EUROPEAN INNOVATION MONITORING SYSTEM (EIMS)

EIMS PUBLICATION N° 14 - Vol. 2/2

TECHNOLOGY DEMONSTRATION AND APPLICATION CENTRES IN THE EU

COUNTRY REPORTS EU, USA AND JAPAN

BY

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EUROPEAN COMMISSION DG XIII D

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Technology Demonstration and Application Centres in the EU

Foreword

The design, implementation and evaluation of policies promoting innovation and technology transfer have undergone a series of changes. In the 1970s policy was to a large extent an ad-hoc and judgmental process. However, during the 1980s policy changes became more informed and professional in outlook.

In order to continue this development, DG XIII / EIMS has carried out a number of state-of-the-art reviews in the field of innovation and technology transfer support. These so called "policy workshops" are mainly directed to public sector scheme managers and the aim is to discuss recent development in innovation policy, to exchange experience of best practice, to assess existing as well as future Community actions in these fields, and to discuss options for concerted actions.

This report (published in two volumes) presents the comprehensive survey and the workshop proceedings on the subject of **Technology Demonstration and Application Centres in the EU**. While the Executive Summary is reproduced in both volumes, the first (Vol. 1/2) focuses on analysis, policy recommendations and the workshop discussion, the second (Vol. 2/2) contains details of schemes at national level in the EU, the USA and Japan.

The two volumes are:

> Technology Demonstration and Application Centres in the EU
> Empirical Survey and Policy Implications, Final Report and Proceedings of EIMS Policy Workshop, Luxembourg 11-12 May 1995
> (EIMS Publication N° 14 - Vol 1/2)
>
> Technology Demonstration and Application Centres in the EU
> Country Reports EU, USA and Japan
> (EIMS Publication N° 14 - Vol. 2/2)

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Technology Demonstration and Application Centres in the EU

Empirical Survey and Policy Implications

Executive Summary

for

CEC DG XIII - D 4

in the Framework of

SPRINT EIMS Project 94/71

Fraunhofer-Institute for Systems and Innovation Research (ISI), Karlsruhe (Co-ordination)

CM International (CM), Paris

June 1995

Objectives and Study Approach

In recent years a number of studies have gathered a considerable amount of information on the development of innovation supporting services and the ways and means of technology transfer. They have focused on consulting, training, information distribution, and the development of production processes as offered by research organisations (e.g. RTOs), university institutes, and private organisations. There is, however, a lack of information on the role that demonstration activities and in particular Technology Demonstration and Application Centres (TDAC) play in the process of technology transfer to SMEs. It was the objective of the EC funded study described in this paper to investigate TDACs in the EU in order to provide an understanding of the profile and function of these organisations and their demonstration activities and to analyse the results with a view towards policy implications. To discuss the results of the study with a larger audience of policy makers, TDAC managers, and other person involved with demonstration activities a workshop was arranged.

The work was carried out by a consortium of four research organisations from France, Germany, the Netherlands, and the United Kingdom. A questionnaire-based written survey supplemented by field interviews was used to gather information on TDACs and demonstration activities in twelve European countries. Only organisations which were expected to demonstrate technology in a neutral fashion were originally selected. A total of 411 TDACs were contacted by mail with 214 of them responding. In addition 94 interviews were conducted with TDAC managers, their clientele, and policy makers (concerned with TDAC affairs).

TDAC Profiles

Many of the TDACs have been founded within the last ten years. Only 30 % of the TDACs responding to the questionnaire had started demonstration activities before 1986.

A **typical TDAC** can be described as an organisation which:

- demonstrates new technologies and processes to public or private enterprises;
- offers additional services such as consulting, seminars/training, and testing/certification;
- uses systematic promotion for their services;
- has mainly small and medium sized clients;
- is neutral with regards to technology suppliers.

More than half of the TDACs are **part of a larger organisation** which in most cases is a private or public/semi-public research institute. Less than half of the TDACs have more than 25 **employees**.

Initial **funds for investment** came mainly from public sources with national support being the most common (in 129 reported cases); in 58 instances equipment suppliers also provided funding (equipment) and in 91 cases the organisation used some of their own funds. Public funding (both core funding and through projects) amounts on the average to almost 45 % of the budget, the rest is made up of fees for services (about 35 %) and to a lesser degree from donations and other sources. Public **core funding has decreased** over the last 3 years in many instances whereas funds for public projects and income through fees have increased. 113 TDACs reported an **increase in turnover** over the last 3 years. Turnover remained about constant for 45 reported cases and decreased for just 20 of them.

About 50% of TDACs are sector oriented which means that they focus their demonstration efforts on a single sector. This proportion is much higher in Belgium, Spain and the Netherlands. The targeted sectors are generally traditional (wood industry, footwear, meat industry, foundry, etc.). **One third of TDACs are application / technology oriented**. For these centres the importance of demonstration is higher than for sector oriented TDACs. This proportion is much higher in Germany and somewhat higher in Ireland.

Manufacturing technologies and processes make up the most frequently quoted field, followed by information and communication technologies, materials, and environmental technologies (in that order).

To **demonstrate** their new technologies TDACs mainly use the **actual physical system** and in some cases a physical model of it. In addition (in some cases as the only means) some kind of media (e.g. computer simulation, video, picture boards) is used for demonstration purposes.

For the year 1993 more than ¾ of the TDACs reported having **less than 500 clients**. The majority of these clients (87 %) can be categorised as **small and medium sized enterprises (SMEs)**. Most clients belong to the **secondary sector**. Although most clients are located within the region or nation almost 120 TDACs claimed that they had some **clients from foreign countries**.

Systematic **promotion** is done by the majority of the TDACs. The most commonly used methods to reach clients are direct mailing, participation in conferences, congresses, and trade fairs as well as publication (not advertisement) in relevant journals.

When asked to project into the future and predict **major bottlenecks and weaknesses** and major strengths and opportunities over the next 3 years, most TDACs expect to have some financing difficulties. This includes both financing personnel and obtaining money for equipment and facilities used for demonstrations. Other expected bottlenecks were the recruitment of staff and the attraction of new clients. Strategic development ranks first as a **major strength,** followed by the development of services complementing demonstration activities; attracting new clients; developing co-operations; and keeping pace with technological change.

Plans for the next few years include an increased client base, followed by increasing turnover and an increase in the use of EU programmes and subsidies. Increasing the number of technologies to be demonstrated was also an important goal for the next few years.

A **typology** is proposed for the TDACs within the European Union. Excluding 'weak definition TDACs' (demonstration is not a major activity) and 'pure demonstration centres' (which only provide demonstration in a strict sense) the following two classes were identified:

- **Development centres** (47%) - oriented towards non-mature technologies, which develop / adapt and demonstrate technologies, generally for a first time in avant-garde firms.
- **Integration centres** (32%) - generally oriented towards the demonstration of mature technologies and helping SMEs to efficiently integrate / use the new technology.).

Both integration and development centres are fairly well represented in each country. However, there is a dominance of integration centres in the Netherlands and Spain and of development centres in Belgium and Portugal.

TDAC Related Policies

Advanced technology demonstration policies in the EU can be roughly divided into **government programmes** which are usually initiated at the national level (as part of a broader technology specific policy) or which are non-technology specific technology transfer measures predominantly at the regional level, and **institutional (private) initiatives**. Initiation and continued funding for demonstration activities by national governments have focused on public and semi-private research organisations and universities (RTOs, TDACs, etc.). **Government support** ranges from initial funding of equipment and facilities up to and including funding of staff and demonstration activities. In some countries, such as Great Britain and Germany, direct support programmes for industry were also initiated. This includes the *Inside UK Enterprises* (IUKE) programme in Great Britain and the '*Technologie-orientiertes Besuchs- und Informationsprogramm*' (TOP) in Germany. In other countries, such as the Netherlands and Denmark, firms were given financial support to adopt new technologies and processes on the condition that they in turn demonstrate these to interested firms.

At the **institutional level** both private and public research institutions and universities have taken their own initiatives to demonstrate new technologies and processes. For some institutions this is done to support their own research and to promote the results of their work. In several cases the objective is to demonstrate their know-how and competence by providing neutral demonstration and information on new technologies and processes for SMEs. This way of launching TDACs is characterised by the directing of their own funds to demonstration activities. However, in many cases these funds originate from public sources as well.

Within the EU **support** to TDACs by national governments **varies from country to country**. In Germany the Federal Government has supported demonstration activities in TDACs for more than a decade and is currently concentrating on the 'Neue Bundesländer.' In Southern European countries, such as Italy, the government is contemplating the initiation of programmes for demonstration activities.

Main Issues

A comprehensive analysis of the TDAC survey and interview results led to the identification of a number of major aspects concerning TDAC strategies, their role within the technology innovation and transfer activities, and the assessment of their activities.

- *Range and Integration of Services in TDACs.* The demonstration of technologies and their application possibilities alone do not provide a sufficient basis for a TDAC. Thus demonstration is very seldom the only activity of TDACs. Although 40% of the responding TDACs reported demonstration as an activity of major importance, the interviews showed that demonstration activities are in general complementary actions to support the main objectives of the organisation. A range of **integrated services** is being offered by most of the TDACs identified. Services such as the assistance of firms not only in selecting a suitable technology but also during the planning and implementation phases are indicative of the integration oriented characteristics of the support offered.
- *Promotion of TDAC Services.* One of the important issues for TDACs is the attraction of a sufficient number of clients. To meet their goals most of the surveyed TDACs promote their activities in a systematic way. Active promotion appears to be necessary as small enterprises are especially difficult to reach and attract. There is some reluctance in firms to approach organisations or institutions which are associated with high level research institutes. Promotion has to convince potential clients that TDACs will assist them with their day-to-day technical problems and that they as actual users will benefit from the new technology. There was some concern by clients about a lack of transparency/visibility of the TDAC activities. It should become clear to clients how they can benefit from the new technology.
- *Appropriateness of Technology, Application, and Sector Oriented Strategies.* The study has shown that the distinction made between technology and application oriented TDACs on the one hand and sector oriented TDACs on the other hand formed an appropriate criterion for a basic categorisation of the institutions. The three organisational types can ideally be related to the technology life cycle. In the early phase of technology diffusion technology oriented TDACs are the appropriate institution for the demonstration. During the increasing diffusion of technology application oriented TDACs, which focus their activities on services beyond the mere demonstration of a technology, seem to be the appropriate organisation. In the late phase of technology diffusion, when questions of

broad distribution and promotion of structural changes become important, sector oriented TDACs seem to be more adequate.

- *The Management of Change.* The development of TDACs, especially of the technology-centred ones, is closely linked with the pattern of diffusion of the particular technology in the nation's economy. As a result of the strong links with the extent and speed of technology diffusion, TDACs must be in the position to adjust or transform themselves regarding their function in the national innovation system, the services they offer, target group(s), their mode of addressing customers, necessary qualifications, etc. If this process is accompanied by a steady cut-back in public support, then the TDACs are also faced with the challenge of guaranteeing the continuation of the institution by securing adequate liquidity.
- *The Assessment of TDAC Performance.* The performance of a TDAC and the assessment of its success is largely dependent on the mission or goals of the centre. The objectives of a TDAC will vary depending on the role it plays in the diffusion of technology. The measurement of a TDAC's performance is thus complex and difficult to perform. It is generally not practised by TDACs at this time. This does not mean that TDAC managers and policy makers do not evaluate at all the success of a TDAC's operation, but that the criteria used are only indicative of directly measurable factors. Factors which are more tangible and difficult to measure and especially which are related to clients' needs and requirements, have up to now only rarely been used to assess TDACs. Particularly among policy makers there is some dissatisfaction about the approaches and instruments available to assess the success and performance of TDACs.
- *Regional Orientation in TDAC Establishment.* Initiatives for the establishment of TDACs started in some countries (e.g. Germany and France) on a regional level. Regional government (sometimes supported by some policies of the national government) and local institutions saw a demand for activities which would improve technology transfer to local or regional enterprises or institutions. These activities concentrated on technologies relevant to the industry or the characteristics of the region. A crucial point in regionalisation of TDACs is the degree of specialisation achievable and the critical mass of customers in advanced technology fields.
- *Demand Assessment and Demand Orientation.* The establishment and operation of TDACs have in the past been mainly supply oriented. The scope of the services offered and the type of technology demonstration and technology transfer are based primarily on assumptions and not on reliable information on the actual needs of the potential customers. Not one case could be identified in which the demand potential for TDAC services or the potential target groups as well as their need for information and their information behaviour patterns had been studied. This strong supply orientation has impacts on the demand for TDAC services and the use of demonstration centres. This applies above all to technology-centred TDACs and those which are organisationally linked with research or university institutions.

- *The Timing and Integration of Technology Demonstration in the Context of Broader Technology Programmes.* The effectiveness of TDACs within the national innovation system is influenced by two factors in particular: the timing of the launch of technology demonstration and application activities in relation to the diffusion and degree of maturity of the technology in question, and the conceptional and chronological co-ordination of state promotion measures for TDACs with other technology policy measures (e.g. for the diffusion of certain technologies). Besides the degree of maturity of the technology demonstrated in TDACs, the conceptional and chronological co-ordination of state support for TDACs with other national and even regional technology policy measures is of great importance to the effectiveness of demonstration centres.

Policy Implications

The results of the study have shown that TDACs with their demonstration activities form a stand-alone institution in the range of technology transfer bodies and can play an important part in an overall strategy of technology and innovation transfer. TDACs have focused their actions on SMEs and have succeeded in attracting a clientele mainly from small. They have thus at least partly succeeded in addressing enterprises which traditionally are a major but difficult target group of technology transfer processes. These enterprises in fact appreciate the TDACs in particular for their skills in monitoring technologies, their neutrality, their usefulness during the feasibility-adaptation phase and their reasonable cost.

The following policy issues were identified in the study and presented with possible actions to be taken at the European level. Some of the measures discussed are suitable for application at both the national and the European level.

- *Networking.* The study has revealed that although there is some exchange of information between TDACs at the national level and also to a lesser degree at the European level, no systematic activity to share experience or know-how could be identified. International activities, as the study showed, are of interest to TDACs and should be further developed. An idea would be a European exchange programme for TDACs which could not only extend demonstration activities and promote technology transfer across regional and national boundaries but would also provide an excellent way to exchange experiences between TDAC management and staff. The exchange programmes should be supplemented by periodic seminars or workshops providing a platform for the discussion of relevant issues not only for TDAC managers but also leading actors from other demonstration and technology transfer actions.
- *Promotion/Marketing.* The awareness of TDACs and their services is a prerequisite for the subsequent use by SMEs. Promotion of their activities is thus a very important issue for TDACs. The mission of most TDACs is to focus their activities on SMEs as a target group.

It is, however, a difficult task to convince small enterprises that the technologies demonstrated are not only for large firms but that the TDAC services offered are especially tailored to meet the needs and requirements of SMEs. Best practices have to be identified or developed to be employed by all TDACs. This could be a field for actions on a European level in two directions: to generate awareness of TDAC activities and to develop and initiate best practice promotion methods. Support from the European Commission in this area will be especially important as awareness campaigns on a European level under the patronage of the EC have more leverage and will reach larger target groups in all regions of the EU.

- *Orientation to Client Demand.* Generally TDACs were established and managed based on a supply-oriented strategy. There often is little known about the demand side of demonstration activities and services offered. Questions like 'How much information do companies need?' or 'What kind of information are firms looking for?' have not really been answered. Ways to remove this deficit especially before the establishment but also during the active phase of TDACs have to be analysed and solutions developed. The integration of these procedures in technology transfer policies should be a goal both at the national and the EU level.
- *Evaluation and Performance Assessment.* Evaluation of a TDAC with respect to its effectiveness within a technology transfer and innovation policy is very difficult and as of today has generally not been undertaken by TDAC's management or public bodies. On the other hand it is important for policy makers to have a reliable and comparative information in order to rate and compare the performance of TDACs with other institutional measures. Due to the diversity of TDACs (in their missions, strategies, etc.) evaluation criteria will be quite complex. A crucial aspect is the impact on industry and therefore current and potential customers have to be considered in any approach or methodology. The evaluation of TDACs is not only a national objective but is of importance to all members of the EU. A joint action could thus be appropriate.
- *Further Development of Technology Demonstration Policies within the EU.* A survey of national demonstration policies and interviews with policy makers has shown that some form of government support has been given to TDACs in the past in almost all EU countries (and also in Japan and the USA) which implies that policies have existed for demonstration activities respectively that different technology programmes have partly referred to demonstration as a means of technology transfer. These actions have, however, in general been rather isolated and focused on particular technologies. A comprehensive concept of the role of technology demonstration in technology (transfer) policy is largely missing. Complementary to the policy actions proposed above the European Union could play an important role in the co-ordination of the national (and even regional) demonstration policy actions within the EU. It is necessary to realise that demonstration activities are an

important part in the chain of technology transfer and innovation support instruments available and as such should form an explicit element in technology policy.

TDAC Workshop
A two day workshop on demonstration activities as part of technology transfer and innovation policies was organised by the Commission and the FhG-ISI in Luxembourg on May 11th and 12th. More than 40 participants and speakers exchanged their experience with demonstration activities. In addition to TDACs as one demonstration facet several schemes of technology demonstration via company visiting programmes were introduced and their merits discussed.

It was found that experience with demonstration activities supported the main results of the study. It was made clear that demonstration is not restricted to TDACs. Demonstration has to be understood as a function which can be part of a variety of programmes for technology transfer. General agreement existed on the role of demonstration as an important part of technology transfer and innovation measures. Demonstration, both within TDACs and as part of other programmes. is an excellent means to reach small and medium sized firms.

Examples of TDACs within the EU were presented. They also exemplified the differences in public policies within the EU. In addition an overview of the current situation in Japan and the USA was given. An important feature of demonstration activities (especially also of TDACs) is the neutrality of the service. This increases the trust particularly of small firms (which can be reached by this activity) in these centres and eases their problem of minimising the risk involved in changing to new technologies and organisational forms. The complementary form of demonstration to other technology transfer related service was also stressed. Possibly because of the variety of structures and policy measures in this area it was not possible to come up with a single recommendation to policy makers. Instead it was felt that additional research should be done on a number of aspects such as the assessment of the impact, the cost effectiveness, and the market demand.

Technology Demonstration and Application Centres in Belgium and Luxembourg

Country Report in the Framework of the SPRINT EIMS Project 94/71

CM International
Centrale Management
Vélizy - Villacoublay, France

June 1995

CONTENTS

DEFINITION AND DIFFERENCES OF TDACs
Compared to Related Institutions

A « Technology Demonstration and Application Centre » (TDAC) is understood as an institution which mainly offers public or private enterprises demonstrations of new technologies and distributes these services with a systematic marketing approach. In addition to that, it can offer further services such as information about and advice or training on new technologies, testing and certification, and so on. In detail, the services offered include the following aspects :

⇨ *Demonstration of New Technologies*
The operability, competitiveness or specific application of new technologies are demonstrated to back up the information and consultation offered. Different media methods may be used for this purpose.

⇨ *Information about New Technologies*
First of all, general information about how the new technology functions and its productivity. In addition, general information about aspects of application such as general prerequisites of implementation, organisation or qualification for using the technology.

⇨ *Advice about New Technologies*
Individual consultation is also offered alongside general information. This may relate to company-specific technical aspects as well as questions of utilisation (e.g. introduction strategies, training,..).

The services offered are generally neutral with regard to technology suppliers, are presented without sales intention and are aimed at public or private enterprises (i.e. private households are not included as a target group). Based on this definition, a TDAC has to be distinguished from institutions with similar aims and services such as :

⇨ *Technology Centres / Science Parks* : These institutions provide young companies developing new technology products and processes with a fully developed infrastructure as well as services and advice. In contrast to a TDAC, this is only offered to companies based within a technology centre.

⇨ *Technology Transfer Centres* : There are many different terms for this kind of institution such as technology transfer, technology advice, innovation advice or interface centre. Their common characteristic is that they all attempt to promote the transfer of information, knowledge and resources from Technological Resources Centres to companies. In contrast to a TDAC, the technology transfer centre does not necessarily have to be connected with the demonstration of systems or processes.

⇨ *Exhibition / Demonstration Centres of Technology Suppliers* : In contrast to a TDAC, these centres present manufacturer-related offers which aim to sell new technologies.

⇨ *Consumer Advice Centres (e.g. local utilities, energy suppliers)* : In contrast to TDACs, the services offered are aimed primarily at private households.

1. INTRODUCTION

➔ Objectives of the European Study

For Public authorities concerned by Technology Transfer policies, one of the crucial and current questions is the following : ***How to enlarge the innovation fabric and how to reach traditional SMEs ?***

This study evolved from the hypothesis that demonstration activities could be an adequate solution to facilitate the diffusion of technologies towards enterprises who, up until now, have not been aware of the existence, or the benefits, of such technologies. In this context, four main objectives formed the structure of the analysis :

- ⇨ *Characterise Technology Demonstration and Application Centres (TDACs) in the European Union* : Identifying technological and sectorial fields, status, regional distribution, activities, client base, finance structure, difficulties encountered and major trends.
- ⇨ *Compare TDACs with other types of Demonstration Tools, especially from the SME's point of view* : such as Company Visiting schemes, demonstration investment programmes, supplier commercial activities,..
- ⇨ *Compare existing public policies towards demonstrations.*
- ⇨ *From the lessons learned, identify some key areas for the Commission's policies (DG XIII).*

This study will also contribute to the share of experience / best practices between policy makers and TDAC managers at the European level.

