technological Diffusion - Implications for South-South Cooperation", in: L. Mytelka (ed.), *South-South Cooperation in a Global Perspective*, Development Centre OECD, Paris
Ernst D. and Guerrieri P. (1998), 'International Production Networks and Changing Trade Patterns in East Asia: The Case of the Electronics Industry', *Oxford Development Studies*, Vol.26 No.2.
Ernst & Young and BRM, 1998: On the Right Track: An Entrepreneur's Guide to Success.
Esposito G.F., Mauriello D. (1996), "Subcontracting Systems and Organizational Changes in Italian Industrial Districts", Istituto Guglielmo Tagliacarne Working Paper, 8.96.
Ettlinger, N., Tufford, M., (1996), "Evaluating Small Firm Performance in Local Context: A case study of Manufacturers in Columbus, Ohio", *Small Business Economics*, 8:139-157
European Observatory for SMEs (1993) "First Annual report" European Network for SMEs Research, Brussels.
European Observatory for SMEs (1994) "Second Annual report" European Network for SMEs Research, Brussels.
Federation of the Electronics Industry (1999) *FEI 1998/99 Review*, London.
Federation of Greek Industries, Annual Report 1998, Athens.
Frova S. (ed.) (1996), L'industria meccanotessile in Italia. Comportamenti strategici, commerciali, finanziari, EGEA, Milan.
Garofoli G. (1991), *Modelli locali di sviluppo*, Franco Angeli, Milano
Gayego, A. and R. Mansouri 2000: The Effects of Competition on Think Tanks in Israel, BA Seminar paper, The Hebrew University, Jerusalem.

Geroski, P., Machin, S. and Van Reenen, J., 1993, “ The profitability of innovating firms, RAND”, *Journal of Economics,* vol. 24, 198-211.
Giannitsis T. (1993), Limits and Functions of Credit Policy in the Process of Industrial Crisis, in Industrial and Technology Policy in Greece, (Ed) T. Giannitsis, Athens: Themelio.
Giza Group (eds.), 1998: IVA 1998 YEARBOOK: A Survey of Venture Capital and Private Equity in Israel, Israel Venture Association.
Globes (Newspaper) 1999: Information Security-Special Issue
Grannoveter M. (1973), “The Strength of Weak Ties”, *American Journal of Sociology*, vol. 78, pp. 1360-1380.
Grannoveter M. (1985), “Economic Action and Social Structure: The Problem of Embeddedness”, *American Journal of Sociology*, Voume 91, No3, pp 481-510.
Grannoveter, M., (1992), “Economic Institutions as Social Constructions: Framework of Analysis”, *Acta Sociologica,* 35:3-11.
Grassi M. and Pagni R. (1998), ‘Sistemi Produttivi Localizzati e Imprese Leader’, IRPET, *Interventi, Note e Rassegne*, Firenze.
Gray M., Golob E. e Markusen A. (1996), “Big Firms, Long Arms, Wide Shoulders: The ‘Hub-and-Spoke’ Industrial District in the Seattle Region”, *Regional Studies*, Vol. 30, n°7.
Guerrieri P., Iammarino S., Pietrobelli C. (1998), “Agglomeration Economies, Cluster Effects and Industrial Districts: a Survey of the Literature”, mimeo TSER Project, Istituto di Affari Internazionali, Rome.
Haaretz (newspaper),1999: Gilyon Ha'azor (The Decade's Magazine) Special Issue, December.
Hadjimichalis, C., Papamichos N. (1990), *“Local Development in Southern Europe: towards a new mythology”*, Antipode Vol. 22.3, pp 181-210.
Handy C., Understanding Organizations, Penguin , England.
Hatzis, A. (1997), Structure Transformation in Greek Manufacturing: Production and Competitiveness, Thesis for the Master ‘s Degree, Panteio University.
Hughes, K., 1986, *Exports and Technology,* Cambridge, Cambridge University Press.
Humphrey J. (1995), “Industrial Reorganization in Developing Countries: From Models to Trajectories”, *World Development*, Vol. 23, n°1, pp.149-62.
IDC (1995) “IT Communications Directory ’95, K/Communications, Athens (in Greek).*IT and Telecommunciatiosn Directory, 1997, “Greece: Telecommunication Paradise or IT Hell?”*, Athens: Strategic International Sa.
ILO, (1998) Transforming Apparel Production Channels: Lessons from the Clothing Industry in the US, UK and France, International Institute for Labour Studies, Geneva.
Israel Venture Capital Association (IVA), Web Site
Istat, Sforzi F. (1997) (ed.), I sistemi locali del lavoro 1991, Argomenti, 10.
Istituto Guglielmo Tagliacarne, Unioncamere (1997), Rapporto 1996 sull’impresa e le economie locali, FrancoAngeli, Milan.
Kalogirou J (1993), State Markets, Industrial Structures, and State Policies in Greece, in Industrial and Technology Policy in Greece, (Ed) T. Gianitsis , Athens: Themelio.
Kataras K. (1992) “Small Fast Growing IT Markets : Portugal, Greece, Turkey, Israel”, Paper presented at the European Forum, Venice, September 1992.
Katsos, G. and Ioanoy Chr. (1988), Textiles and Garments. Planning Issues no. 44. Greek Center of Research Planning.
KEPE (Center for Planning and Economic Development), (1989), Proposals for the reform of Law 1262/82, Athens.
Kmenta J., 1990, *Elements of Econometrics,* Maxwell Macmillan International Edition.
Knorringa P. (1998) ‘Cluster Trajectories in Developing Countries. Towards a Typology’, paper presented at the EADI Workshop at the Institute of Social Studies, The Hague, 18-19 September.
Koutsoyiannis A., 1977, *Theory of econometrics,* Macmillan Education.
Lall, S., (1992), “Technological Capabilities and Industrialization”, *World Development*, vol. 20, No. 2, pp. 165-186.