1.1. Information Sources

A first list was established by CM International which was then added to by their contact at the Flemmish Institute for the Promotion of Scientific Technical Research in Industry (IWT). Direct contact was also made with certain members of the Union of Community Reseach Centres (UCRC) Network, having consulted the UCRC directory.

➔ The TDAC Survey

In total, 25 questionnaires were sent to Belgium of which 11 centres replied and all of whose responses were analysed. Only 1 questionnaire was sent to a Luxembourg centre, which replied and of which the response was then analysed.

TDAC INTERVIEW GUIDELINES

Objective	Topics / Questions
History	● Historic development of the demonstration activities - origin ? - evolution of client needs and anticipation of future client needs ? - investment strategy ?
Presentation of Demonstration Activities	● How important are demonstration activities compared to other services offered by your centre ? Brief description of the other services ● Description of the technology demonstrated. Why is a demonstration stage necessary for this technology? ● What is your definition of a demonstration activity?
Role in Innovation Process	● Role of TDAC in the dynamics of innovation, diffusion and technology transfer at sector and regional level ● Client base targeted ? Original expectations of the client ? ● Do you know of any other forms of demonstration ? ● Synthesis of the added value of a TDAC
Performance of Demonstration Activities	● Are the demands and the specific needs of the target groups (SMEs) met ? ● How successful has the TDAC been in providing innovation services ? ● Major bottlenecks ? What are the solutions envisaged ?
Management of Demonstration Activities	● Presentation of the different stages ● Key success factors ● Is this activity recognised by the institutions which finance you ? ● Any particular difficulties in obtaining financing for investment ? ● Methods to anticipate the future needs in terms of demonstration activities ? ● Methods used to attract potential clients ?
Public Policies	● Your evaluation of the position of TDACs in National technology transfer plans, ● Recommendations that can be given to regional, national and European policy makers ? ● Participation in any national / European TDAC network / Association ?

➔ The TDAC Interviews

The data from the returned questionnaires were entered into a database, along with the data from the other countries being analysed, and from this a typology of the TDACs was produced. Once all of the TDACs had been slotted into the typology, it was decided to visit some of the centres in order to carry out more in-depth face-to-face interviews to be able to get a better understanding of the centre and its demonstration activities.

3 TDACs were visited in Belgium : CRIF Metal (Liège), The Office of the Future (Brussels) and Teleport (Brussels).

The interviews with the centres were carried out using the guidelines shown in the table opposite.

➔ The Policy Maker Interviews

Similarly, the interviews with the Belgian policy makers were carried out along the guidelines shown in the table over the page.

1.2. Content of the report

Having identified in the first section the methodology followed in this survey and any difficulties encountered, the second section will briefly cover the Technology Transfer activities in Belgium. The third section provides mainly a quantitative presentation of the main results of the questionnaire survey.

The fourth section looks at the results from the interviews : a qualitative presentation and discussion of the field interviews will be given, focusing on the aspects of demonstration activities and using a detailed example of one centre complemented by the input from other interviews.

The fifth and final section contains the conclusions based on the survey.

POLICY MAKER INTERVIEW GUIDELINES

Objective	Topics / Questions
Role of TDAC	• Role of TDACs in public technology and innovation support programmes at sector and regional level, • Rationale for the existence of TDACs
Performance of TDAC	• Success of TDAC in supporting SMEs, • Are there technologies or applications which can be better diffused via TDACs ? • Effectiveness of TDAC activities, • Methodology and criteria used for the assessment of TDAC activities.
Public Policies	• Position of TDAC in National technology transfer systems / programmes, • Other related activities or measures in the area of technology transfer and innovation strategies promoted by the government, • Role of public authorities / sponsors (funding, strategies on technologies, application fields, target groups),, • Links with European policies (implications)..

2. TECHNOLOGY TRANSFER ACTIVITIES IN BELGIUM

The current situation with regard to Technology Transfer structures in Belgium is very different to that of any other country in Europe. In particular, the technology transfer structure in Belgium is mainly centred around Sectorial Technology Centres of which there are 13 regrouped into the UCRC network and which are involved in the following sectors : wood, brewing and malting, ceramics, cement, building, electricity, metal-processing, gas, metallurgy, paint and coatings, road, textiles and glass.

The aim is that the centre carries out a particular research project which has been chosen by a Committee made up of representatives from the Ministries and the industry concerned. Once the research project is completed, the results are diffused to all of the subscribing enterprises. **In a global context, it can be said that one half of the Community Research Centres are active in the field of demonstration activities.**

It would appear from the Belgian survey that the majority of TDACs belong to the UCRC network and in fact 7 centres in the survey came from this network. However, there does remain a small percentage of structures that fall outside of this category and yet which still offer some form of technology transfer and demonstration activities. These are in general, however, structures which receive very little, or no, public funding. 4 such structures were identified in the survey as TDACs. The private nature of these structures brings a whole new element into play. In order to earn their living, these private structures are forced to charge clients/enterprises for technology transfer or demonstration activities which makes it much less attractive for SMEs.

List of the TDACs analysed in Belgium and Luxembourg

➤**THE OFFICE OF THE FUTURE**
⇨1020 BRUSSELS
⇨ Office automation software and applications

➤**CENTRE DE RECHERCHES ROUTIERES**
⇨1020 BRUSSELS
⇨ Road construction and maintenance

➤**CENTRE HENRI TUDOR**
⇨1359 LUXEMBOURG
⇨Technologies for : computer integrated manufacturing, multi-media, health,..

➤**CRA**
⇨5030 GEMBLOUX
⇨ Environment protection, chemical analysis,..

➤**CRIF METAL**
⇨1090 BRUSSELS
⇨ CAD / CAM, inspection, casting

➤**CRIF**
⇨3001 HEVERLEE
⇨ Metal manufacturing, automation,..

➤**CUNIC COMPOSITES**
⇨6000 CHARLEROI
⇨ Composite materials

➤**CRIF PLASTIQUES**
⇨4000 LIEGE
⇨ Composite implementation
⇨ Rapid prototyping

➤**CTIB**
⇨1180 BRUSSLS
⇨ CAD
⇨ Micro-waves

➤**CENTEXBEL**
⇨9052 ZWIJNAARDE
⇨ Manufacturing processes in the textile industry

➤**CSTC**
⇨1932 ZAVENTEM
⇨ Construction materials

➤**TELEPORT**
⇨1020 BRUSELS
⇨ Telecom., Information technology

3. SURVEY RESULTS

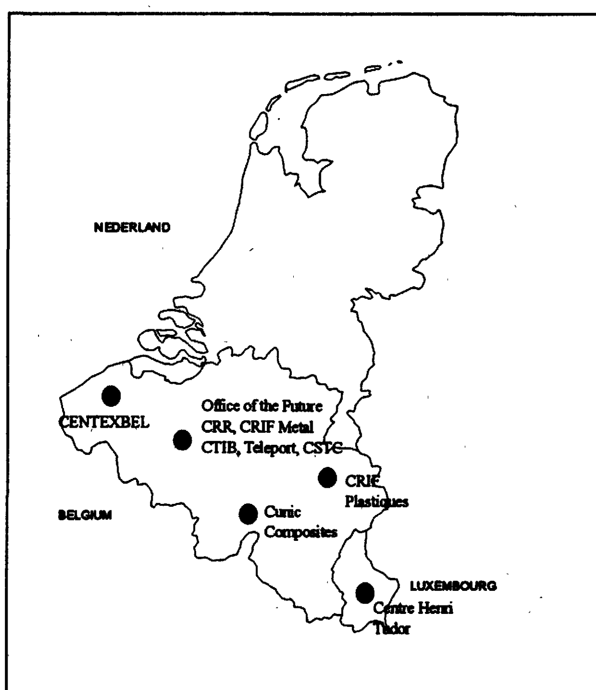
3.1. Introduction

The body of this section is based on the country particularities that have been identified from the results of the survey carried out in Belgian and Luxembourg, compared to the overall results of the European countries analysed (the E.U. average). For more detailed information, please consult the synthesis of the study.

➔ The list of Belgian / Luxembourg TDACs

The table opposite lists the 12 TDAC centres that were analysed in the study and gives their address and area of activity.

➔ Map of Belgium / Luxembourg showing the locations of the TDACs identified in the Study



➔ The Organisation, Status and Size of Belgian / Luxembourg TDACs

6 out of 10 centres declared to be an independent unit.

- 2 out of the 6 centres who answered this question were Public Research Centre laboratories, 2 were Regional Development Bodies and there was 1 each of an industrial association and semi-public research institute.

- Due to the high proportion of Community Research Centres in Belgian, the TDACs are in general large units with 7 out of the 11 employing more than 25 full time staff. This is also true for the Henri Tudor centre which employs 80 people. Only 2 centres in the survey employ between 1 - 10 staff.

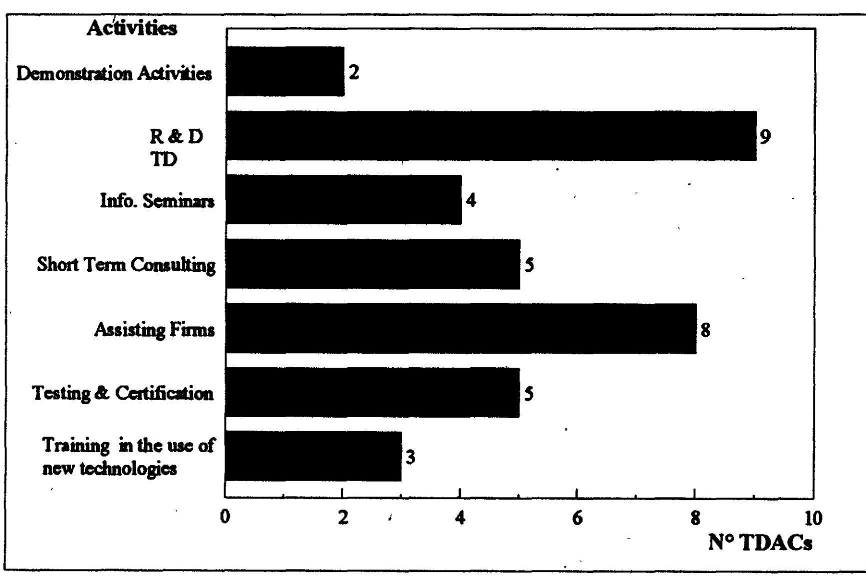
3.2. Activities of the TDACs

➔ Demonstration activities are not considered the most important

The centres carry out numerous activities other than the demonstration of advanced technologies and in the case of the Belgian and Luxembourg TDACs other activities are considered more important.

Whereas only 2 centres consider demonstration activities to be very important, 9 consider R&D to be a very important activity and 8 give their role in assisting firms with the conception, development and implementation and technological solutions a weighting of equal importance.

Activities mentioned as "very important" by Belgian / Luxembourg TDACs



➔ Sectors and Technological Fields : Materials and Manufacturing Technologies

7 out of 11 Belgian TDACs consider the technological field of Materials to be a "very important" sector in which to offer their TDAC services. This is greatly superior to the EU average. 5 centres also place an importance on the Manufacturing technologies sector. The principal sector in which the Henri Tudor centre is involved, is that of Electronics, Communications and Information technologies.

Not one centre in the survey, however, classed the Energy sector as "very important".

➔ Typologies : Belgian TDACs are development and sector oriented

- The table on the following page describes the various typologies that were identified for the centres in the study.

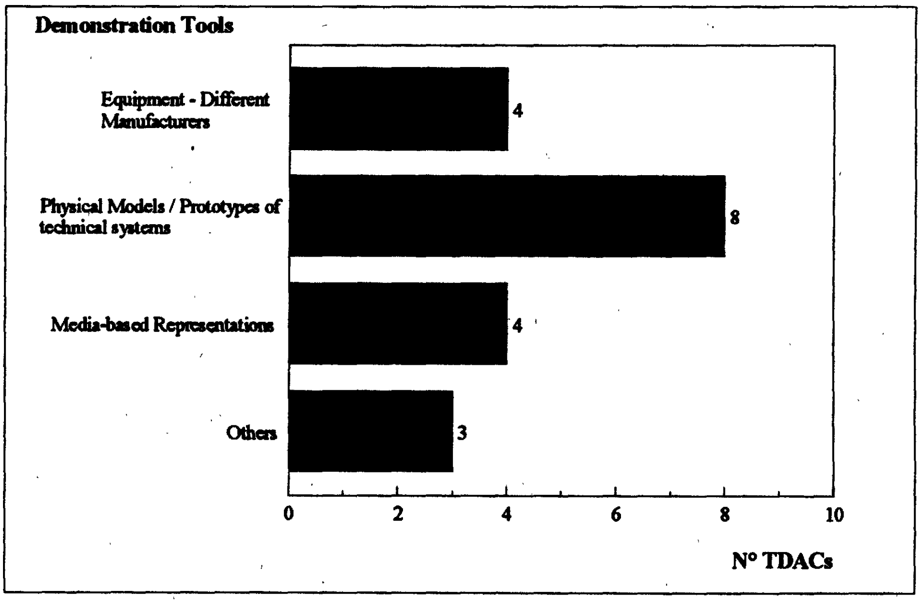
  Looking at the typology based on the associated activities, **the majority of TDACs (in Belgium and Luxembourg) are classed as Development oriented centres (7 out of 12), 1 is a Pure Demonstration Centre and 1 is an Integration centre**. This leaves 2 of the centres analysed as weak definition TDACs. The large weighting of development oriented centres reflects the importance that the centres places on R&D.

- 10 of the 12 TDACs are sector oriented, the other 2 being oriented towards the application of a certain technology. The fact that so many are sector oriented is not surprising bearing in mind the importance of the large Community sector research centres in Belgium.

➔ Methods of demonstration : Physical models / prototypes of new technical systems

In order to demonstrate these advanced technologies, 8 out of 11 of the TDACs do so via the use of physical models and prototypes of new technical systems, like their French and Italian counterparts. Different from the other European countries however, only 4 centres in Belgium use systems from different manufacturers to demonstrate the technologies.

Tools used to Demonstrate Advanced Technologies



Definition of the TDAC Typologies

Two main elements have been used to typify TDACs within the European Union :

1) The importance of the demonstration activity for the centre, which differentiates 3 classes :

- **Non TDAC** (15% of the first European sample) - where the demonstration activity is not important. These centres have been kept out of the analysis.

- **Weak definition TDAC** (18% of the first European sample) - where the demonstration activity is not one of the most important activities of the centre.

- **TDAC** (77% of the first European sample) - where the demonstration activity is strategic for the centre (one of the most important areas of activity for them).

2) The nature of the major associated activities within TDACs, excluding Non TDACs and Weak definition TDACs. From this, three new classes emerge:

- **Pure Demonstration Centres** (4% of European TDACs) - where demonstration is the only activity of the centre.

- **Integration Centres** (35% of European TDACs) - these centres are oriented towards helping the SME integrate new technologies (technical assistance, testing, training,..).

- **Development Centres** (57% of European TDACs) - these centres are oriented towards developing / adapting a new technology for the particularities of a particular industrial sector (R&D in particular)..

Typology of the TDACs in Belgium and Luxembourg

Weak Definition Centres	TDACs		
	Pure Demo.	**Integration Centre**	**Development Centre**
CRIF - IGPP	The Office of the Future	CENTEXBEL	Centre de Recherches Routières
CTIB			Centre Henri Tudor
			CRA
			CRIF Metal
			Cunic Composites
			CRIF Plastiques
			CSTC
			TELEPORT

➔ Diffusion / Promotion Channels

All of the Belgian and Luxembourg TDACs who replied to this question systematically promote their TDAC services. In order to promote them, the centres principally use 3 channels of promotion regularly : **7 out of 11 centres place publications in relevant journals, 6 participate in conferences/fairs and 6 use the method of mailings**. The first channel of promotion mentioned is used much more widely here that in other European countries (the E.U. average is 51 %). In addition to these methods, the Henri Tudor centre also demonstrates technologies at technological or training fairs.

3.3. Finance Structure

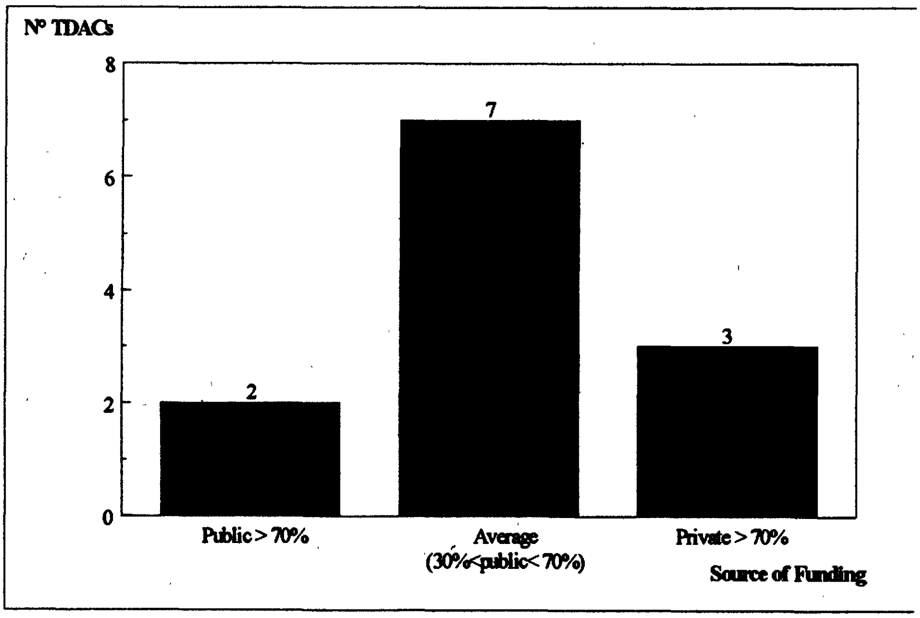
➔ Initial Investment : Financed principally by Public European funding

The Belgian centres, like the French centres, appear to have benefited from the different areas of public funding (Regional, National and European) to a larger extent than the other European countries in the initial investment. The largest difference is that 9 out of 11 Belgian TDACs declared that the initial investment in their centre was financed to some extent by Public European funding (E.U. average is only 30 %).

➔ Budget Sources

The financing structure in Belgium is fairly similar to that in Spain. 7 out of 12 centres have a balanced financing structure, 3 are funded more than 70 % by Private funds and 2 more than 70 % by Public funds. **Along with Spain and GB, Belgium and Luxembourg have a very low proportion of TDACs funded more than 70 % by Public Funds.**

Budget Sources of Belgian / Luxembourg TDACs



3.4. Client Base

For 7 of the Belgian centres, over 60 % of their clients are small enterprises. However, only 13% of the Henri Tudor centre's client base is represented by this client type, the majority of their clients being large enterprises or public organisations. In addition, half of the centres in Belgium claim that over 60% of their clients are of a local or regional origin.

Only 1 centre in Belgium stated having over 20% of their client base represented by international clients.

3.5. Conclusion

From the quantitative information given in the survey, the following points stand out as being fairly specific to the Belgian/Luxembourg TDACs :

- ⇨ R&D activities and assisting firms is considered in Belgium and Luxembourg to be more important than the demonstration of advanced technologies.
- ⇨ Nearly all the centres are sector oriented.
- ⇨ European public funding of some level was very prominent in the initial investments made in the Belgian centres.
- ⇨ In general, the TDACs have a balanced financing structure between public and private funds.
- ⇨ 7 out of 11 Belgian centres declare that over 60 % of their client base are small enterprises (less than 50 employees).
- ⇨ 50% of Belgian centres claim that over 60% of their client base is represented by regional and/or local enterprises.
- ⇨ The presence of international clients is minimal amongst Belgian TDACs.

THE OFFICE OF THE FUTURE

Status :	Independent unit
Annual Turnover :	203,000 Ecus (1993)
Initial investment :	Suppliers, users, self-financing
Budget sources :	Fees for services (100%)
Principal activities :	Demonstration of advanced technologies, Information seminars, training in the use of a technology.
Technological domains :	Electronics, Communications and Information technologies - software and applications of office automation
Demonstration method :	Systems from different suppliers. Systematic promotion of services through mailings and publications in relevant journals.
Total number of staff :	5 (1 technical, 1 administrative, 3 others - management, marketing and organisation of events)
Client Base	70 % have more than 50 employees National origin (100%)

4. INTERVIEW RESULTS

Field interviews were carried out in three different centres, one of which is representative of the large Community Research Centres and the other two which come from the minority of private research centres.

4.1. A case study of the "Office of the Future" centre

• ***A private research centre focused on the concrete applications of informatics and their impact on the enterprise***

The Office of the Future is a centre oriented towards the various applications of computers/ data processing. It is one of the few private research centres in Brussels employing a team of 5 people (including administrative staff) and it has three principal permanent activities :

- ⇨ events / open days,
- ⇨ assistance / training,
- ⇨ demonstrations.

➔ The Centre's Mission

"To make the clients (Department Directors) aware of the possibilities and potential of the information systems/applications currently available on the market through explanations and demonstrations given in layman's terms which clarify the vague ideas held by the directors."

• ***A centre set up in response to a real demand from non-technical people***

The director of the centre recognised a gap in the market and set up the Office of the Future to fill it. The gap he recognised evolved from the unsatisfactory relationship which exists between the informatics department of an enterprise, who speak a technical language, and the Directors of various departments (e.g., marketing, finance, sales,...) who are only familiar with layman's terms.

The Department directors do not have the time to constantly watch the emergence of new technologies or applications which could be of interest to them, and they do not feel able to turn to their informatics department to ask them basic questions about these technologies. According to the director of the centre, **this ability to provide clear and basic explanations is a key success factor for the centre.**

➔ The Centre's Activity

The centre's principal activity revolves around the organisation of events or open days when the directors of large companies are invited to participate in the demonstration of numerous technologies, applications or products.

Before organising the demonstration session, a particular theme is chosen by the centre in response to identified demands and then in one day, the participants are shown all the latest products on the market in this field and can even learn some first hand experiences from other directors who may have already used the technology/equipment. During the course of the day, the centre may propose various solutions to the companies' individual problems.

Comments from participants (as told by the director) :

- "The cost for attending is quickly justified by the service provided"
- "Lots of different suppliers do not have to be visited individually because all their equipment is gathered in the one room, therefore gaining valuable time"
- "There is no fear of ridicule in asking a basic question"
- "There is no supplier pressure to buy the equipment"
- "All the participants are in the same situation and speak the same 'basic technical language'"
- "The centre manages to communicate the information in a basic language that the company's Informatics director is incapable of doing"

However, after the demonstration session has taken place, the centre does not seem to be as much involved as it was during the demonstration activity. It does not get involved if the client is interested in purchasing the technology or pursuing it further with a particular equipment supplier (it is a separate matter between the two parties) nor does it perform any type of follow-up activity or continuous assistance during the implementation of an equipment/technology. Furthermore, although the centre can offer some advice facilities, the staff do not leave the centre to visit clients in their company.

➔ A Centre not very effective in reaching SMEs

Bearing in mind the size of the centre and the lack of external funds which it has access to, the client base of the centre grows not through an expensive advertising campaign but by word of mouth. The Office of the Future knows of only one other centre like it which is in Holland, and so clients visit them from all over Belgium on the recommendation of a friend/colleague from large enterprises who has already participated at one of the open days or training sessions.

Even though the centre works very well with clients from large enterprises, it recognises that it is significantly less involved with SMEs. However, it believes that on their side, SMEs are very badly informed about the existence and potential of new technologies and very few are even aware of the existence of the centre. This is because on the one hand, the cost to attend one of the demonstration sessions is too high for the SME and on the other, the centre does not have the means to finance a large marketing campaign to promote the sessions and the potential benefits. It is a catch-22 situation.

In order to escape from this situation, public funding needs to be developed to enable the centres to realise the potential offered by the SME market.

4.2. Lessons from the TDAC Interviews

In all of the cases analysed, the Belgian/Luxembourg TDACs do not see themselves as a rival to the equipment supplier. Indeed, in the case of the Office of the Future centre, it could not function without the co-operation and collaboration of the equipment suppliers. In general, they see themselves more in the role of an intermediary who :

- ⇨ introduces enterprises and individuals to a world that would otherwise be incomprehensible to them,
- ⇨ creates interest to develop the technological opportunities existing in enterprises by showing what benefits can be gained,
- ⇨ offers both technical and psychological support to the enterprise when faced with change. In the case of the last aspect, the support offered involves conquering the reticence of the employees with regards to change, both human and technical.

Two major problems were identified by the Belgian / Luxembourg TDACs :

- ⇨ *Obtaining public funding to reach SMEs.*

  In order to reach a larger number of clients or target a different type of client, e.g. SMEs, these centres need access to external funds in order to be able to benefit these clients from their expertise and services.

- ⇨ *Staying up to date*

  The centres must ensure that they remain up-to-date with the equipment/ technologies they are demonstrating available on both the European and International markets. A substantial effort is subsequently needed in competent man power which obviously requires a fairly large and steady flow of funds.

Over the next three years, 2/3 of the centres indicated that they would increase the proportion of activities devoted to demonstration along with the development of marketing activities.

4.3. What do enterprises think of Demonstration Activities ?

In the case of the large sectorial technological centres, the enterprises/clients were obviously in contact with them and used to working with them before demonstration activities became a more important part of their research processes (e.g. CRIF Metal). As the centre evolved from being a traditional research centre to a centre carrying out technological demonstrations, highlighting the major technological changes in the sector, the client and his expectations evolved too.

TELEPORT

Status :	Independent unit
Annual Turnover :	255,000 Ecus (1993)
Initial Investment :	Regional Public funds and membership fees
Budget sources :	Public core funding (70%) and membership fees/donations (30%)
Principal activities :	Demonstration of advanced technologies, R&D, training in the use of new technologies, agents of public promotion schemes.
Technological domains :	Electronics, Communications and Information technologies - Telecommunications
Demonstration method :	Systems from different suppliers and media based representations. Systematic promotion of services through advertisements in relevant journals.
Total number of staff :	2 (1 technical, 1 administrative)
Client Base :	Total clients : 510 90% have less than 50 employees Local origin (100%)

Brief description of the main activities :

Different from the Office of the Future, the Teleport centre (a creation of Technopol) is charged with the mission to inform free of charge the 22,000 SMEs in Brussels. This structure was set up by 15 institutions (50 % private, 50 % public) but now consists of only 2 people. **It initiates the SMEs in the usage of Communication and Information technologies (Minitel, data bases, EDI...) without favouring any one supplier**. The centre invites the SME to the centre and demonstrates / promotes the latest technology. The SMEs in general turn up with a vague idea of what is going on and, most importantly, do not feel at all influenced by the usual supplier pressure.

The centre believes that the need for demonstrations will increase dramatically in the field of Telecommunications.

The advantages offered by subscribing to these Sectorial Technological centres (according to the enterprises) are numerous and include :

- ⇨ "the centre, and its team, know extremely well the business of its clients and their various operating processes",
- ⇨ "the centre can provide various services throughout the course of the project, such as training, preparation of a work programme, technical assistance during the first production series,...",
- ⇨ compared to a supplier, the centre, in particular the various staff members (especially technicians), have the time to sit with the client and exchange ideas or just clarify some points which were, until then, quite vague for the client".

For the non-sectorial technology centres, very often it is the case that they have evolved from originally being purely information centre to being centres that provide demonstration activities (e.g. Office of the Future and Teleport).

The clients of these structures are very different to those of the large Sectorial Technology centres particularly because they are not a captive client base, and the advantages they gain are slightly different to those offered by the sectorial centres :

- ⇨ "first initiation to a technology /equipment and its use (both actual and potential)",
- ⇨ "demystification of new information technologies - explanations in layman's terms",
- ⇨ "the centre provides an exhaustive range of the different equipment and highlights the opportunities represented by them" (e.g. Office of the Future, Teleport).
- ⇨ "offers a speed / performance apprenticeship",
- ⇨ "they are neutral and the enterprises feel that they can ask any question without the same fear of reprisal that is present with a supplier"

CRIF - METAL
(CENTRE DE RECHERCHES SCIENTIFIQUES ET TECHNIQUES DE L'INDUSTRIE DES FABRICATIONS METALLIQUES)

Status :	Independent unit
Annual Turnover :	1.3 Million Ecus (1993)
Initial Investment :	Regional, National and European Public funds
Budget sources :	Public core funding (50%), fees for services (20%) and Membership fees / donations (30%)
Principal activities :	R&D, assisting firms, short term consulting
Technological domains :	Materials, Manufacturing technologies Electronics, Communications and Information technologies,
Demonstration method :	Systems from different manufacturers, physical models/prototypes of new technical systems, Systematic promotion of services through participation at conferences
Total number of staff :	140 (115 technical, 25 administrative)
Client Base	Total clients : 790 60 % have less than 50 employees 100 % national origin

Brief description of the main activities :

The CRIF Metal centre is an example of a Sectorial Technology Centres which works in the sector of metal manufacturing. It demonstrates CAD-CAM, injection, foundry, robotics and numerical machining by using equipment and prototypes. The aim of the centre is to exhibit or demonstrate the full range of the current "promising" technologies.

4.4. Role of the Policy Makers

In Belgium, the policy makers are at two different levels : the Ministers of Industry and Research at the National level, and the public authorities at the regional level (of which there are three different regions). **It is clear from the interviews with all the parties concerned that technological demonstrations are an activity which is not recognised in itself by the Belgian Policy Makers.** Subsequently, there is no specific action or policy in Belgium for demonstration activities

• ***However, some related projects are beginning to emerge.***

One of the CRCs, the CRIF Metal, has developed a project for the creation of a demonstration centre oriented towards a particular technology rather than a particular sector (for commercial reasons, he could not specify which one). The project was presented to the policy makers and succeeded in arousing interest amongst them. However, his project to set up demonstration activities has come up against some difficulties : the technology that will be demonstrated is applicable in several domains. The problem behind this is that the project induces a cross-sectorial approach which is today, different from the organisation of the traditional current transfer technology structures. As it is the CRIF Metal centre who has had this initial idea of a cross-sectorial technology demonstration centre, they have proposed to the policy makers that the technology be installed in their premises.

The uncertainty surrounding the project has led to several questions being raised of which the most important is : will the location of demonstration activities within sectorial centres limit the diffusion of the technology ?

Consequently, in the future, the appearance of this type of multi-sectorial demonstration centre could shake the actual Belgian technology transfer structure, a structure which is at present organised almost sector by sector.

5. CONCLUSION

⇨ For the Belgian TDACs, the demonstration of advanced technologies is an activity which is not recognised in itself within the global technology transfer structure nor by the Policy Makers. Although the situation is evolving, the main problem is that the development of demonstration activities often involves a non-sectorial approach.

⇨ Demonstration activities have a national development potential, therefore a significant inter-regional co-ordination is needed which is not facilitated by the current, new political situation in Belgium.

⇨ In general, demonstration activities of advanced technologies are perceived in a very positive light by enterprises/clients and are appreciated a great deal for their neutrality and their "approachability" when giving information or technical (and psychological) assistance on new technologies/products.

⇨ 2 major problems have been identified

- *A need for inter-regional co-ordination*

  Must eliminate the duplication of services being offered in Belgium and encourage the exchange of ideas between centres (on both national and European scale). A network should be created with the objective of rationalising and optimising the country's resources.

- *A need for public financing towards non-sectorial Technology Centres*

  Most of the Belgian TDACs are not largely supported by public authorities which forces them towards a certain market, with an orientation towards :
  - profitable clients (large enterprises as opposed to SMEs)
  - profitable services (these do not include revealing the needs of enterprises nor accompanying them throughout their innovation phases)

  In order to fully exploit the potential of demonstration activities and also to directly help SMEs, the centres need to have access to public funds to be able to reach this new market, different to the one that they are constantly being forced towards.

  Furthermore, to remain efficient vis à vis their competitors and to offer an exhaustive service to their clients, the centres are forced to stay up-to-date with the equipment/technologies they are demonstrating and which are available on both the European and international markets, activities which require of course time and funding.

Technology Demonstration and Application Centres in Denmark

Country Report in the Framework of the SPRINT EIMS Project 94/71

Fraunhofer Institute for Systems and Innovation Research, Karlsruhe

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June 1995

CONTENT

page

1 Introduction

The situation of TDACs in Denmark was analysed by the FhG-ISI. First contacts with research organisations and public institutions already indicated that it would be difficult to locate demonstration centres as defined. For the questionnaire survey a set of 14 addresses of potential TDACs (see Annex B) was obtained from the Danish Ministry of Research. The questionnaires were mailed in June and returns arrived in July and August. Of The 14 questionnaires mailed a total of 5 were returned resulting in a return rate of about 35 %.

To complement the information obtained from the survey and to learn about the more qualitative issues involved in TDAC management and policy making a field study followed the survey. Two TDAC managers were selected from the returned questionnaires. They represented two of three centres that qualified as strong TDACs. It was also possible to discuss with a TDAC client his experience and views on demonstration activities and the benefits arising from a TDAC. For a closer look at possible policies and programmes on demonstration and application actions one representative each of the Danish Ministry of Research and the Danish Ministry of Industry were visited.

The results of the above work and an analysis on demonstration activities found in Denmark are described on the following pages. The next chapter gives a brief overview of the technology transfer activities in Denmark. Chapter 3 presents the result of the survey including the questionnaire evaluation and the interviews. Finally conclusions and recommendations will be given in Chapter 4.

2 Technology Demonstration Activities in Denmark

2.1 History

During the mid eighties (i.e. from about 1984-1988) a technology development programme was initiated by the Danish Government (value of about 350 mill. DM). Of this a small part was intended for demonstration projects. Firms could apply for financial support if they agreed to demonstrate the results of their projects dealing with the introduction and use of new technologies. The majority of the technologies demonstrated were computer assisted methods in production. Avant-garde firms were thus motivated to share their experience with other firms (followers). The support programme thus initiated an efficient way for the dissemination of advanced technology applications and the experienced gained from its implementation. According to government sources the participation in the programme was good and the activities have been fairly successful.

Some broader demonstration activities have also been started by publicly supported institutes. The Danish Technology Institute for example had initiated comprehensive demonstration activities on technologies and methods in the field of CIM. This initiative was, however, not very successful as the applications demonstrated were not close enough to the actual applications in industry. Several other trials of demonstrations failed for similar reasons.

2.2 Current Activities

Today demonstration activities are no longer considered to be significant by Danish policy makers and are thus not part of Danish measures to promote technology and innovation processes. The only active demonstrations are those being done by a few technical institutes based on their own initiatives. Demonstrations can be seen as part of the research and development activities being done by these institutes, i.e. new developments are demonstrated to a potential clientele as part of their marketing activities.

The reason for no longer supporting TDACs is, however, mainly due to a change in policies, i.e. the emphasis has changed. Low effectiveness was not the reason for the move away from demonstration activities. Today the priorities have shifted to other methods for assisting SMEs. Among these are support in the area of quality assurance, consulting for small and medium sized firms, and the firm network scheme, i.e. the support of companies in their effort to work together by pooling resources and co-operating in some processes along the production chain.

Being a small nation the technological development of the Danish industry is only in part based on research done in Denmark. The bulk of technological development and innovation comes from Danish purchases of production equipment, licences, patents, etc. made from other countries. The import and dissemination of knowledge from abroad also plays an important role.

The evaluation, selection, and implementation of research results (especially from other countries) require, however, active research and a flexible infrastructure and organisations to pass on these results to industry. Research results and technical information are made in a number of ways available to the various interest groups. Important means to disseminate knowledge and technical know-how are: technical libraries, archives, databases (e.g. DANDOK), information centres (e.g. Infoscan, PUF), the 'Approved Technological Services' (GTS) system, and Science Parks.

Five Science Parks were established in Denmark between 1986 and 1992. They are all connected to universities with one objective being the transfer (application) of the knowledge that exists at research centres and universities to industry. This is done through co-operation between these institutions and companies in the region.

The Science Parks are expected to play a major role as 'incubators' for the development of new and small knowledge-based companies. They provide facilities such as shared offices and office infrastructure. They also support the informal exchange of information and the contracting of consultants. One of the science parks can also provide venture capital for new firms.

The activities to promote trade and industry are spread across several ministries of the Danish Government (Research and Technology Policy, 1993). Public funding can range from a small percentage to 100 % of the total costs. Supported will be projects that otherwise would not be undertaken. In addition venture capital is available from semi-private financing institutions. There are plans by the Danish Government to establish additional sector-oriented financing institutions.

There appears to be a loss of interest in technical sciences by young Danish people. The number of students of technical disciplines is declining. There exists some fear about the future quality of science and technical education. To offset this trend there are policy developments to open up 'Science Centres' which will offer interested persons the possibility to inform themselves about science in general. These centres are wholly science-oriented and are connected to universities or secondary schools.

3 Survey Results

In a second step of the project a written survey was conducted in order to collect basic information on potential TDACs in Denmark. Feedback was requested on the following major aspects:
- organisation (structure, status, size)
- profile (main activities, technological fields, financing)
- client base (size, sector, region, promotion activities)
- trends and developments (strengths and bottlenecks, future plans).

With only 5 of the 14 organisations contacted in Denmark answering the questionnaire a statistical analysis is not appropriate. This chapter will present a summary of the characteristics of the 5 organisations responding.

3.1 Organisation

The majority of the institutions responding consider themselves as being independent organisations. The largest one of them belongs to a larger organisation. All institutions responding are either private or semi-private institutes or companies. The two private companies are not part of any larger organisation.

The demonstration centres and their demonstration activities are relatively old. All but one of them were founded more than ten years ago. Demonstration activities were started as early as 1960.

Four of the centres have less than 100 employees, with one centre having less than 10 employees and one with over 200 employees. In all cases reported there has been an increase in the work force over the last few years.

The average turnover for the five centres was in 1993 about 6 Mill. ECU, however, three of them have a turnover which is half or less the average. This has increased over the last three years for four of them, only one reported a decrease in turnover. The reported numbers together with the other received data are summarised in Table 1 below.

3.2 Profile

Major activities reported by the five organisations were short-term consulting, assisting firms with technological solutions, and R&D (see Table 2). Demonstrations of advanced technologies were reported by two organisations as being very important for them (large 'X'), one felt it was important (small 'x').

Table 1: **Organisational Data**

	TDAC				
Characteristics	1	2	3	4	5
Independent body	X	X	X	X	
Part of a larger organisation					X
Private/semi-private institute		X		X	X
Private company	X		X		
Year of establishment	1982	1982	1959*	1990	1959#
Total number of employees	30 +	54 +	80 +	5 +	211 +
Turnover in 1993 (MECU)	3.2+	1.7-	6.5+	0.51+	18.4+

start of demonstration activities: * 1976 # 1960
+ denotes increases
- denotes decreases

Table 2: **Main Activities**

	TDAC				
Activity	1	2	3	4	5
Demonstration of advanced technologies			X	X	x
R&D	x	X	X	X	X
Seminars and workshops	x			x	x
Short term consulting	X	X	X	X	X
Assisting firms with technological solutions	X	X	x	X	X
Testing and certification	x	X			
Training		X	X	X	x
Agent of public promotion schemes		x		x	

X denotes very important
x denotes important

Demonstrations a performed in a wide range of fields. All organisations are active in the area of electronics, communication, and information technology and in the environmental field (see Table 3). Manufacturing technologies, although only demonstrated by 3 of the 5 organisations, are very important for two of them.

Table 3: **Technological Fields of Demonstrations**

	TDAC				
Technological Field	1	2	3	4	5
Electronics, communication, and information	x	x	X	X	x
Manufacturing	x	X			X
Materials	x				
Environmental	X	x	x	X	x
Energy		x	x		x
Chemicals and pharmaceuticals	X				

X denotes very important
x denotes important

Surprisingly none of the five responding organisations consider themselves to be technology centred (demonstration of a single technology in a multiple application area and multiple sectors). Three of the five classify themselves as sector centred which implies that they concentrate their activities on a given sector and not on a certain technology or application (demonstration of multiple technologies in multiple application areas all relevant to a single sector). The other two organisations are application centred (see Table 4). They support industry in more than one sector with their applications (demonstration of multiple technologies in a single application area for use in a single or multiple sectors).

Table 4: **Demonstration Method**

	TDAC				
	1	2	3	4	5
Type of TDAC	application centred	sector centred	sector centred	application centred	sector centred
Demonstration Method					
Systems from different manufacturers	X	X	X	X	
Physical models		X	X		X
Media-based presentations		X	X	X	

All but one of the responding organisations demonstrated their technologies using systems or equipment from more than one manufacturer. Three use more than one means for demonstration. Two of them use in addition to the actual system physical models and media based presentations (e.g. computer simulations) to demonstrate their technologies and methods (see Table 4).

Funding for the initial investments for all of the reporting organisations came from several sources. Four of the five organisations received national funds for their initial equipment. Two of them were in addition supported by European organisations (see Table 5). Equipment suppliers played a less important role (only one reported receiving support from them), whereas self-financing and potential clients provided additional funding for three of the five organisations. One organisation reported that it received no public support for their initial investments at all.

Table 5: **Financing of Initial Investments**

	TDAC				
Financial source	1	2	3	4	5
National public funding	X		X	X	X
European public funding				X	X
Equipment suppliers					X
Clients	X	X		X	
Self financing		X	X	X	

As far as the yearly budget of the organisations is concerned only two of them rely heavily on public core funding or public project funding (see Table 6). As can be seen from the table, one institution received no public core support for their budget. All but one of them depend on fees charged for services. For two organisations fees are their main source of income. Comparing initial investment funding with core funding one can see that although one organisation received no public funds for the initial investments its yearly budget is financed to a major part by public funds.