Lall S., (1998), ‘Exports of Manufactures by Developing Countries: Emerging Patterns of Trade and Location’, *Oxford Review of Economic Policy*, Vol. 14, No. 2.
Larsson S., Malmberg A. (1999), “Innovations, Competitiveness, and Local Embeddedness. A study of Machinery Producers in Sweden”, *Geographisca Annaler*, vol. 81B (1): 1-18.
Latour, B., (1991), “ Technology is society made durable” in A Sociology of Monsters: Essays on power, Technology and Domination, Ed. J. Law Routledge London.
Lawson, C., (1999), “ Towards a competence theory of the region”, *Cambridge Journal of Economics*, vol. 23, pp. 151-166.
Lee W. (2000),"The Role of S&T Policy in Korea's Industrial Development" in Kim,L. and R. Nelson Techological Learning and Economic Development: The Experience of the Asian NIEs, Oxford University Press.
Liargovas P., Tsipouri E. (1997) Structural Problems of the Greek Industry in relation to the implementation of the White Paper for Growth, Employment and Competitiveness in Greece, Research and Documentation Paper No 44, Greek Center for European Studies, Athens.
Lorenzoni G. (1990), *L´architettura di sviluppo delle imprese minori*, Il Mulino, Bologna.
Lundvall B. (1988), ‘Innovation as an Interactive Process : From User-producer Interaction to the National System of Innnovation’, in Dosi G., Freeman G., Nelson R.R., Silverberg G., Soete L., (eds.), *Technical Change and Economic Theory*, London : Pinter Publishers, pp.349-69.
Lymberaki A., Travlos S. (1993), State Interventions in Industry: Direct and Indirecr Industrial Policy in the Decade if the 1980s, in Industrial and Technology Policy in Greece, (Ed) T. Gianitsis, Athens: Themelio.
Malerba, F. "Public Policy in Industrial Dynamics: An Evolutionary Perspective", paper presented to the Innovation Systems and European Integration TSER
Malerba F. and Orsenigo L. (1995), ‘Schumpeterian Patterns of Innovation’, *Cambridge Journal of Economics*, Vol.19, pp.47-65.
Malerba F. and Orsenigo L. (1995), ‘Technological Innovation and International Competitiveness in Italy’, in Molero J. (ed.), *Technological Innovation, Multinational Corporations and New International Competitiveness*, Harwood Academic Publishers GmbH
Malerba F. and Orsenigo L. (1996a), ‘The Dynamics and Evolution of Firms’, *Industrial and Corporate Change*, Vol.5 No.1.
Malerba F. and Orsenigo L. (1996b), ‘Schumpeterian Patterns of Innovation are Technology-specific’, *Research Policy*, Vol.25, pp.451-78
Markusen A. (1996a), ‘Sticky Places in Slippery Space: A Typology of Industrial Districts’, *Economic Geography*, Vol. 72, pp. 293-313.
Markusen A. (1996b), ‘Big Firms, Long Arms, Wide Shoulders: The ‘Hub-and-Spoke’ Industrial District in the Seattle Region’, *Regional Studies*, Vol.30/7, pp.651-66.
Maroulis N. (1995) “Financing IT Investment in IT & Communication Directory 1995” K/Communications, Athens (in Greek).
Marshall A. (1896), *Principles of Economics*, London: Macmillan.
Maskel, P., Malmberg A. ,1999, “Localised Learning and Industrial Competitiveness”, *Cambridge Journal of Economics*, 23, 167-185
Ministry of Industry and Trade 1998: Industry in Israel, 1998, Hebrew
Moda Industria (1997), “Rapporto di settore 1996”, Moda Consult, Milan.
Moda Industria (1998), “Commercio estero. Abbigliamento, maglieria e calzetteria”, no. 4, Moda Consult, Milan.
Moore, L. (1999) 'Britain's Trade and Economic Structure. The Impact of the European Union'. London: Routledge.
Mugrabi, G 1998: Computer Communications: Protocols and Network Architectures, Hod Ha-ami, Tel Aviv.
Murdoch J (1995), “Actor-Networks and the Evolution of Economic Forms: Combining Description and Explanation in Theories of regualtion, Flexible Specialization, and Networks”, *Environment and Planning A*, Volume 27, pp 731-757.
National Statistical Service of Greece, NSSG, 1995, Annual Manufacture Survey.
National Statistical Service of Greece, NSSG, 1995, Business Registry.