Table 6: **Budget Sources and Changes over the Last 3 Years**

	TDAC				
Source of funding	1	2	3	4	5
Public core funding	5% -	45% -	6% c	10% c	0
Public project funding	0	40% c	4% c	90% +	17% +
Fees for services	95% +	15% +	90% +	0	34% +
Others (production levy)	0	0	0	0	49% c

\+ denotes increases
c denotes no change (constant)
\- denotes decreases

Public core funding is being reduced in two cases whereas it remains about constant in the other two. On the other hand public project funding is increasing in two instances especially in a case where this organisation most heavily depends on it. It remains constant in two other organisations. Fees charged for services are an increasing source of budget funding.

3.3 Client Base

Although more than half of the clients (by number) come from small and up to medium sized enterprises (see Table 7), all of the organisations reported clients from large enterprises and public organisations. One can also see from the table that there is a trend towards serving medium enterprises and large firms. There is a decrease in the number of very small enterprises being served by two of the organisations. Comparing Table 6 and 7 one can see that the organisation receiving the largest amount of public core funding is also heavily engaged in supporting public organisations. On the other hand in the case of an organisation which is mainly financed through fees for services the portion of public clients is small and constant compared to the ones from industry and commerce.

Table 7: **Size of Client Base** (in absolute numbers of each category)

	TDAC				
Clients	1	2	3	4	5
Very small enterprises	30 -	40 -	0	0	0
Small enterprises	50 c	40 c	0	0	50 c
Medium enterprises	100 c	20 +	25 +	0	15 +
Large enterprises	30 +	10 +	25 +	5 +	15 +
Public organisations	5 c	50 c	5 c	20 +	2 c
Intermediary organisations	0	10 c	0	10 +	0

+ denotes increases
c denotes no change (constant)
- denotes decreases

Most of the clients come from the secondary and tertiary sector, only a small percentage is found in the primary sector (see Table 8).

The significance of the organisations reporting goes way beyond the local or regional boundaries. Most clients are found on a national level and a considerable part (35 % of the overall average) are located in other countries.

The main vehicles used for promoting their demonstration activities were reported to be publication in relevant journals and participating in conferences, fairs, etc.. Direct mailing also is very important for most of the organisations reporting. On the other hand advertisement plays a minor role in the promotion of TDAC activities (see Table 9).

Table 8: **Sector and Origin of Client Base** (in % of total)

	TDAC				
Sector	1	2	3	4	5
Primary	10% c	5% -	0	0	0
Secondary	50% c	35% +	50% c	50% c	100% c
Tertiary	40% c	60% +	50% c	50% c	0
Origin					
Local and regional	0	15% c	0	10% c	0
National	60% -	60% -	50% c	50% c	80% -
International	40% +	25% +	50% +	40% c	20% +

\+ denotes increases
c denotes no change (constant)
\- denotes decreases

Table 9: **Promotion of TDAC Activities**

	TDAC				
Promotion method	1	2	3	4	5
Publication in relevant journals	x	x	X	x	x
Advertisement		x		x	
Participation in conferences, fairs, etc.	x	x	X	x	X
Direct mailing	X		X	X	X

X denotes very important
x denotes important

3.4 Trends and Developments

When asked about their major strengths only two items were checked by two or more TDACs. These items were development of complemented services and the development of co-operative relationships (see Table 10). A similar response was received to the question of bottlenecks. In this case the recruitment of qualified staff and the financing of equipment and facilities were checked by two TDACs each.

The future plans of the reporting TDACs are summarised in Table 11. As one can see four out of five TDACs plan to increase their demonstration activities. The same TDACs also intend to expand on marketing activities and go into the exploitation of novel or alternative means to promote technology. More use of programmes and subsidies form the national government as well as from the European Union are also items on the list of future activities.

Table 10: **Major Strengths and Bottlenecks**

	TDAC				
Strengths	1	2	3	4	5
Development of complementing services			X		X
Development of co-operative relationships	X			X	X
Bottlenecks					
Recruitment of qualified staff	X	X			
Financing of equipment and facilities			X	X	

Table 11: **Future Plans**

	TDAC				
Increases planned for:	1	2	3	4	5
Demonstration activities	X	X	X		X
Range of demonstration facilities	X	X	X		
Number of technologies demonstrated		X		X	
Number of Sectors served		X	X		X
Marketing activities	X	X	X		X
Use of government programmes/subsidies	X	X			X
Use of EU programmes/subsidies	X	X			X
Exploitation of novel/alternative means to promote technology	X	X	X		X

3.5 Summary of Survey Results

The results of the questionnaire survey as presented in the above sections are summarised in the following table.

Table 12: **Summary of Survey Results**

Main characteristics	*Survey results*
Organisation	
type	mainly independent private or semi-private organisations
size	size varies between 5 and over 200 employees
turnover	turnover between 0.5 and 18 MECU
Profile	
major activities	R&D, consulting, assisting with technological solution, training
fields of demonstrations	electronics, ICT, environmental, manufacturing, energy, chemicals
demonstration method	via systems from different manufacturers, models, media
initial investment financing	mainly national public support and own resources
budget support	0 to 45 % public core funding, up to 90 % public projects, considerable (up to 95 %) through fees
Client base	
type of client	all serve large firms and public organisations, most serve also medium sized firms, some all types including SMEs
number of clients	between 35 and 215
sector	mainly secondary
origin	predominantly national and international, only few local and regional
promotion	mainly publications in journals and conferences, direct mailing
Trends	
strengths	development of complementary services and co-operations
bottlenecks	recruitment of qualified staff, financing equipment and facilities
future plans	increase demonstration activities, marketing, exploit novel ways to promote technology

3.6 Case Studies

Due to its geographic location and its closeness to the sea as well as its role as an agricultural state Danish research has traditionally concentrated on maritime, water, and environmental as well as agricultural areas. For the TDAC case studies two Danish organisations were selected which are active in some of the above areas and meet the following criteria (based on the information from responses to the questionnaire survey):

- indication on the questionnaire that demonstration activities are very important (only two from Denmark qualified)
- systems from several manufacturers are demonstrated
- demonstration of advanced technologies or methods
- the two classes of centres existing in Denmark (sector centred and application centred) are represented
- both a smaller and a larger organisation are studied.

The following two section describe these two institutes and their activities. At the end of the chapter common aspects are summarised.

3.6.1 Danish Maritime Institute

Organisation

The Danish Maritime Institute (DMI) which originated in 1959 as an offspring of the Technical University of Denmark is located near Copenhagen. It is a private, independent organisation which is affiliated with the Academy of Technical Sciences. The three divisions of DMI are the Marine Simulation Division (case study), the Ship Technology Division (design and tank tests, etc.), and the Wind Technology Division. The main objective of the Marine Simulations Division is to support the maritime industry (ship operators, harbour authorities, etc.) with R & D, training, and counselling utilising advanced methods and technology..

Funding

Only about 8 % of DMI's financing needs are provided by the Danish government. The majority (92 %) has to be earned through their own activities with industry. There exists no explicit funding for demonstration activities.

The DMI sees itself at a disadvantage when compared with the funding that similar organisations receive in other EU countries. With a unified market support of research organisations should be the same in all European countries. This would provide equal chances in an open market.

Major Activities and Technological Field

The equipment used to control and manoeuvre modern ships has undergone major changes. Today complex digital electronic systems have taken over a large part of the controlling of a modern ship. Along with the technological development considerable changes in personnel and job profiles have also taken place. Besides the traditional know-how required for commanding a ship it is now necessary for operators and navigators to make efficient use of the sophisticated electronic equipment. In order to prepare the ship's captain and his officers for the proper use the advanced technology, electronic simulators based on digital computers are being employed. It is economically and practically not possible to exercise and train in the real environment (directly on board of a ship).

Due to the complexity and the costs of these simulators it is not economically feasible for a ship operating firm to install their own simulator. It is much more efficient to have simulators centrally available at an institution which can provide this type of service to a number of firms. The Danish Maritime Institute (Division of Maritime Simulation) has developed a large simulator as one of its main R&D activities. It is offering its facilities to interested firms and public organisations. In addition to using the simulator to train ship navigators it is also used with success in the design and the development of harbours and waterways. Simulation activities have been going on at the institute since 1976. They have started with the simulation output being produced on plotters and have gradually developed the necessary equipment to display the simulation results by using projectors and by creating a realistic visual environment for the navigational training.

The complex software required for a simulator was originally developed for high speed medium sized computers (mini computers). In order to demonstrate the simulator capabilities to a larger target group the institute has recently implemented the majority of its software also on PCs and is using this portable system today to demonstrate the simulator capabilities in seminars and conferences. It is felt that this is a good means to attract new clients. Demonstrations are thus an important part of the promotional activities. It also helps to improve the acceptance of simulation technologies. With some of the capabilities of simulators now being implemented on PCs this opens up new ways for smaller ship operators to train their personnel. With a PC version these operators could afford to have a limited simulator at their own facilities. The major difference between the PC versions and the full blown simulator is that with the PC version only one person at a time can use the simulator. Thus, the interaction between various crew members cannot be simulated.

Clientele/Promotion/Market

Clients of the institute are predominantly medium and large sized enterprises. Most of them are ship owners. These could be operating from about 20 ships up to several hundred ships. The size of the boats can range from small ferryboats to large cruising ships or tankers, container ships, etc. Even small fishing boats are being simulated and tested by the institute. About 10 % of the clients are public institutions such as harbour authorities.

Potential clients are approached through promotion in the form of newsletters and special mailing actions. Conferences are attended where papers are presented to the science community in order to publicise DMI's research activities. Special seminars are arranged for invited guests to present their new developments and demonstrate some of their facilities.

Among the services offered by the institute the training of ship navigators has been quite successful and is appreciated by clients such as ferryboat operators. Although practice with a simulator is not yet a requirement for becoming a navigator on modern boats, many ship operators will already today send their employees to the institute in order to participate in the training programme offered at the simulator. It is seen as an important step towards the goal to minimise mistakes that could be made in the case of real emergencies. It is not possible to practice an emergency in real operation and, thus, the simulator offers a very important alternative (in fact the only realistic one). The co-operation between the Maritime Institute and ship operators is a very close one.

At the institute it is believed that demonstration of their technology will support their marketing and development activities. Important among these are seminars where PCs are used to demonstrate some of the simulation software and testing facilities.

Assessment of Activities

A positive indicator for the success of their services is that nothing happens. This means that their customers have no accidents or serious navigation problems during the sailing of their ships. This would imply that their training and testing have been successful.

Questionnaires are issued after each simulator course in order to get some feedback as to the course set-up and content.

Another measure for the institute's success is the size and content of a database which is kept on the clientele. It includes data on the continued use of the institute's services by clients. The database is continuously being expanded.

About every four years there is an extensive evaluation by the government based on reports on financing, turnover, research activities, strategies, and the products that have been developed.

The commercial value of the institute's products is another indicator for the success of their work. Successful marketing is thus essential for the institute.

Problem Areas

One of the problems in demonstrating and using high tech equipment is the fast changing hard- and software. This means that high capital expenditures are required to keep up-to-date. Together with a mandate to look into the future for new developments institutes such as the DMI are having difficulties with their financial support.

The institute also has problems to participate in projects from the EC. The 50 % funding is not enough to cover the expenditures. It means that the institute has to contribute a considerable amount of their own resources which for an organisation of its legal and business structure is difficult to achieve.

Client's View

The client interviewed has been a customer of DMI for about 7 years. The relationship originated from the close corporation between the DMI and the ship operators in Denmark. In fact some of the ship operators are on the board of directors of DMI. The relationship to the DMI is based on the following activities:

- Before buying a new ship there are some model trials done at the simulation facility of the DMI. This facility includes a 250 m long water simulation channel where all types of currents and wind conditions can be simulated to try out the model of a ship.
- In order to operate a new modern ship prospective captains are sent to the DMI for training with the simulator. The simulator is essentially emulating a ship bridge with all the controls and a visualisation of some of the harbour conditions that will be experienced during a real sailing.

From the above it can be seen that there is a growing need for the type of services offered by the DMI among all ship operators. It is also felt that to concentrate the know-how with simulation and simulators at one centre is very important and more efficient than having simulators in several places.

3.6.2 Ecological Modelling Centre

Organisation

The second organisation interviewed is the Ecological Modelling Centre (EMC). It was established in 1990 as a joint venture between the Water Quality Institute (VKI) and the Danish Hydraulic Institute (DHI). The main objective was to integrate the expertise on hydraulic modelling available at DHI with the experience on water quality and ecological modelling at the VKI. It was the intention to inspire, enhance, and co-ordinate the collaboration on the one hand between different departments of the two institutes and on the other hand with other institutions, both nationally and internationally. The establishment of the EMC has proven during the three years of existence to be a viable unit able to co-ordinate strategic research and ecological model development.

Funding

During the first two years of existence the Centre was funded by a grant from the Ministry of Industry and Business Development. After that the Centre has to finance itself predominantly through services and products it offers to industry and public agencies and organisations. About 10 % of its budget is funded from public sources.

There is no specific funding for the demonstration activities from any public agency or office. Thus, it is important for the centre to market its products and make enough profits to support further work in this field.

Major Activities and Technological Field

The main product consists of modelling and simulation software for various classes of computing systems ranging from the PC through workstations up to minicomputers and mainframe computers. This simulation software is used for modelling waterways and water systems considering ecological as well as hydraulic and water flow aspects.

Currently there are new developments to expand the computer models in two directions. One strategy is to improve the modelling of the chemical components of these models and the other emphasis is on expanding the ecological chains, i.e. to include higher species in the food chain. The demand for modelling and simulation of waterways is still increasing. The awareness that this has to be done is apparently high in Denmark and in the Netherlands; it is not quite as high in some of the more continental states, e.g. Germany.

Models are not only being used to simulate already existing systems with given conditions and within a fixed framework. In addition models are being used to design waterways and water systems and to improve their monitoring. Among others a model will help to prepare the proper strategy for collecting data and taking systematic measurements in the system in such a way that a valid and efficient monitoring and control can be exercised.

Clientele/Promotion/Market

Clients or potential users of the modelling facilities can be found in the area of water control, environmental protection, water supply, and in general in fields where it is necessary to control and limit the pollution of waterways.

The modelling software of the Centre is used by private consultants in the area of waterways and water works, among universities and research organisations in the area of ecological research (this client group is mainly situated outside of Denmark throughout Europe and the world), in firms with water pollution problems, and in public environmental and water control institutions.

The Centre presents its work to the scientific community mainly at conferences. In addition scientific journals and product specific journals in the area of water quality and hydraulics as well as modelling are used to inform potential clients. Direct mailing of their own newsletters and special leaflets on the introduction of new models is done relying on a network of agents who are located world-wide as part of the Danish Hydraulic Institute. Seminars which are arranged for user groups of the product are also a means to disseminate new developments. Demonstrations diskettes which illustrate some of the possibilities offered by the models are sent to potential clients.

Demonstration activities are quite important for the marketing of the software. Demonstrations are either done at the Centre or at the client's place, at fairs, or at conferences. With the software being portable it can easily be adopted to the various computer platforms.

The main competitors are located mainly in the Netherlands and to some extent in the United Kingdom. It is felt, however, that competition in this case is healthy and there is enough demand so that all competitors can co-exist in this field.

One good effect of demonstrations is that persons attending it can see for themselves what can happen when using models and they can better understand what models are. At the beginning it was not always easy to make people accept modelling. Quite often they looked at it as something rather mystical.

There has been not enough co-operation between institutions or organisations in the modelling field. Recently a project has been started with other organisations under the EC programme MAST. This project is aimed to develop new ecological models.

Assessment of Activities

The main measure for the success of the institute's work is the commercial value of the products they are developing. Another way to measure success is through the number of actual demonstrations. Today about one demonstration per week is being carried out.

The Centre has also received positive feedback on the modelling especially from the United Kingdom. Reactions to presentations at conferences and in seminars are additional indicators especially on the quality of their research activities.

3.7 Interviews with Policy Makers

The interviews with two Danish policy makers from the Ministry of Research and the Danish Ministry of Industry (Danish Agency for Development of Trade and Industry) respectively confirmed the results of the analysis of technology demonstration activities described in Chapter 2 above. Since the middle eighties there have been no new government programmes in this area. There has been a change in priorities.

Today technology demonstration activities in Denmark have rather low priorities. Some of the reasons are:

- The cost for demonstrating advanced technology or processes is considerable. It will in general not be paid by the clientele it is targeted for. Especially for neutral demonstration activities funding is needed.
- A firm attending a neutral demonstration on a new technology in many cases expects to receive some form of recommendation. It is, however, difficult for an organisation to make recommendations without resulting consequences. The fast changes in technology make it difficult to have reasonable data for qualified recommendations.

Although there has been no real assessment of technology demonstration activities it is not felt that previous work has not been effective. One of the problems in evaluating a technology demonstration measure is the difficulty to determine what actually triggered a firm to implement a new technology. It is not necessarily just being introduced to a technology during a demonstration or being informed about it by a technology centre. Many other factors (e.g. general trends of the business sector, internal promoters, competition, etc.) will influence and guide the decision making process of a company in implementing a new technology.

4 Conclusions and Recommendations

Demonstration activities **no longer** play **a significant role** within the technology and innovation policy of Denmark. During the last five years there has been no programme to actively support the demonstration activities of technology within organisations in Denmark. The importance of demonstrating technology compared to the overall technology and innovation policy in Denmark is low. This is not necessarily based on poor results of previous activities it is instead felt that for the last few years demonstration activities are no longer important and other ways are more appropriate to support the development of technology and the innovation process in industry.

All of the organisation responding to the survey conducted as part of the study are involved in a number of activities. They perform R&D, short term counselling and support firms with technological solutions. For four institutions demonstrating their technology and methodology is important. The main objective behind their demonstration activities is to **promote their work** and to attract customers to their products and services. Technology transfer to SMEs is neither a mission nor a prime goal of these organisations. However, SMEs can still benefit from the services and products offered and, of course, R&D organisations are important for the overall innovation strategy of a country.

Demonstration activities are valued as a way to obtain **feedback** from customers or potential clients on the usability and functionality as well as the quality of the products demonstrated and eventually marketed. This feedback is very important for the designers and the developers especially for those who are involved with man-machine interfaces.

One of the **problems** in demonstrating and using high technology equipment is the fast changing hard- and software. This means that high capital expenditures are always required. Together with a mandate to anticipate future developments, institutes in Denmark are faced with the problem of getting enough financial support from public funds. Although some of the institutes are participating in European programmes financed by the European Commission, they have great difficulties with the 50 % support policy. This is in particular a problem for those institutions that are non-profit organisations.

The **success of demonstration activities** is in general measured by the client base that can be achieved. In addition organisations that receive some government support are evaluated every four years on their performance by the government. This extensive evaluation is based on reports on financing turnover, research activities, strategies, and the products that have been developed. Another indicator for success is the commercial value of the products that are being marketed. In the case of training there is an immediate feedback at the end of the training through the issue of questionnaires asking for evaluation of the course.

Policy makers believe that although demonstration activities are important for some organisations to promote their products and services, at present there are more important measures to assist SMEs. Today **priorities have shifted** towards support in the area of quality assurance, consulting for small and medium sized firms, and company network schemes.

Considering the **problem areas** reported by Danish TDACs it appears that one of the major difficulties is to obtain proper funding for demonstration activities. Being mainly self-supporting organisations demonstrations can only be justified if they assist in the marketing of their products and services. For the institutions analysed demonstration activities are considered to be essential for the operation of the unit. They are a very important part of the overall activities.

In connection with public funding the question of how R&D **support from national and especially EC sources** should be targeted is of great concern to some organisations. It is believed that financial support should be shifted from the top down approach which currently provides support to industry to the bottoms up approach which implies that the research organisations should be directly supported. For several years now industry has been given funds in order to initiate research and to contract research institutes for their projects. It is believed that this, however, has not been really working well, as industry has used the money for their own developments and did not pass on an appropriate share to independent research organisations. It is important to have the right mix of funding so that industry, research organisations, and potential users are supported accordingly.

ANNEX A: A Danish TDAC

A Brief Description of a Danish TDAC

Conception and Objectives	
Year founded	1990
Founding goals	integrate the expertise in hydraulic modelling with the experience in water quality and ecological modelling
Founding organisation	two Danish research institutes
Initial funding	2 year grant from the Ministry of Industry and Business Development
Planned target groups	private firms, consultants, and universities and research organisations.
Strategy of demonstration activities	to promote own R&D, introduce modelling concepts to clients, receive feedback from clients
Organisation	
Legal form (parent organisation)	independent semi-private institute
Turnover	0.5 MECU
Funding structure	10 % public core, 90 % public projects (national & EU)
Staff	4 researchers, 1 staff
Partners	2 larger institutes
Profile	
Main activities	R&D (major activity), short term consulting, training, demonstration of simulations
Technological fields covered	environmental, water systems, information technology
Technologies demonstrated	environmental models on computers (computer programs)
Method of demonstration	using information technology, computer simulations, videos
Sector and region covered	service sector water quality, national and international
Accomplishments	.
Clients served	private firms, consultants, and universities and research organisations
Volume of services	about one demonstration per week
Structure of clients	large firms (5), public institutions (20), intermediary organisations (10)
Relationship to clients	long-term relationships
Future Developments	
Goals	Increase client base, diversify in the applications
Problems	lack of funds for equipment (initial public support)

ANNEX B: List of Danish TDACs

Dansk Teknologisk Institut
Gregersensvej
Postboks 141
DK-2630 Taastrup

Bioteknologisk Institut
Holbergsvej 10
Postboks 818
DK-6000 Kolding

Dansk Hydraulisk Institut
Agern Allé 5
DK-2970 Hørsholm

DELTA Dansk Elektronik,
Lys & Akustik
Venlighedsvey 4
DK-2970 Hørsholm

dk-Teknik
Gladsaxe Møllevej 15
DK-2860 Søborg

Geoteknisk Institut
Maglebjergvej 1
Postboks 119
DK-2800 Lyngby

VKI
Vandkvalitetsinstituttet
Agern Allé 11
DK-2970 Hørsholm

Forskningscenter
RISØ
Postboks 49
DK-4000 Roskilde

Dansk Brandteknisk Institut
Datavej 48
DK-3460 Birkerød

Dansk Toksikologi Center
Agern Allé 15
DK-2970 Hørsholm

DIFTA
Nørdsøcentret
Box 59
DK-9850 Hirtshals

FORCE Instituttet
Park Allé 345
DK-2605 Brøndby

Skibsteknisk Laboratorium
Hjortekærsvej 99
DK-2800 Lyngby

Slagteriernes
Forskningsinstitut
Maglegaardsvey 2
DK-4000 Roskilde

Itai Tondern
Nordre Landevej 2
DK-6270 Tondern

Technology Demonstration and Application Centres in the Federal Republic of Germany

Country Report in the Framework of the SPRINT EIMS Project 94/71

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Content

1 Introduction

For several years the instrument of Technology Demonstration and Application Centres (TDACs) has formed an integral part of various programmes to support technology transfer on the part of the Federal Ministry of Education and Research (BMBF)[1] and the Länder (state) governments. This partially prominent role in German technology policy was also a reason, in a European study, to investigate the distribution, structure and role of technology demonstration and application centres as well as the technology policy measures involved. The following report describes the results of this investigation for the Federal Republic of Germany.

In spite of the existence of numerous technology demonstration and application centres and their role in technology policy, there is no generally accepted definition for this type of institution for technology transfer in Germany and, logically, no comprehensive overview. So the first step was to identify institutions and contacts, which according to the working definition in the project (see European summary report), offer technology demonstrations as a service. For this purpose programme documents, which list the promoted centres, and surveys of the institutions and measures for technology transfer in the federal Länder or larger research and technology organisations (RTOs) (e.g. the Fraunhofer Society) were consulted. Today, at the conclusion of the study, it can be established that at present in Germany between 70 and 100 institutions are operating as technology demonstration and application centres. Parallel to the identification of the centres current studies were evaluated. Two evaluation studies in particular (Wolff et al. 1993, Behringer et al. 1994), which deal with state support measures in which the instrument of technology demonstration centres was used, deserve mention. Even though a close definition of TDACs was applied in order to allow comparative quantitative analysis the focus of the desk research was widened to alternative approaches of technology demonstration as a means of technology transfer.

In a second step, from July till September 1994 a written survey was carried out in 75 of the TDACs known at that time or their parent institutions. This poll was intended to collect basic information on the distribution and the structures of technology demonstration and application centres, with the following main points:

- organisation (status, establishment, financing, personnel)
- services offered (main activities, technology fields, marketing)
- client base (according to size, sectors, regions)
- profile of strengths and bottlenecks, plus goals for the coming years.

1 The BMBF only since end of 1994 combines the former Ministries of Research and Technology (BMFT) and of Education and Science (BMBW). Insofar many programmes and initiatives reported here date back to the BMFT period.

48 TDACs returned the completed questionnaire. This is equivalent to a 64% return. However, as only inadequate information is available on the total basic population, the representativeness of the survey can only be regarded as of limited validity, despite the high proportion returned: The 48 usable questionnaires reflect approximately the distribution in technology fields and parent institutions of the TDACs identified.

In a third step, five interviews with TDAC managers were carried out in order to add to the quantitative data available. An attempt was made to take into account the various types of centres and the multiplicity of technology fields. In addition, clients of the TDACs visited were contacted for telephone interviews. Finally, discussions were held with a number of policy decision-makers.

The results of these steps are presented in the following report. First of all, a classification of technology demonstration in the technology transfer system and the innovation infrastructure in Germany is attempted (Chapter 2). This includes an overview of important state programmes, in which TDACs are promoted. In Chapter 3 the quantitative distribution, structures and orientation of the German TDACs on the basis of the written survey are presented. Chapter 4 describes central problems, success factors and others on the basis of the interviews conducted and discussions with experts. Finally, the results are summarised and open questions and possible perspectives discussed.

2 Development of Technology Demonstration Policy and TDACs in Germany

2.1 TDACs as part of technology transfer activities in German technology policy

The innovation infrastructure in Germany is extremely varied, due to the federal structure and also the wide support for different technology fields on a national and even regional (Länder) level. The concept of technology transfer has been of increasing importance since the beginning of the eighties (see for instance Sternberg 1988)

- because in Germany a deficit in the transformation of technology knowledge into practice was noted
- and because of unsatisfactory possibilities for small and medium-sized enterprises, which are considered especially relevant in terms of employment, to realize innovations independently.

Accordingly, almost all technology policy support (push) programmes comprise a technology transfer component aimed mainly at small and medium sized enterprises and the promotion of the diffusion and application of the respective advanced technologies.

In the course of differentiating technology policy, in the mid eighties the demonstration of new technologies gained independent importance among the different instruments for technology transfer. Demonstration centres - first of all in the field of microelectronics - were to round off the existing R&D infrastructure and, especially for SMEs in advance of RTD, break down the inhibition threshold vis-a-vis consulting and cooperation, and arrange for competent discussion partners and knowledge orientation, in order to improve the transfer and diffusion of new techniques (cf. Wolff et al. 1993, Behringer et al. 1994).

In the framework of the promotion programmes of the BMFT in particular technology fields, partly complemented by help from the regions/Länder where the centres were to be located, funds were provided for the setting-up (machines and apparatus) and - for a limited time - the operation (personnel and running costs) of demonstration centres. These were awarded primarily to existing, relevant research institutions.

According to Wolff et al (1993) the promotion of TDACs had an experimental respectively model character in two respects:

- The feasibility was to be demonstrated and experiences to be collected in order to stimulate taking over or copying this approach under other forms of funding.

- The selection of different technology fields was to show the possible respective appropriateness of the instrument.

The spectrum of services in the advance of RTD should be broad, including first information on new technologies, supplier independent consulting, consulting on application potentials and implementation prospects, demonstration of applications and training. The centres were seen to extend existing technology transfer offers as they provided an own institutional framework for information and consulting allowing for a specific and systematic marketing.

The evaluation study of Prognos and FhG-ISI of BMFT schemes on R&D cooperation of SMEs undertaken in 1990 (Wolff et al. 1993) mentioned 42 TDACs supported by BMFT. In the guide book on research and technology 1993/1994 of the BMFT 51 TDACs were listed. However, not all of them still received BMFT subsidies at that time and some might have more or less stopped service. But in the field of microsystem technologies alone, the number of microsystems technology service centres in between climbed up from 9 to 26. This shows that TDACs up to date remain a relevant instrument in German technology policy. In the following relevant programmes with their technology demonstration component are described in more detail. An overview is given in table 2-1.

In 1989/1990, within the framework of the **Materials Research Programme**, seven demonstration centres for fibre reinforced plastics were established and promoted with a total of DM 50 million. An eighth one followed later. The subsidies in most cases finished in 1993. Two new establishments in the new Länder were founded in 1993 as branches of the Süddeutsches Kunststoffzentrum. In an evaluation of the measure the DIW (Behringer et al. 1994) gives a positive assessment of the TDAC instrument. Even though the prime objective to accelerate the diffusion of fibre reinforced plastics into practical application was not achieved. The reason was that the technological maturity of the new material was not sufficient and did not develop in due course as was originally expected. The TDACs under these circumstances served partly as useful sensors for changes in the market relevance of the material which may be used in the context of the important problem of the selection of appropriate technology policy instruments in dependency of the maturity of the technology in question. Another interesting result of the DIW evaluation was that the integration of the demonstration centres into existing research institutes on the one hand proved very successful, not least because of the availability of broad know-how in the host institute and in turn the confrontation of researchers with practical problems. On the other hand this integration often hampered an independent image building and promotion of the centres. The TDACs are only one element of the materials research programme in the particular field of plastics. The programme in addition covers several other fields. Recently two further technology demonstration centres have been established in Jena and Zwickau on material specific processing (detaching and cutting technologies) of new materials as part of the BMBF initiatives to strengthen the technological infrastructure in the new Länder.

In the priority promotion **Application of Microsystem Technologies** 26 service centres have been established, which among other activities demonstrate exemplary microsystem solutions and were promoted with a total of DM 17 million. Each is specialised in particular sub-fields such as micro mechanics, chemical sensors, adhesive technology in microsystems. Another element of this programme aimed at the broadly effective diffusion of microsystems is an indirect-specific promotion with potential applicants. Already, the preceding programmes of microelectronics and microperipherals used the instrument of technology demonstration centres. Some of these still exist and are also integrated in the new programme. For most of the „Dienstleistungszentrum Mikrosystemtechnik" (service centres for microsystems technology) federal subsidies which accounted for ca 50% of the funds for their activities finished end of 1994. A recent workshop draw largely positive conclusions and many centres have good prospects to continue their activities.

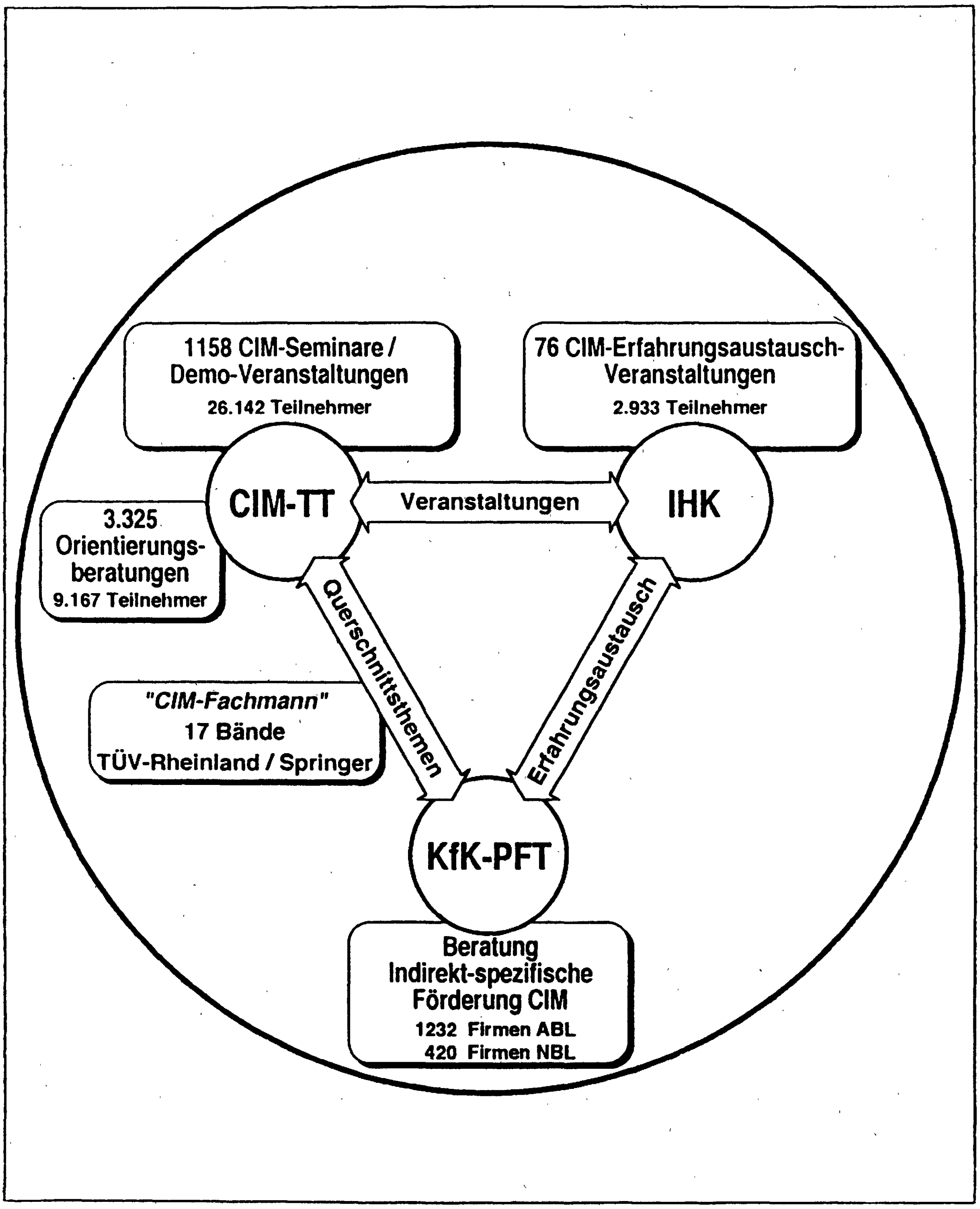
A specific case of the founding of TDACs linked, time-wise, with the start of a public promotional programme are the **Manufacturing Technologies Programmes** of BMBF as they largely aimed at process innovations. The CAD/CAM lab was established in 1983 by the project administration body (Kernforschungszentrum - nuclear research centre, Karlsruhe) in the framework of the first programme 1980-1983 and is still working. The second programme 1984-1987 contained an indirect-specific programme to introduce CAD/CAM technologies. According to this same concept there followed in the years 1988-1992 the promotion of CIM components and the establishment of CIM technology transfer centres (CIM-TTs), which offered practical demonstrations in pilot plants, besides seminars and orientation consulting (cf. fig. 2-1). Since 1988 the 22 CIM technology transfer centres have received altogether almost DM 100 million from the manufacturing technologies programme. Approximately one third of these funds went to the six East German centres established in 1993. Host organisations were in almost all cases chairs of manufacturing technologies at universities. The CIM-TTs in West-Germany between 1988 and 1992 hold almost 3700 events (seminars, orientation consulting, demonstration) with more than 30.000 participants, the 222 technology demonstrations attracted 4245 clients (Walze/Weck 1994). However, prospects after the termination of the funding 1992 were different. Many CIM-TTs now receive Länder support, others continue on a reduced level with project funds or fees. Final figures for East-Germany are not yet available.

Table 2-1: The Promotion of Technology Demonstration in Public Programmes in Germany (selection of most relevant schemes)

programme (technological field)	**range of measures**	**duration**	**budget**	**administration**	**technology demonstration element**	**total subsidies to TDACs**	**foundation of TDAC**	**pre-dominant TDAC host organisations**
micro systems technologies	cooperative projects, indirect-specific promotion, technology transfer	since 1990	ca 140 Mill.DM per year (average 30-50% subsidies)	BMBF (VDI/VDE-IT centre, Berlin)	26 micro systems technology service centres	ca. 17 Mill.DM	most 1992 (some earlier)	universities, research institutes (FhG)
manufacturing technologies (in particular CIM)	prenormative research, cooperative projects, indirect-specific promotion, technology transfer	1988-1992 and 1992-1995 (new Länder)	ca 500 Mill.DM in total	BMBF (Nuclear Research Centre[1])	22 CIM-technology transfer centres (6 in new Länder incl. 1 in Berlin[2])	> 60 Mill.DM (West) > 30 Mill.DM (new Länder)	1988 (West) 1992 (new Länder)	universities
materials research (e.g. ceramics new metal and polymer materials)	cooperative projects, technology transfer	since 1995	ca 1100 Mill.DM (until end of 1992)	BMBF (DLR)	8 demonstration centres for fibre reinforced materials 2 demonstration and training centres for plastics technology 2 centres for materials processing	ca 50 Mill.DM not available not available	1988/89 1992/93 1994	researach institutes sector-related education body universities
technology-orientied visiting and information scheme (TOP)	company visits in the form of seminars (200 in 1995)	since 1994		BMWi (IMK)	firms show their own techno-organisational solutions	not applicable	not applicable	around 40 firms from different sectors

1 now: Research Centre Technique and Environment, Karlsruhe.
2 The CIM-TT Berlin was already among the Western CIM-TT.

Figure 2-2: The Network of CIM Technology Transfer in the New and Old 'Bundesländer' in the Third German Manufacturing Technologies Programme (source: Walze/Weck 1994)



In former years centres in the technology fields of microelectronics, informatics, energy technology and construction research, among others, were promoted by BMFT programmes and some are still in existence today. It seems somewhat surprising that TDACs in the fields of energy and environmental technologies do not play a bigger role. Apparently, technology policy in these fields rather uses other instruments to demonstrate the applicability of new technological solutions, i.e. demonstration projects, special fairs.

Currently, it is planned to establish within the laser technologies programmes TDACs to support the diffusion of laser equipment to trade. Given this particular target group the selection of appropriate host organisations is crucial as they have to have the technical competence as well as the proximity to trade enterprises. The „Schweißtechnischen Lehr- und Versuchsanstalten“ (training and testing institutes for welding) are such bodies and would therefore indicate a remarkable extension of the type of organisations to host TDACs (which usually were universities and RTOs) in the context of a BMBF scheme.

Apart from the BMBF programmes the promotion of technology demonstration centres is mainly undertaken by the Länder, and here again attached to universities or technical colleges. As opposed to the technology push approach of the BMBF, Länder promotional initiatives tend to take up existing technical competences and to reinforce the technology transfer orientation of the respective body in order to support local or regional industry. Funds consequently stem from general technology transfer programmes (or budgets) rather than technology-specific schemes. The best-known examples are the almost self-supporting institutes of the Steinbeis-Stiftung (Steinbeis Trust) in Baden-Württemberg which partly have established technology demonstration facilities. In other Länder technical colleges are also used as a basis for demonstration centres. Besides this, however, technology demonstration centres in independent transfer institutions, which are organised as limited companies, for example, have also been set up with public (Länder) funds. Whereas some states strongly follow an industry(demand)-oriented approach others try to integrate in the TDACs they support a wider (societal) perspective of technological innovation.

2.2 TDACs Based on Initiatives of RTOs

The interviews tell that two different patterns for the origin and development of TDACs in the Federal Republic of Germany can be ascertained. On the one hand there are centres whose foundation depended on the initiative of a technology policy decision-making institution on national or regional level. The great majority of the German TDACs belong in this category. On the other hand, there are demonstration centres which were created by private research organisations. The founding of the first named type of centre is to be seen against the background of the state duty to promote diffusion or technology transfer with funds of the Federal Ministry of Education and Research and Technology (BMBF), or from the responsible Länder ministries since the beginning of the eighties (see also chapter 2.1). The close time and conceptional links were of crucial significance for the TDACs - for the development of and demand for their services, but also for their role in the national innovation process. The effects of these links will be dealt with in more detail in the following.

The second type of TDACs in Germany goes back to the initiative of non-public research institutions. A very typical example is the setting-up of four demonstration and application centres in the field of virtual reality by the Fraunhofer Society. The establishment of these four centres is based on the estimation that virtual reality will prove to be an important technology for the future. As its development until now has been technology-centred, the search for economic/profitable fields of application has now become a necessary condition for the further development and diffusion of this new technology. As the Federal Ministry for Research and Technology (BMBF) did not share this opinion at the beginning of the nineties, the board of directors of the Fraunhofer Society decided that the Fraunhofer Society should finance the centres from its basic funds. The main motive in this case was primarily the attempt to open up a strategic technology field and so secure future potential contracts.

Independent of whether a TDAC was founded by public funding or by a non-public organisation, the primary intention is to offer the opportunity to demonstrate and disseminate information about new technologies. This orientation on the offer aspect meant that the investigation of the potential demand for TDACs' services was systematically ignored at the time of founding TDACs, i.e. no analyses were carried out on the nature and extent of information required or on the behaviour of potential TDAC customers when seeking information. This is explained on the one hand by the methodological difficulties of attempting a prognosis of the demand potential for new technologies. On the other hand, it is assumed that small and medium-sized enterprises in particular have a need for demonstration and information.

2.3 Demonstration activities in technology parks

Technology transfer in Germany is bodied by many institutions. Among these technology parks have an important role. Therefore it was doubtful whether technology parks are also involved in **demonstration activities**. To answer this question, a short survey was additionally carried out in **technology parks**. 50 centres were directly addressed, 26 replied; this corresponds to a return of 52% (cf. Table 2-3). Of the technology parks which answered, half said that they also demonstrated technologies. However, only a third of these institutions utilized systems and equipment in the demonstrations, the great majority utilized media-based representations (e.g.

illustrations, models, videos). The financing of these activities was supplied by self-financing, which was complemented either by public promotion or participating manufacturers. Almost two-thirds of the facilities which replied had begun these activities in the nineties, and therefore began later than the technology demonstration and application centres. They do only marginally meet the definitions applied for the main survey (cf. European Summary Report and chapter 3).