National Statistical Service of Greece, NSSG, 1995, TradeStatistics.
Nelson R.R., Winter S. (1982), *An Evolutionary Theory of Economic Change*, Cambridge MA : Harvard University Press.
Nuti F. (1992), *I distretti dell'industria manifatturiera in Italia* (2 volumes), CNR for Franco Angeli, Milan.
OECD (1992), *Technology and the Economy. The Key Relationship*, Paris: OECD.
OECD, 1996, *Innovation, Patents and Technological Strategies*
OECD, (1997), Science, Technology and Industry; Scoreboard of Indicators, p. 158.
Oerlemans L. Et al (1998), "Do Networks Matter for Innovation? The usefulness of the Economic Network Approach in Analysing Innovation", *Tijdschrift voor Economische en Sociale Geografie*, Vol.89., No3, pp 298-309.
Omar, N.H. (1992) 'Financial Performance in the UK Electronics Industry', Research Paper 58, Institute of Advanced Studies. Manchester: The Manchester Metropolitan University.
Palaskas, T.B and Antoninis, M., (1997), Science and Technology Development in the Context of International Integration: The Case of Greece. Report prepared for TSER project: Science and Technology Policies in Developing and transition Countries:Reform and Technical co-operation with Europe.
Paniccia I. (1997), Division of Labour and Cooperation in Local Systems of Small and Medium-Sized Firms in Italy. A Comparative Study, paper presented at the EMOT Conference in Stresa, 11-13 September.
Park S. (1996), "Networks and Embeddedness in the Dynamic Types of New Industrial Districts", *Progress in Human Geography*, 20,4, pp 476-493.
Park S. and Markusen A. (1994), "Generalizing New Industrial Districts: A Theoretical Agenda and an Application from a Non-Western Economy", *Environment and Planning*, Vol. A, n°27.
Pavitt K. (1984), Sectoral Patterns of Technical Change: Towards a Taxonomy and a Theory, *Research Policy*, 13 (6), pp 343-374.
Pavitt K. and Patel P., (1995), "Patterns of Technological Activity: their Measurement and Interpretation", in *Handbook of the Economics of Innovation and Technological Change*, (Ed.) Stoneman P., Blackwell Publishers Ltd., Oxford.
Pietrobelli C. (1998), "The Socio-economic Foundations of Competitiveness: An Econometric Analysis of Italian Industrial Districts", *Industry and Innovation*, Vol.5, n°2, December, pp.139-55.
Pietrobelli C. and Samper J. (1997), 'Measurement of Europe-Asia Technology Exchanges : Asymmetry and Distance', *Science and Public Policy*, Vol.XXIV, No.4, August.
Pietrobelli C. (1996), *Emerging Forms of Technological Cooperation: The Case for Technology Partnerships - Inner Logic, Examples and Enabling Environment*, Science and Technology Issues, Geneva: UNCTAD.
Pizzi P. (1998), Il distretto tessile di Teramo, Economia Marche, XVII, 3, 101-112.
Pyke F., Becattini G., Sengenberger W. (eds.) (1990), Industrial Districts and Inter-firm Co-operation in Italy, International Institute for Labour Studies, Geneva.
Pyke R., Becattini G., Sengenberger W. (eds.), 1991, *Industrial Districts and Inter-firm Cooperation in Italy*, ILO, Geneva.
Raider, J.H., (1998), "Market Structure and Innovation", *Social Science Research*, vol. 27, pp 1-21.
Robertson P.L., Langlois R.N. (1995), "Innnovation, Networks, and Vertical Integration", *Research Policy*, Vol 24, No4, pp 543-562.
Ruttan V. (1997), Induced Innovation, Evolutionary Theory and Path Dependence: Sources of Technical Change, *The Economic Journal*, vol. 107, 1520-1529.
Saito M. (1999), "From Individual Skills to Organizational Capability in Japan", *Oxford Review of Economic Policy*, Vol15, No1, pp 114-126.
Santarelli E., Sterlacchini A., Quaglia F. (1991), "Investimenti in macchine e innovazione nelle piccole e medie imprese". *L'Industria*, February, 289-318.
Saxenian A. (1994), *Regional Networks: Industrial Adaptation in Silicon Valley and Route 128*, Cambridge: Harvard University Press.