Table 2-3: Demonstration Activities in Technology Parks (n=26)

Demonstration Activities in Technology Parks		
Demonstration of Technologies:		
yes	13	(50%)
no	13	(50%)
How does your Institution demonstrate Technologies?		
via systems/equipment	4	(30%)
via physical models or media-based representation	9	(70%)
How are the demonstration activities financed?		
Public Funding	1	(8%)
Self-Financing	5	(38%)
Self-Financing and Public Funding	3	(23%)
Self-Financing and Suppliers	3	(23%)
Suppliers	1	(8%)
When were the demonstration activities initiated?		
≥ 1985	2	(15%)
1986 - 1990	2	(15%)
1991 ≥	8	(62%)
no answer	1	(8%)
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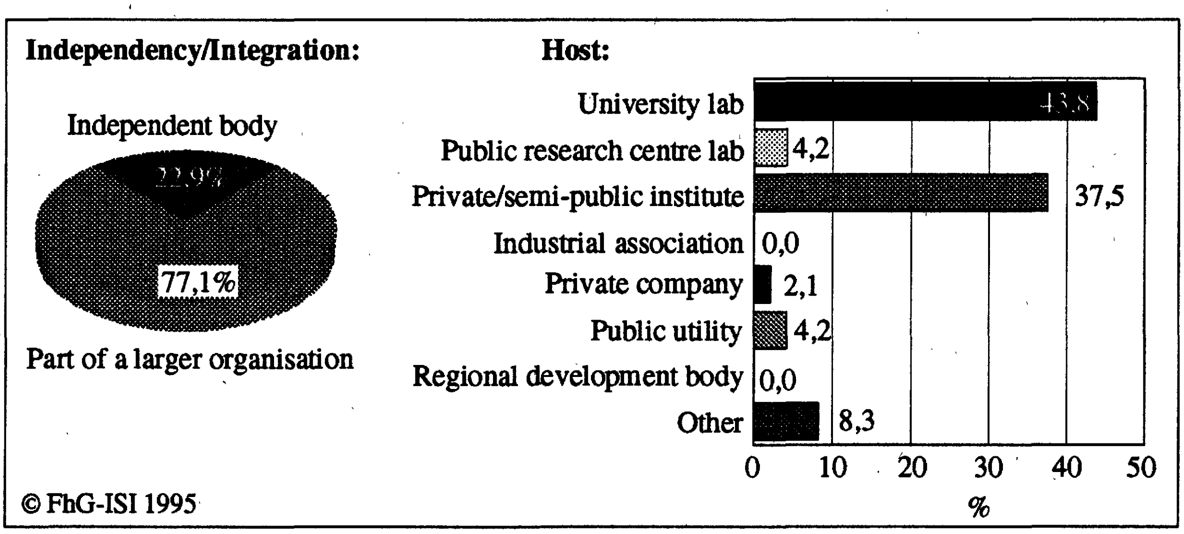
3 Survey Results

The aim of the survey was to collect information on the distribution and services offered by technology demonstration and application centres (TDACs). In the following the results of the survey will be documented; the main focus will be on information on the organisation, services offered, the client base and the bottleneck and strengths profile of, and goals set by, the TDACs which took part in the survey.

3.1 Organisation of the Centres

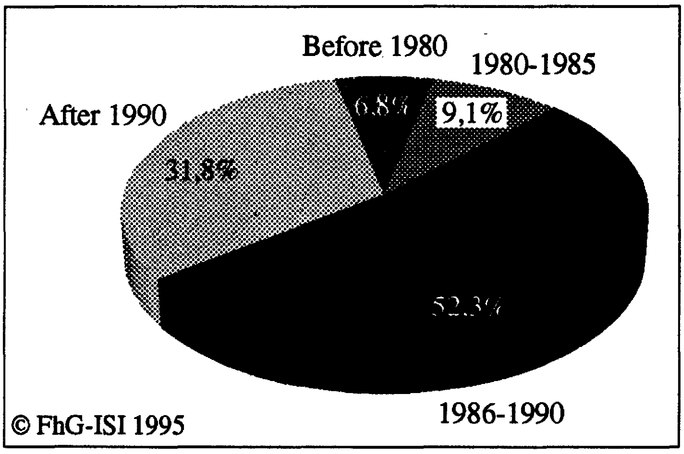
Over three-quarters of the technology demonstration and application centres questioned in the Federal Republic of Germany are part of a larger organisation (see Figure 3-1). For the main part these demonstration centres are attached to a university or technical college, or a private or semi-public research institute. Typical examples of this organisation form are the CIM technology transfer centres at higher education institutions or the demonstration centres of the Fraunhofer Society. A mere quarter of the centres are independent installations, which concentrate exclusively on the demonstration of technologies and technology-oriented services, and which were founded with this only aim in view, as for example the Bayerische Laserzentrum (Bavarian Laser Centre) or the regionally oriented centre Technology Transfer Trier. Thus, in most of the cases no new or specific organizations for the TDACs were created in the FRG, they were rather incorporated into existing and experienced organizations.

Figure 3-1: Status of the Unit in which Technology Demonstration Activities Occur (n=48)



Just over half of the centres began their activities in the years 1986 to 1990, at the time therefore when the demonstration of technologies was gaining an independent significance as an instrument in technology policy aimed at technology diffusion (cf. Figure 3-2a). Almost a quarter of the facilities were founded in the nineties. The demonstration centres are a relatively new type of organisation in the national technology transfer field.

Figure 3-2a: **Starting Year of TDA Centre (n=44)**



Most of the TDACs are located in Baden-Württemberg and Bavaria. These state have especially in the '80s institutionalised their technology transfer activities. Federal programmes (see Chapter 2) have started a number of centres in the „New Bundesländer".

The facilities usually received initial financing from public funds, whereby national or regional sources dominate (cf. Figure 3-3). Just half of the establishments provided own capital for the founding. In over a third of the cases technology suppliers shared in the kick-off financing. The actual financing of the centres on average is depicted in Figure 3-4. The facilities finance themselves with a third each of core and project funding from public authorities and payment fees for services rendered. On the other hand, income from membership fees plays a subordinate role. In the last three years the share of financing for the payments for services and project funding have increased; the core financing from public funds has a small growth rate.

Figure 3-2b: Regional Distribution of TDACs (n=43)

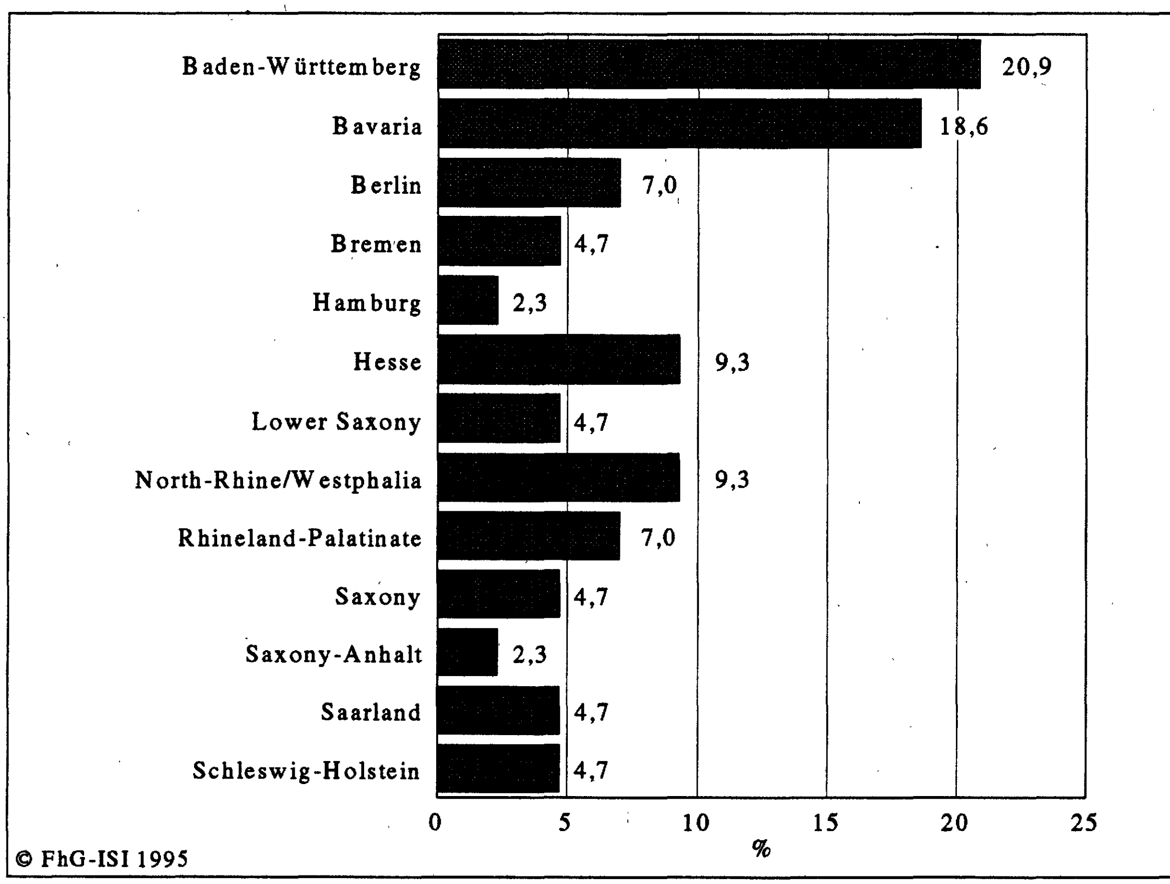


Figure 3-3: Who Financed the Initial Investment in the Equipment Used for Demonstration Purposes? (n=48, multiple responses)

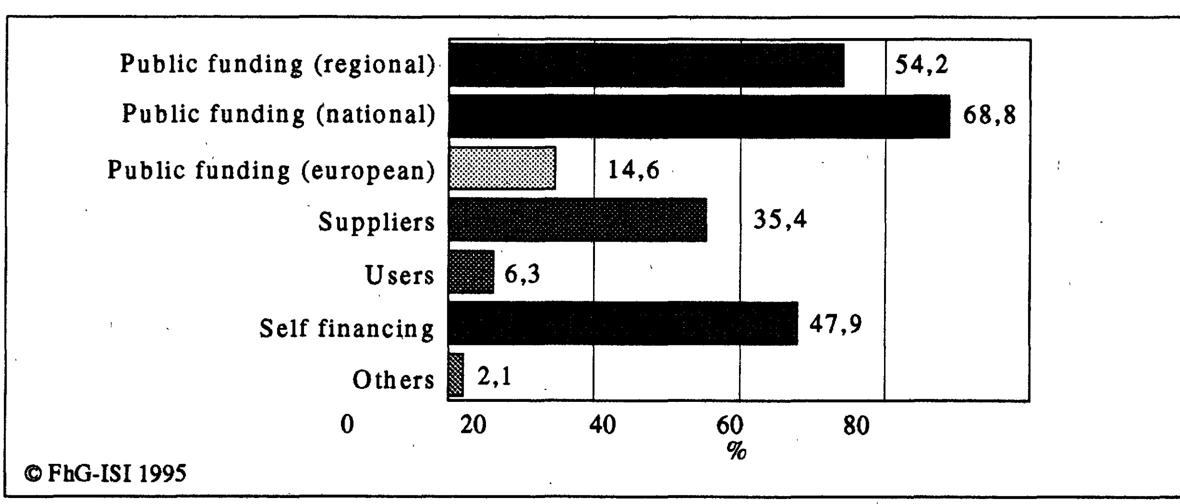
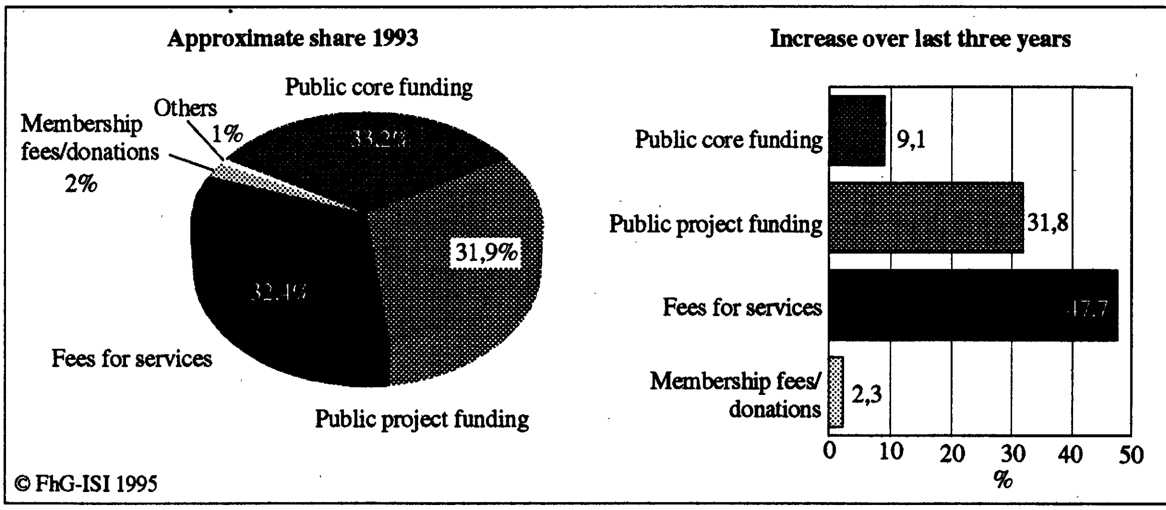
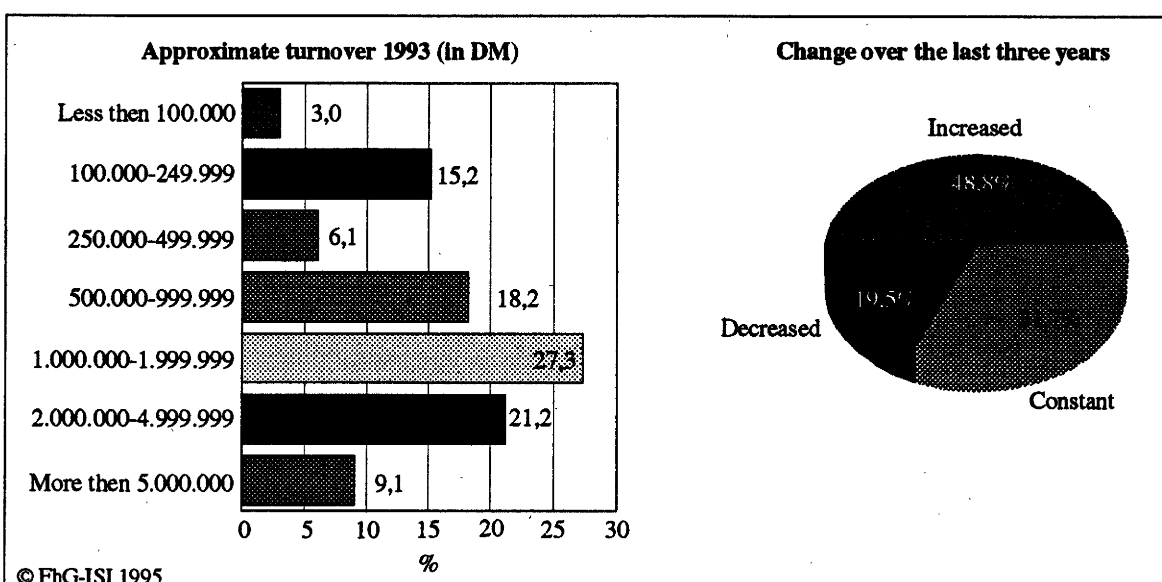


Figure 3-4: TDAC Budget Structure and Sources over all TDACs (n=44)



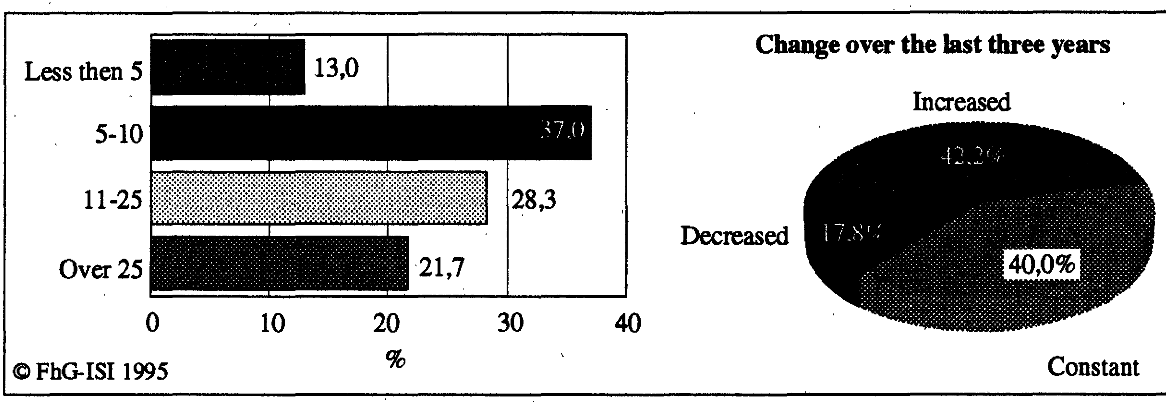
The average turnover of a demonstration centre amounted to ca DM 1.5 million in the year 1993. A mere third of the centres have a turnover of DM 2.0 million and more, almost half of the centres have a turnover of under DM 1.0 million (cf. Figure 3-5). This turnover has increased in the last three years in almost half of the centres. Only a fifth of the centres recorded a drop in turnover. However, these figures are to be carefully interpreted as for most of the TDACs it was very difficult to distinguish the TDAC related turnover from that of the host organisation in general. This is also indicated in the comparatively low response rate to this question. The figures most probably overestimate the money involved in technology demonstration and related services (though not as much as in other countries, cf. main report).

Figure 3-5: Turnover of TDACs and its Development (n=33/n=41)



More than a third of the centres employ 5 to 10 employees. Half of the centres employ 11 persons and more (cf. Figure 3-6). In the last three years nearly half of the centres have increased the number of employees, on the other hand just under a fifth of the centres has cut back on personnel.

Figure 3-6: Total Number of Employees Working in the TDACs and it Development (n=46)



3.2 Services Offered by the Centres

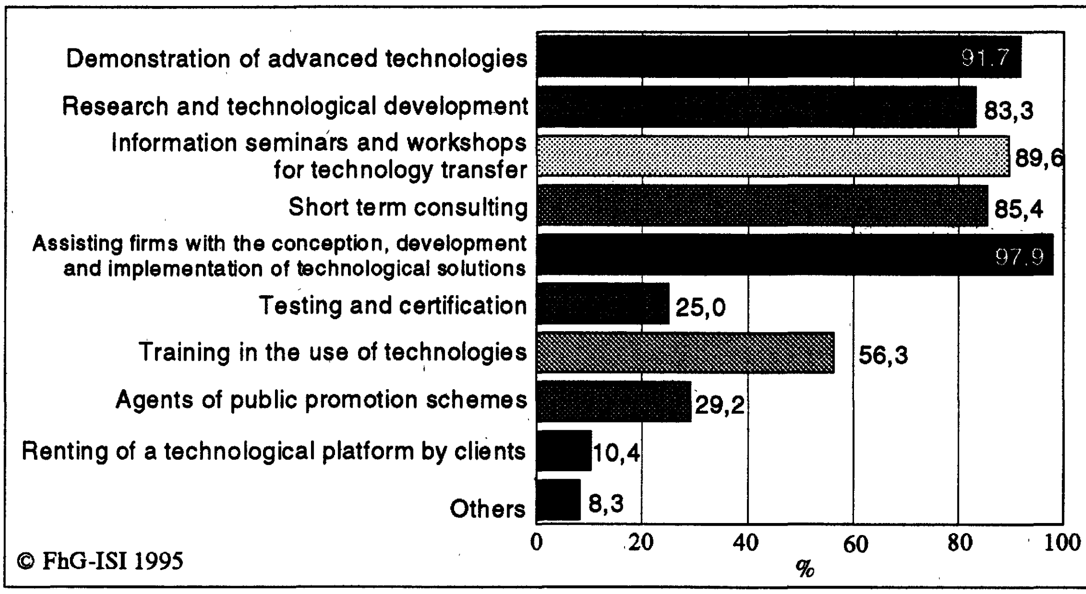
As already mentioned in the introduction, the aim of the survey was to collect basic information on the services offered by technology demonstration and application centres. Therefore the centres were requested to tick their main offers from a list of activities. As depicted in Figure 3-7, the services offered by the centres were not restricted only to the demonstration of one single technology. Besides demonstration activities for certain technologies (which not even all TDAC regard an important or very important activity)

- almost all centres assist their clients with the conception, development and implementation of technological solutions
- carry out short-term consulting
- hold information seminars and workshops for technology transfer and
- help their clients in research and technological development.

In addition, over half the centres offer training courses. A quarter of the centres offer the certification of technical solutions and arranging participation in public promotion schemes in their catalogue of services as well.

Independent facilities are more active in supporting firms with the implementation of technological solutions (e.g. short-term consulting and training courses). Demonstration centres attached to larger organisations on the other hand are more active in supporting their clients in the field of research and technological development.