Saxenian 1998, Regional Advantage: Silicon Valley and Route 128,Oxford University Press, 2nd. Edition.
Schumpeter J.A. (1934), *The Theory of Economic Development*, Harvard Economic Studies, Cambridge MA.
Schumpeter J.A. (1942), *Capitalism, Socialism, and Democracy*, Harper, New York.
Schmitz, H., 1995, “Collective Efficiency: Growth Path for Small-Scale Industry”, vol. 31, No. 4, 529 – 566.
Scientific American 1999: Communications Special Issue
Sefertzi, E. (1998), “Crisis, Restructuring and Innovation Development in textiles and clothing Industries” in Sefertzi (Ed) “*Innovation: System- Regions, Technology Transfer and Innovation Development in Greece”*, Athens: Gutenberg *(in Greek).*
Sforzi F. (1987), La geografia dell’Italia marginale, *Politica ed Economia*, 3, 33-41.
Sforzi F. (1990), in: Pyke F., Becattini G., Senbenberger W. (eds.).
Storey D. and B. Tether, 1996: New Technology-Based Firms(NTBF) in Europe.
Symeonidis, G.,1996, *Innovation, Firm Size and Market Structure: Schumpeterian Hypotheses and Some New Themes*, Organization for Economic Co-operation and Development, Paris 1996.
Teubal ,M. "The R&D Performance Through Time of Young, High-Technology Firms: Methodology and an Illustration", Research Policy 11(1982).
Teubal,M. 1993:"The Innovation System of Israel: Description, Performance and Outstanding Issues", in Nelson(ed), National Systems of Innovation, Oxford University Press.
Teubal M. 1996 :"R&D and Technology Policy as Learning Processes", World Development, 24(3), 449-460.
Teubal M. 1997, "A Catalytic and Evolutionary approach to horizontal technology policies", Research Policy 25, 1161-1168.
Teubal M. 1998 "Enterprise Restructuring and Embeddedness: A Systems of Innovation and Policy Perspective" , Center for Research on Innovation and Competitiveness (CRIC), University of Manchester.
Teubal M. 1999:"Towards an R&D Strategy for Israel", The Economic Quarterly, December (In Hebrew).
Teubal,M. & and E. Boehm 1998:"The Creation of the Magnet Committee: an Example of an Industrial-Technological Policy in Israel", forthcoming in How To Influence, Jerusalem Institute for Israel Studies.
Teubal, M. & E. Andersen ,2000: "Enterprise Restruction and Embeddedness: a Policy and Systems Perspective" Industry and Corporate Change, forthcoming.
Tsilenis S., Sefertzi E (1998), “New technologies and the development of electronics and information industries in Greece” in Sefertzi (Ed) “*Innovation: System- Regions, Technology Transfer and Innovation Development in Greece”*, Athens: Gutenberg *(in Greek).*
Tsipouri, et. All (1994), Investigation of Sucesfull and Failed Innovations in Greek Manufacturing, Athens.
UNCTAD (1995), ‘New Technologies and Issues in Technology Capacity Building for Enterprise mimeograph, Division for Science and Technology, Geneva.
United Nations (1995), *World Economic and Social Survey 1995*, New York: United Nations.
Vaitsos K., Giannitsis T. (1994), Technological Transformation and Economic Development: The Greek Experience, Athens: Gutenberg (*in Greek)* .
Valente T. (1996), “Social Network Thresholds in the Diffusion of Innovations”, *Social Networks*, vol.18, pp 69-89.
Varaldo R., Ferruci L. (1996), “The Evolutionary Nature of the Firm Within Industrial Disticts”, *European Planning Studies*, Vol4, No1, pp 27-35.
Viesti G. (1996), “Le esportazioni dei principali sistemi produttivi italiani: un’analisi introduttiva”, Rapporto ICE, Chapt. 7.
Viesti G. (1997), “Le esportazioni dei sistemi italiani di piccola e media impresa”, ICE, Quaderni di Ricerca, 3, October.