Figure 3-7: Important or Very Important Activities of TDACs (n=48; multiple responses)



Respectively more than two thirds of the centres answering the questionnaire in the Federal Republic of Germany provide information in the field of electronics, communication and information technology and manufacturing technologies (cf. Figure 3-8). Obviously, the distribution on these two fields of technology mirrors the public programmes initiated in the 80's (see chapter 2). Centres which are part of a larger organisation demonstrate both technology fields; independent facilities focus on manufacturing technologies. About a third of the centres demonstrate modern material technology and energy technology. Environmental technology and chemical and pharmaceutical technologies are rarely demonstrated, agricultural technology plays no role whatsoever in the German survey.

The demonstration of the new technologies takes place via systems and equipment from different manufacturers (cf. Figure 3-9) in the majority of cases. Over and above this, two-thirds of the centres utilize media-based representations of the technology for demonstration purposes (e.g. video, illustrations). None of the centres is based on systems and equipment from one manufacturer only, which guarantees neutrality towards the manufacturers.

Figure 3-8: **Important or Very Important Technological Fields of Demonstrations (n=48; multiple responses)**

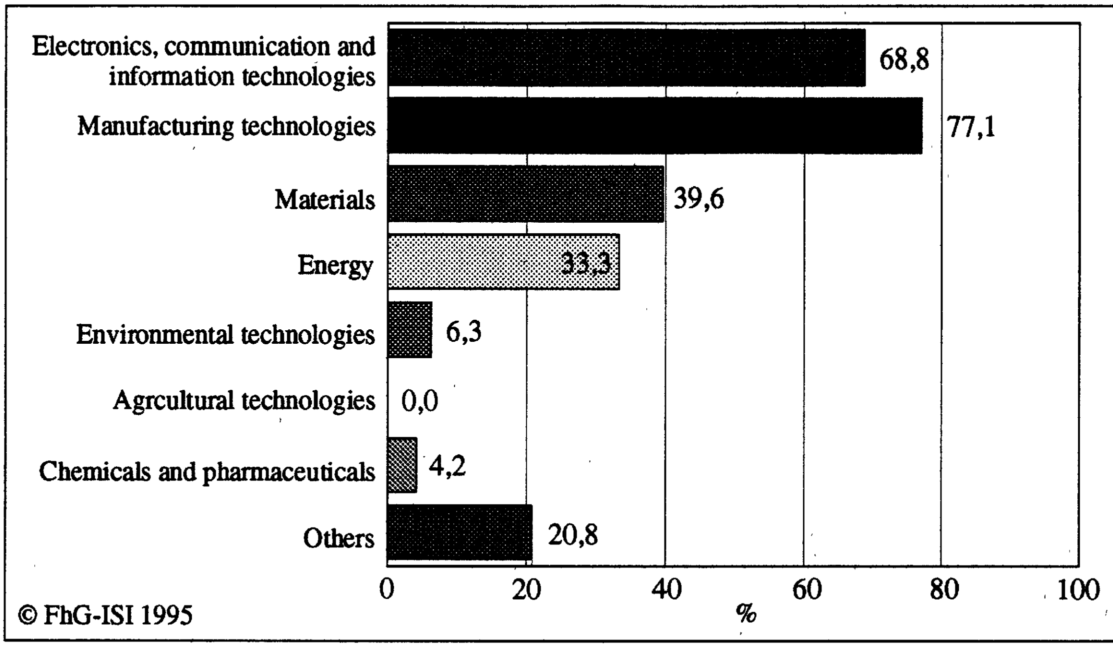
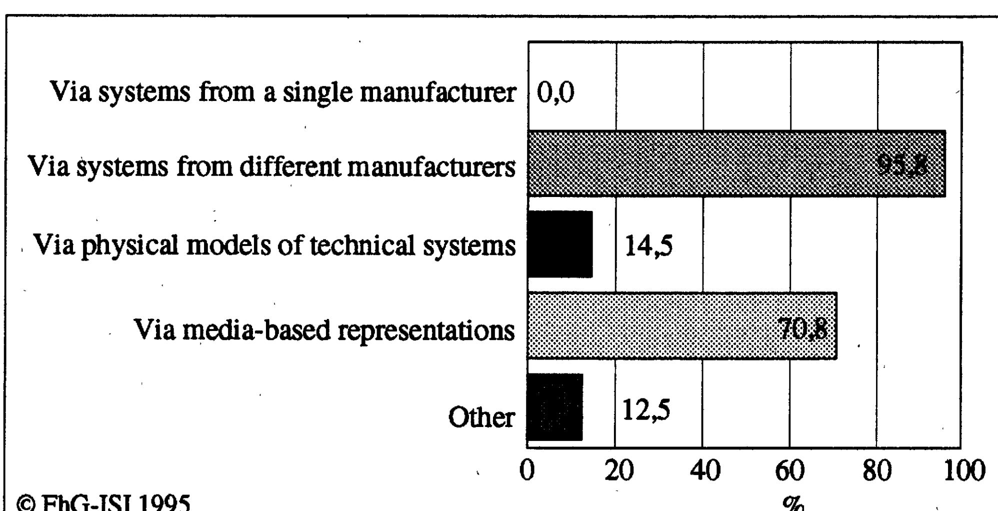


Figure 3-9: **Means Used to Demonstrate Advanced Technologies (n=48; multiple responses)**



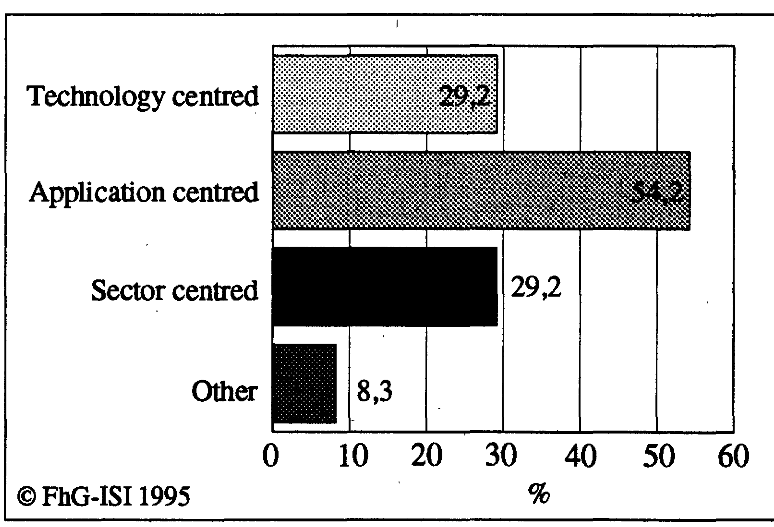
The centres were requested to classify themselves according to a given organisational type (cf. Figure 3-10). According to this classification, more than half describe themselves as *application-centred*, i.e. they demonstrate several technologies in one field of application. About a third of the centres classified themselves either as *technology-centred*, i.e. they demonstrate one technology exclusively, or as *sector-centred*, i.e. they demonstrate several technologies for one sector only.

Technology-centred facilities to a higher degree conduct research and technology development and market their activities more often via publications and conferences. They see the strength of their institution in estimating the needs of clients, in acquiring new clients, and in preparing the ground for cooperations. The centres want to increase their turnover, the proportion of demonstration activities and the size of the client base in the coming years.

Application-centred facilities more often provide information seminars and training courses in parallel and market their activities more via direct mailing of information brochures. They see the strength of their institution in the recruitment of qualified personnel. The centres want to participate more in national and European programmes in the coming years.

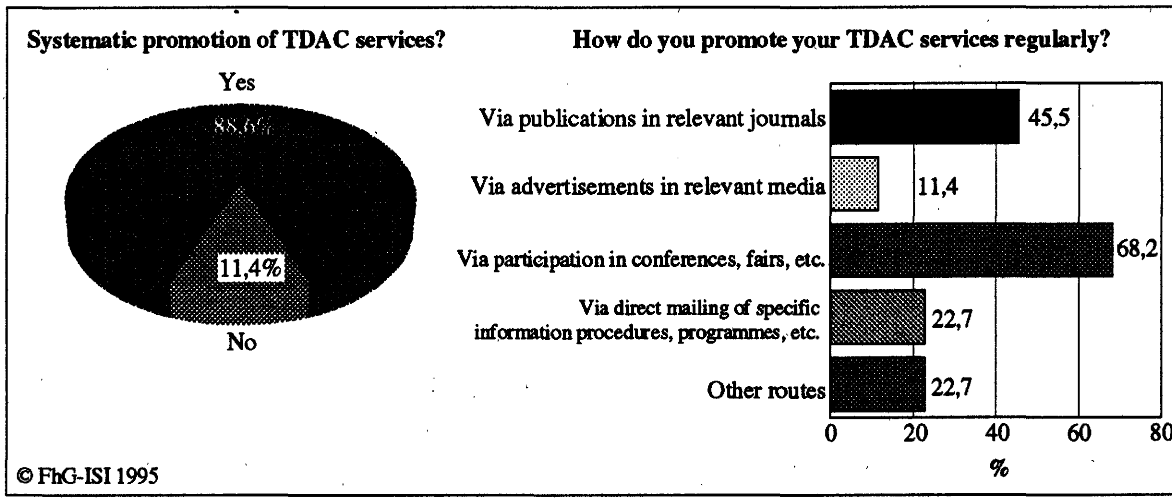
Sector-centred facilities relatively more frequently offer short-term consultings. By comparison with the other types of organisation these centres have a less market strength profile. The centres want especially to increase the number of personnel in the coming years.

Figure 3-10: How Would You Best Describe Your Centre? (n=48, multiple responses)



How the technology demonstration and application centres market their services can be seen in Figure 3-11. Almost all centres promote TDAC services systematically. The potential clients are contacted through participation in conferences and fairs. Almost half of the centres publish in relevant periodicals and thus draw attention to their services. A further information channel is direct mailing of information brochures to potential customers, for a quarter of the centres, and for a tenth of the centres, direct advertising in relevant media.

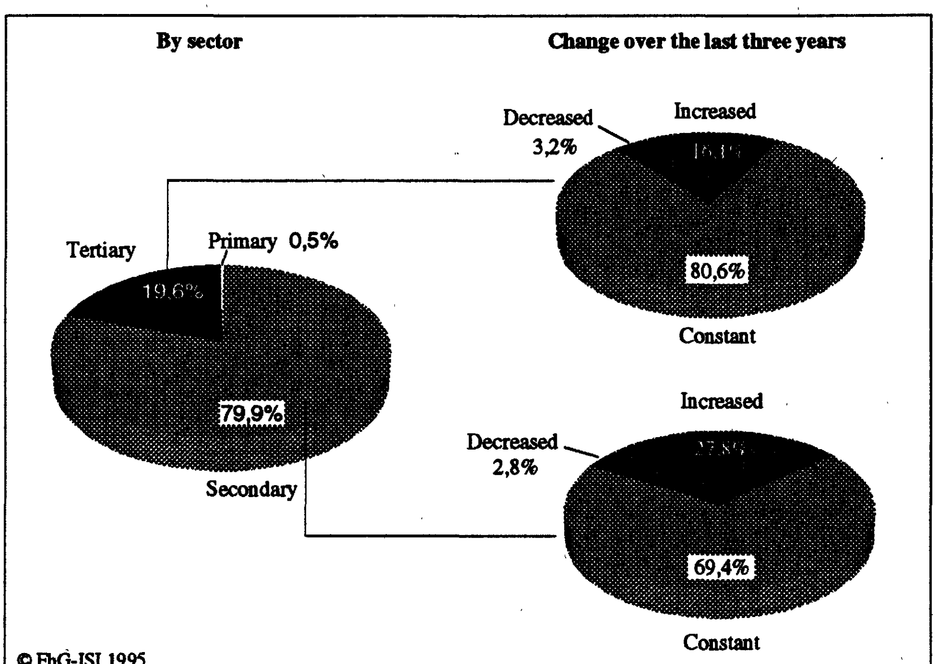
Figure 3-11: Promotion of TDAC Services (n=44)



3.3 Client Base of the Centres

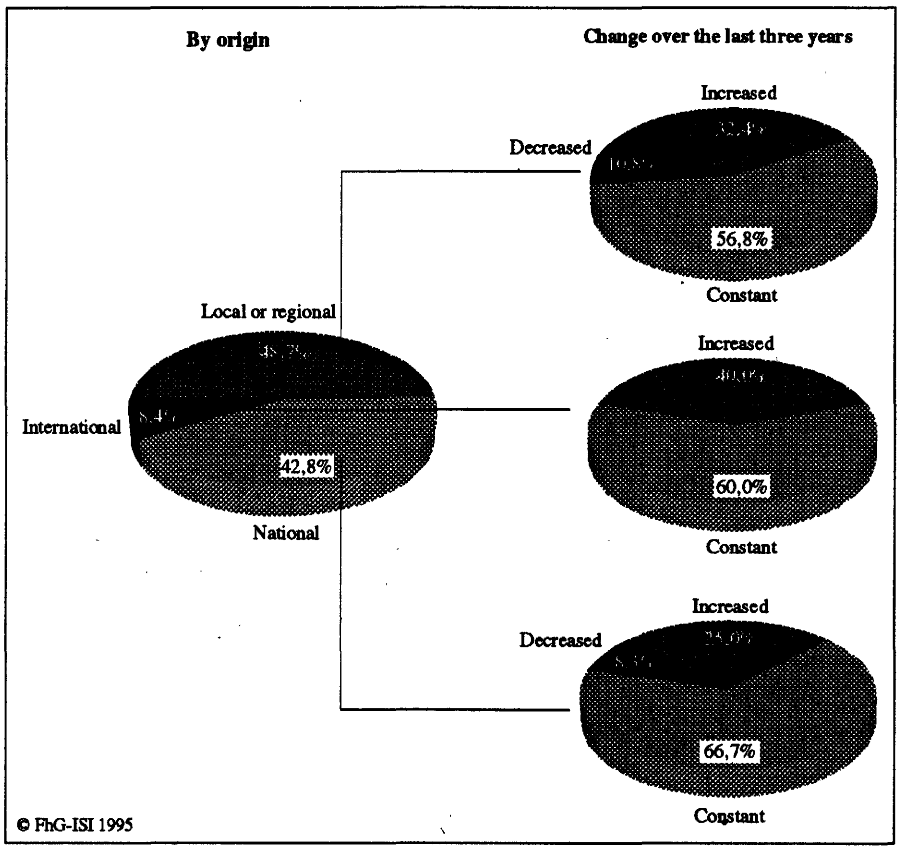
A further focus of the survey was the narrowing down of the client base of the centres (cf. Figure 3-12). Over three-quarters of the clients are in manufacturing (secondary) industry, about a fifth of the clients are to be found in the service (tertiary) sector.

Figure 3-12a: Client Base 1993 of TDACs by Sector and its Development (n=37)



On the average of all demonstration centres investigated almost half of the clients are located in the region of the TDAC; a high proportion of clients still comes from within Germany. The client base on an international level is relatively small, on the other hand; however, this branch has increased relatively in the last three years. The centres orient their service offer mainly towards small and medium-sized enterprises, but also large enterprises take advantage of the centres' services. On the other hand, public or intermediary organisations play a rather subordinate role.

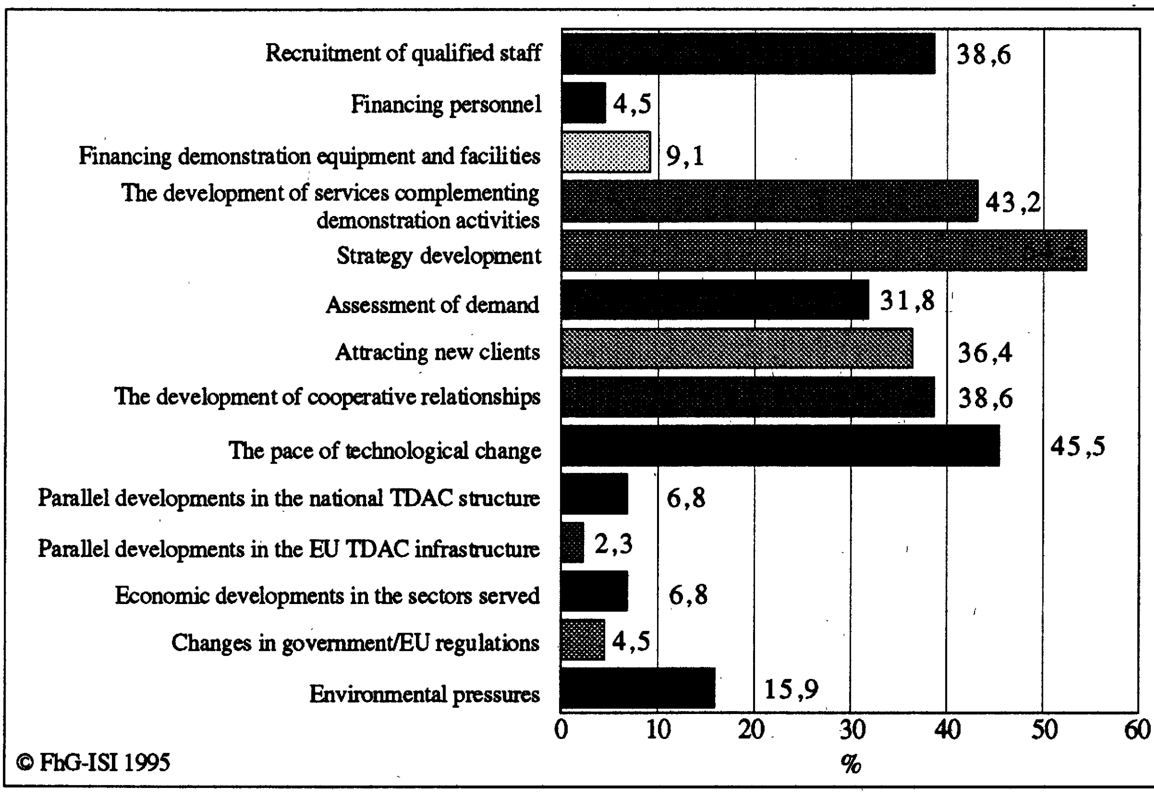
Figure 3-12b: Client Base 1993 of TDACs by Geographical Origin and its Development (n=41)



3.4 Strengths, Bottlenecks and Goals of the Centres

The technology demonstration and application centres were asked to mark their essential strengths; the result is depicted in Figure 3-13. More than half the centres see the ability to develop a specific strategy for the potential customer as one of their essential strengths. Similarly often managing the pace of technological change, and the development of services which complement the demonstration activities were mentioned. The recruitment of qualified personnel was also rated relatively high as well as the development of co-operative relationships and attracting new clients. The latter is especially emphasized by the independent demonstration centres and by those centres which finance their activities mainly from payment fees for services ability to recruit good people seems to contrast with the difficulties in the financing of personnel as is reflected in the list of bottlenecks.

Figure 3-13: Main Strengths from Point of View of TDACs in the Coming Years (n=44)



The financing of personnel seems to be the most important bottleneck factor in the coming years (cf. Figure 3-14). Two thirds of the TDACs mentioned it followed by the financing of demonstration equipment and facilities. The independent centres especially see problems in this field in the future. Further bottleneck factors named were: attracting new clients and economic upheavals in the branch to which the demonstration activities are geared. Altogether, to ensure the financial basis for the survival and development of the centres is the major concern of the TDAC managers addressed in the survey. The other factors play a rather subordinate role. Centres which do not systematically market their services will have to combat more bottlenecks in the coming years.

To conclude the survey, the centres were requested to specify their goals for the coming years (cf. Figure 3-15). The increase of the client base, named by ca four-fifths of the centres, assumes an outstanding role. Further, the centres named the increase of turnover and the utilization of new and alternative methods to demonstrate new technologies as important goals; especially the independent demonstration centres and centres which are largely financed through payment for services emphasize this. More than half of the centres regard the increase in demonstration capacity and the number of technologies demonstrated, the development of new marketing activities and the use of national and European promotion subsidies as important factors, which should be scrutinized carefully in the near future.