Willis and Ray (1998) 'Software and IT Sector in Oxfordshire. A Report on the Needs of the Sector by Oxford Innovation Ltd. for the Heart of England Training and Enterprise Council'. Oxford: Oxford Innovation Ltd.

Newspapers & Magazines:
Globes, Haaretz, News Week

7. Annexes

7.1. Publications, conference presentations, and other output

Working papers

- Guerrieri, Paolo and Iammarino, Simona, “The Dynamics of Italian Industrial Districts: Towards a Renewal of Competitiveness ?"
- Albu, Mike, ‘Public Policy Toward Small and Medium-sized Manufacturing Enterprises, in the UK and EU’ (July 1998).
- Romijn, Henny, ‘Measuring Technological Performance in Manufacturing Firms: A Review’ (April 1998).
- Henny Romijn (1998) 'Technology Support for Small Industries in Developing Countries: From 'Supply-Push' to 'Eightfold-C', Queen Elizabeth House, Electronic Working Paper Series no. 21, http://www.qeh.ox.ac.uk/qehwps21.html
- Palaskas T.B., Arapoglou V., Hatzis Th. (2000), "Benchmarks of competitiveness: an econometric approach"
- Arapoglou V., Palaskas, T.B., Tsampra M. (2000), "Innovation, local and international embeddedness: competition challenges for the Greek SMEs in the information technology industry"
- Romijn, H. (1999) 'Technology Support for Small Industries in Developing Countries: From Supply-push to Eightfold-C', Queen Elizabeth House and Centro Studi Luca D'Agliano Development Studies Working Papers, no. 128, June. (also submitted to Development Studies for academic journal publication)

Conference papers

- Hardstone, G., "Clustering of SMEs in the Scottish software industry : current reality and aspirations" (paper presented to the 7th Annual High Technology Small Firms Conference, Manchester Business School, May 1999).

Journal publications

- Romijn, Henny, ‘Technology Support for Small Industries in Developing Countries: From “Supply-Push” to “Eightfold-C”’ (October 1998) *World Development*.

- Two empirical papers about the determinants of technological capability in SME in the UK are in progress. One paper analyses the findings for the whole survey, the other focuses specifically on the problems and prospects of high-tech SMEs. We intend to publish both papers in academic journals. At least one of them will also be submitted as a conference paper.

- Further publication plans include a paper comparing the UK and Korean policy environment for SME; and a paper focusing specifically on the current problems of the SME in the garment industry in the UK.

Book chapters

- Henny Romijn (1998) 'Small Enterprise Development in Developing Countries: Innovation or Acquisition of Technological Capability?', Paper presented at the EADI Workshop on The Importance of Innovation for Small Enterprise Development in the Third World, Institute of Social Studies, The Hague, 18-19 Sept.; also forthcoming in: M.P. van Dijk, P. Knorringa and H. Sandee (eds) (1999) "Innovation in Small Enterprises in the Third World". London: IT Publications.

Policy documents

- Teubal, M. (1999), "Towards an R&D Strategy for Israel".

- Teubal,M. (1999) "Hi-Tech Cluster Creation and Cluster Re-configuration: A Systems of Innovation and Policy Approach"

- Toren, B. (2000), " Rehabilitation of the Israeli Garment Industry; Analysis of a Low-Tech Industry"

7.2. Agreed deliverables

Deliverable	Description	Status
WP1	Literature survey and methodology	Completed
WP2	Questionnaire preparation	Completed
WP3a	Country studies in Europe - literature survey	Completed
WP3b	Country studies in Europe	Completed
WP4	Country studies in Asia	Completed
WP5	Quantitative analysis	Completed (annexed herewith)
WP6	Final country reports	Completed (annexed herewith)
WP7	Synthesis of policy implications	Completed (chs 3&4)

7.3. Other annexes (under separate binding)

Quantitative analysis : econometric study

Country reports :

- Scotland
- England
- Italy
- Greece
- Israel
- Korea
- Japan
- Taiwan