Figure 3-14: Main Bottlenecks Affecting TDACs in the Coming Years (n=44)

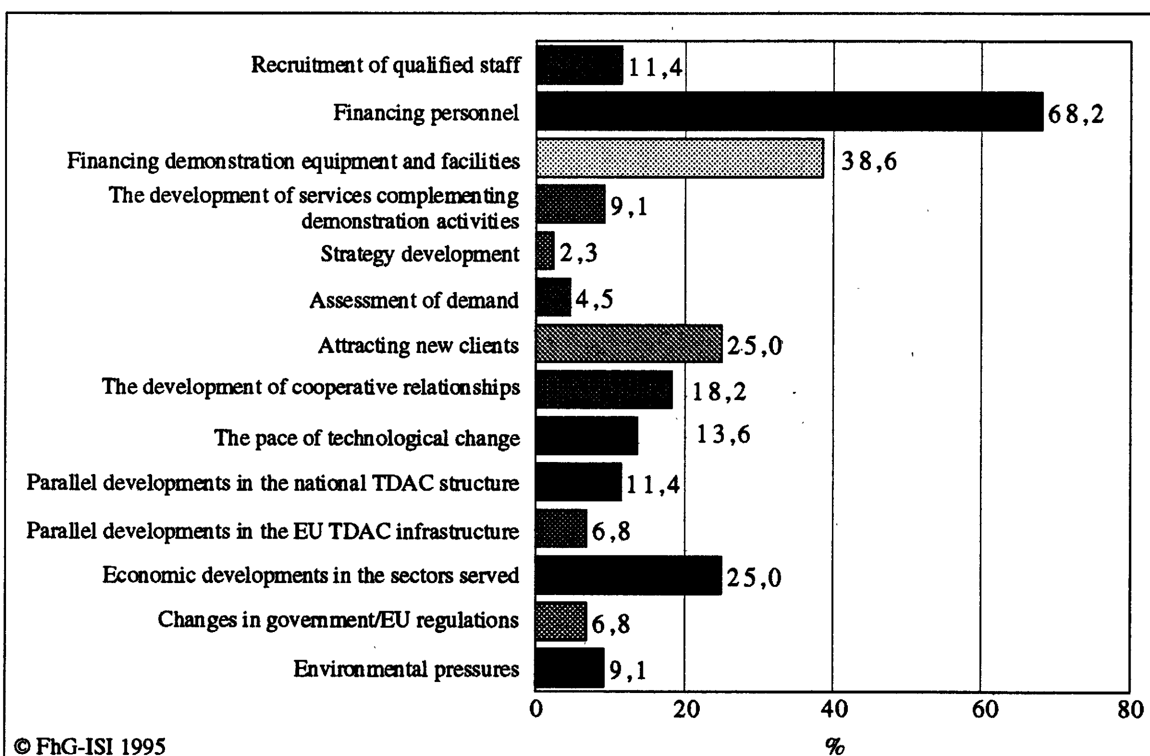
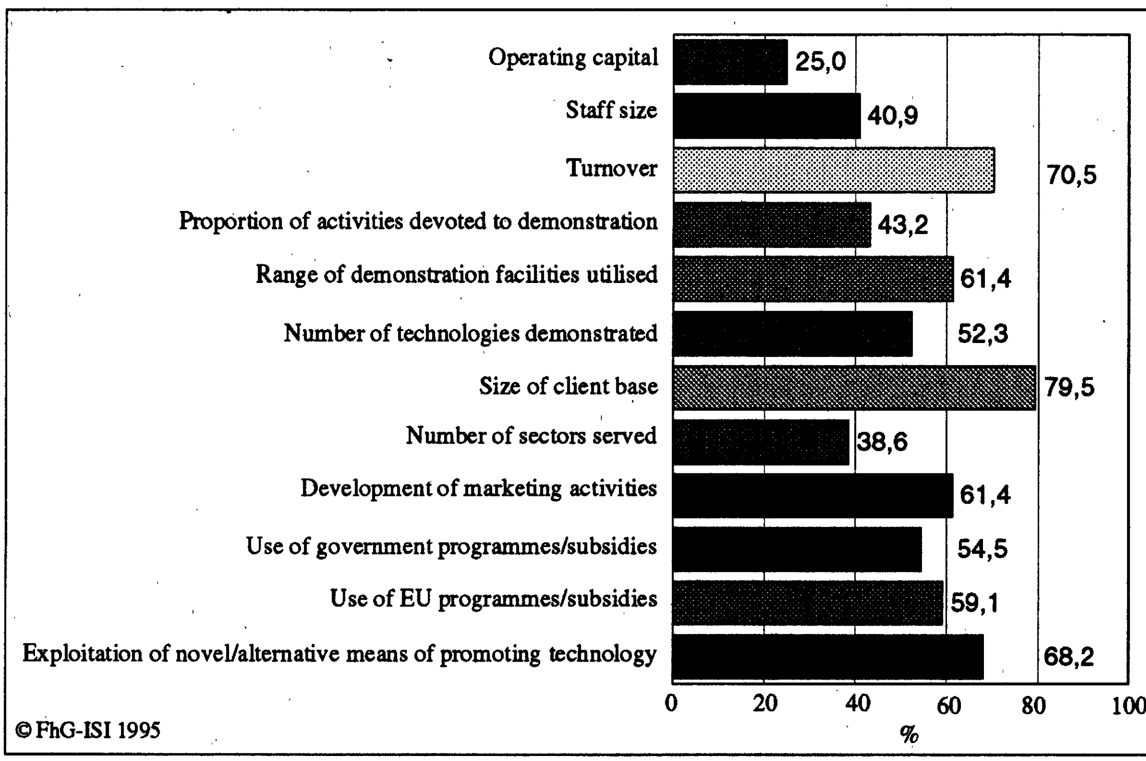


Figure 3-15: Main Goals for the TDACs in the Coming Years (n=44)



3.5 Management of TDACs

An important task in the eyes of numerous TDACs is the strengthening of cooperation relationships with other institutions. The TDACs in particular which work in technology fields with wide dissemination aim at a better cooperation with other organisations in the area „seminars and conferences". For the TDACs which deal with relatively „unknown" technologies, the increased cooperation with research and development institutions is of paramount interest.

The communication with potential clients is regarded by all TDACs as a fundamental problem. Technology-centred centres have most problems with this. The marketing problem for them grows greater, the more widespread the technology on which their demonstrations and consulting is based becomes in industry. In that case the TDACs are in direct competition with other (commercial) consulting and demonstration services. One of the main difficulties for TDACs in this case is often how to point out the comparative advantages over their competitors (i.e. How do I draw attention to myself, How do I convince potential clients of my know-how?).

The marketing problem is closely linked with questions of what services to offer and financing. As regards the offer of services, a constant change of topics and services to be rendered is apparent. If in the early stages of disseminating a technology the imparting of core information about the technical potential and economic application possibilities are in the foreground of activities, in later stages of diffusion it is rather questions of adequate embedding in the organisation, qualifications, profitability etc. which are of increasing importance. This change of subjects in phases makes special demands of the management of TDACs: new subjects must be taken up, employees must be (re-)trained accordingly, new client groups must (perhaps) be identified and approached as a specific target group. The fact that the increasing spread of a technology as a rule runs parallel to the phasing out of the public funding of the centres exacerbates the marketing problem.

3.6 Summary of Survey Results

The results of the German survey can be summarised as follows:

- More than three fourths of the questioned TDACs are part of larger organisation. In most cases no new organisations were founded.
- More than half of the TDACs were initiated in the '80s. This reflects the increasing importance of demonstration activities in the field of technology transfer.
- More than three fourths of the questioned TDACs received their initial financing from public sources.
- The activities concentrate on the following technology sectors: manufacturing technologies, electronics, communication and information technologies, materials and energy.
- The majority of the TDACs see themselves as application-centred. Approximately 30 % consider themselves as technology or sector centred.
- The activities are not limited to demonstration but include numerous other activities such as counselling, training, etc.
- Surprising many TDACs are located in Baden-Württemberg and Bavaria. These states have especially in the '80s institutionalised their technology transfer activities. Federal programmes have started a number of centres in the 'Neue Bundesländer' (new German states).

4 Interview Results

The questionnaire survey was supplemented by a field study which was designed to provide qualitative information of TDACs and their role within the technology transfer and innovation policy of Germany. For this purpose five TDAC managers were selected - based on the criteria listed below - from those responding to the questionnaire survey. In addition several TDAC clients were interviewed by phone. The German policy on TDACs was discussed with politicians from the Federal Government.

During the selection of TDACs for the case studies care was taken to choose organisations which together represent i.e. cover the following characteristics:

- Orientation. TDACs have been classified as either application/technology or sector oriented.
- Technological field. Technologies most popular in Germany should be covered making sure that new (i.e. not yet diffused) and mature technologies would be represented.
- Regional significance. Potential differences of TDACs located in high-tech regions, regions of industrial change, and in the new Federal States should be identified.
- Initiation. The reasons for the creation of TDACs should be identified by visiting TDACs which were initiated by the Federal Government as well as those started by private, local or regional actions.
- Organisation. Both independent TDACs and those being part of a larger Organisation were to be considered.

4.1 Technology-centred TDAC: CADCAM Laboratory, Karlsruhe Research Centre

Organisation/Institutional Affiliation

The CADCAM Laboratory is a public technology transfer institution for CA... technologies and is a part of the Karlsruhe Research Centre (Forschungszentrum Karlsruhe). The demonstration centre was founded in 1983 on the initiative of the Federal Ministry of Research and Technology (BMFT) and its project management agency for manufacturing technology, the PFT (Projektträger Fertigungstechnik) in the context of public efforts towards technology transfer. In the first five years of its existence the centre received basic funding from the federal government and was organisationally autonomous. Since January 1988, the CADCAM Laboratory has been affiliated, both organisationally and regarding its legal status, to the Engineering Technology

Department of the Karlsruhe Research Centre. The employees of the laboratory are not, however, established in the budget of the Research Centre.[1]

The centre has been intentionally located in the city of Karlsruhe. This has been done in order to make the centre easily accessible to small and medium sized firms, and to help remove the psychological inhibitions that have sometimes been associated with new technologies and research institutions.

Funding

As the initiative for the foundation of the CADCAM Laboratory originated with the Federal Ministry of Research and Technology (BMFT), personnel costs were financed from federal funds during the period from 1983 to 1987. The major part of the hardware and software used to equip the demonstration laboratory was loaned by various systems suppliers. This form of supplementary financing represents an important frame condition for the founding of the centre; in view of the prices of CAD/CAM technologies in the early 1980s, and the limited public funds available, it would not have been possible to set up a laboratory without this support in the form of noncash resources.

With the affiliation of the CADCAM Laboratory to the Karlsruhe Research Centre's Engineering Technology Department in 1988, there was a change in the mode of financing. Instead of direct basic funding, the basic financing for personnel costs is now provided by the Karlsruhe Research Centre. In addition to this basic funding, the centre is also required to secure supplementary financing through third party projects (i.e. project work, seminars, consulting).

Major Activities and Technological Field

The centre regards itself as a neutral, supraregional information and consulting office for the technological field of CIM, with its components CAD, CAP, CAM, PPC and CAQ. The major aim of the centre is to support small and medium sized firms in the planning, introduction and use of computer-aided processes, both for production planning and manufacturing and for the inter-firm exchange of product data. The CADCAM Laboratory deals both with individual CIM components and with the tasks of "interlinkage of systems, data integration, computer networking and interfaces between CIM components". In cooperation with the VDA (Verband der deutschen Automobilhersteller, the association of German automobile manufacturers), the

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1 Until 1994, the Forschungzentrum Karlsruhe (Karlsruhe Research Centre) was known as the Kernforschungszentrum Karlsruhe (Karlsruhe Nuclear Research Centre).

laboratory is also a centre of competence for data exchange as well as a testing-point for interface processors (VDAFS and VDAIS).

The CADCAM Laboratory's close cooperation with research institutions and numerous software and hardware suppliers ensures that the technological state-of-the-art can always be demonstrated and future trends in development indicated.

In addition to demonstration the centre offers the following services:

1. Seminars and courses:
- Seminars on system comparison
- Special seminars
- Training courses
- Firm-specific seminars

2. Consulting
- Orientation consulting
- Management consulting
- Consulting on data exchange
- Trial runs

The centre's broad demonstration field makes it possible to observe systems with various types of performance specifications, giving a clearer view of the market offer, and provides practical demonstrations of application-specific concepts. Unlike the CIM technology transfer centres associated with universities, the centre intentionally does not perform autonomous development work, i.e. it attempts to show not the newest state of technology, but the technology that can be used now by small and medium sized firms ("CAD as a tool"). In contrast to the universities, interest is concentrated mainly on technology transfer, rather than on science and research.

In the first few years the emphasis was mainly on providing information about CAD/CAM technologies ("What is CAD ? What systems are available, and what are the differences between them ?"). In the course of time other aspects were included; technological problems increasingly gave way to questions relating to organisation, financial viability and the introduction process. Initiated by a BMFT promotion of quality control, the aspects of quality assurance in the design and manufacturing process and in CAD data exchange, CAD/CAM data transmission and system modelling also gained importance at the beginning of the 1990s.

Clientele/Promotion Market

The target group addressed by the centre is primarily small and medium sized firms. These are located mainly in the mechanical engineering branch and the automobile industry. The focus is on the application of CAD/CAM technology in the area of mechanical design, i.e. questions of the use of CAD in building and in product design are not dealt with.

Contact with potential clients is made through

- press releases
- publication of specialist articles
- advertising in specialist journals
- visits to fairs
- participation in specialist congresses
- keeping address data banks
- maintaining contacts with industrial associations

The development of demand has been closely linked with the degree of diffusion of CAD/CAM technology in Germany, and with a public promotion programme on the use of CAD/CAM systems in firms that ran from 1984 to 1988[2]. At the beginning of the 1980s, industry's need for information on this technology was very great due to the fact that it was still new. This information demand was increased by the introduction of the public programme for the promotion of the use of CAD/CAM systems in firms in 1984. As a result, there was a rush of visitors to the centre in the first few years following its foundation.

In the early 1980s, the centre held a monopolistic position in manufacturer-independent demonstration and consulting on CAD/CAM technologies. Over the next few years other providers of these services began to appear, especially private consulting firms. At the beginning of the 1990s, the demonstration and consulting offer on CIM technologies in Germany was enlarged by the founding of CIM technology transfer centres (cf. also Chapter 2). As a result, the demand for the demonstration and consulting services offered by the CADCAM Laboratory continuously decreased.

2 On the public promotion of the use of CAD/CAM systems within the Manufacturing Technology Programme (Programm Fertigungstechnik), see Lay/Wengel 1989.

Assessment of activities

According to its self-assessment, the centre has played an important role in the diffusion of CAD/CAM technology in Germany. The centre considers, however, that its role should be regarded in close association with the public promotion of the use of CAD/CAM technologies in 1984-1988: this promotion magnified the demand of investment goods manufacturers for information on this new technology, and the CADCAM Laboratory, as one of the first suppliers of the relevant demonstration and consulting services, was able to satisfy this demand in a competent, practice-oriented way.

The advantages of the centre over trade fairs and other information sources were (and, to some extent, still are):

- continuous demonstration (i.e. not just for the duration of a fair),
- consulting and demonstration independently of manufacturers
- specialist competence in all the relevant areas of CAD/CAM,
- a pragmatic approach in demonstration and consulting.

However, the role of this centre in the diffusion process has changed following the further development of CAD/CAM technology. Thus in the early 1980s, a specific hardware basis (Vax, Prime) was required for demonstration which, due to the purchasing costs and the technological conditions of use (e.g. mainframe computers, cooling systems) was not available everywhere. Today mobile demonstration centres can be set up in buses, at fairs or on-the-spot for potential users. This, as well as the increasing appearance of other suppliers of demonstration and consulting services, has had an important influence in changing the centre's effectiveness and competitive situation.

The role of the CADCAM Laboratory in the diffusion process has also changed due to the fact that today CAD/CAM is largely a mature technology. The associated industrial demand for information and consulting has also changed. Whereas, in the first few years following the founding of the centre, interest was concentrated on questions of possible applications and technical performance potentials, in the meantime questions relating to the organisational embedding of CAD, to financial viability and quality assurance have come to occupy the foreground. Finally, the supply of information in Germany, and the general state of informedness in industry on new production technologies, have considerably improved. All these factors have led to a change in the demand for the centre's consulting and demonstration services.

Problem Areas

The most urgent challenge is seen as the procuring of additional funds to supplement the basic financing by the Karlsruhe Research Centre. This will be necessary, as financial support from the VDA (association of German automobile manufacturers) is decreasing, and at the same time the seminars are not so well attended as they used to be. Moreover, the Karlsruhe Research Centre's willingness to cover deficits is limited, due to its own tight budgetary situation.

Communicating its service offer externally is seen as another, permanent challenge, the question being "How can the target group best be made aware of the centre and the services it offers ?". Constructive solutions to this and other questions relating to the marketing of the centre are continually being sought, although the centre is aware of its comparative strengths with regard to its competitors, and now enlists professional support for the textual and graphic design of its programme brochures.

A further challenge is seen in the continuous state of change in the content of consulting. In view of the degree of diffusion of CAD/CAM technology, the state of general knowledge and the competitive situation, the aspects of integration (e.g. reliability of inter-system data transmission, data management, data banks) and quality assurance will predominate even more in future. In addition, the topic of the technological structuring of data processing in international manufacturer-supplier relations is becoming increasingly prominent, as substantial deficits are still seen in this area, especially in other countries.

4.2 Sector-Centred TDAC: IZ Innovationszentrum Plauen/Vogtland GmbH

Origin and Development History of the Centre

The IZ Innovation Centre Plauen/Vogtland was officially opened in autumn 1992. The opening of the centre was preceded by a one-year planning and start-up phase involving a start-up team of four. The aim of the start-up activities was to develop a concept for the centre, to find suitable premises and to secure financing for the project. Impulses for the concept were received, among others, from the ADT (Arbeitsgemeinschaft Deutscher Technologie- und Gründerzentren, the association of German technology and incubator centres).

The centre was conceived as an autonomous, technology-oriented incubator centre with the following tasks: to provide office and shopfloor sites for small and medium sized enterprises and firm founders and to support, advise and service firms in their start-up phase (see below). The centre is located in a renovated industrial building in the city centre. The financing for the start-up team was provided by the employment office (ABM funds), the city acquired the industrial building and placed it at the disposal of the Innovation Centre, and the centre itself was financed half and half by the Free State of Saxony and the European Union.

Frame Conditions of Centre and Self-assessment of its Role

The centre is located in the traditional industrial region of Vogtland. The region is one of the structurally weaker regions of the new Laender (previously the German Democratic Republic). The region of Vogtland is characterised by the following problem situations:

- There are no research or university institutions in this area, meaning that a research infrastructure is lacking, and
- the industry located there has a very strong monostructural orientation and is at present undergoing a structural crisis; the region has always been dominated by the textile industry.

Under the German Democratic Republic, this region was a border region and the regional "border syndrome" is only now slowly dissipating. Points of departure for regional structural change are the promotion and restructuring of potentially competitive branches in the region: special mechanical engineering, the food industry, the textile industry and the building and construction industry.

All the important actors of the region are represented on the advisory board of the centre: the city, the "Landkreis" (county), the Chamber of Industry and Commerce, banks and some enterprises.

Major Activities and Technological Fields

The range of services offered by the Innovation Centre includes the following:
- Technology demonstration: a "Centre for Technology Applications" was set up already in the start-up phase of the centre. A CNC lathe and a CNC milling centre were installed and presented as a networked mechanical engineering enterprise to be "tried out" by visitors to the centre. A CIM demonstration centre for the textile industry, originally planned in cooperation with the TU Chemnitz, was not realised. The demonstration centre is incorporated into the training facilities, and can also be used by local industry for manufacturing tests.

- Materials testing laboratory: destructive and non-destructive testing of metallic and non-metallic materials, including accompanying quality assurance. The laboratory is available to regional industry and is much used by the building industry there.

- Office for the dissemination of techno-scientific information and certification of norms for regional industry: the office performs online searches and keeps a supply of information materials and guidelines available (DIN, ISO, technical regulations, etc.)

- (Further) training: training facilities include organising and carrying out training in the following areas: quality assurance, product responsibility, materials testing, management training, business management and CNC technology. From 1994 to 1998, a pilot project on training in the dual system for the metal industry is running at the centre, entitled "Combined qualification in quality control and maintenance integration in the Training Association of the metal industry" and financed by the previous Federal Ministry of Education and Science (now the BMBF).

- The centre's incubator park offers firm founders nearly 6000 m^2 of office, laboratory and shopfloor space. 29 firm founders have now moved into the building, but not all of these firms are technology based; many of them are engineering firms.

- Consulting for firm founders: consulting includes the areas of firm foundation and firm planning, and is performed in cooperation with the Chamber of Industry and Commerce for South West Saxony, the Wirtschaftsförderung Sachsen GmbH, the regional council of Chemnitz and the Ministry for Economic Affairs and Employment of Saxony. Consulting also includes information about current promotion programmes.

Performance and Promotion

The Innovation Centre takes into account the particular situation of the region. There are no research institutions in the area, and there is a goal to support the process of transition and sectoral structural change in the region. Thus there would be no point in concentrating on high technologies (e.g. a laser demonstration centre or high speed processing), as these are not related to the present needs of the region. The demonstration activities of the Innovation Centre are only one part of a broad spectrum of services, and do not necessarily represent the centre's most important activity. Information seminars, consulting, testing and certification, and training activities, as well as the provision of commercial sites, are aspects of more central interest.

Assessment of Activities

The Innovation Centre works in close cooperation with the most important actors in the region; these are also represented on the advisory board of the centre (city, county, banks, chamber of industry and commerce, etc.). Some firm founders and enterprises located in the centre give this close network of contacts as an important reason for their decision to move in there.

The lack of research institutions and infrastructure is one of the region's major problems. Another application-oriented research institute ought to be located in the region. The Innovation Centre cannot be, and does not wish to be, regarded as a substitute for research and development institutions. The Centre sees itself more as a regional partner for contact, cooperation and transfer, demonstrating technologies in addition to performing other important consulting and service tasks.

4.3 Application-Centred TDAC: ADITEC

Organisation

The ADITEC Technology Transfer Centre was founded by faculty members of the University of Aachen and a non-profit organisation called AGIT (which is a private organisation initiated to support the development of small and medium sized firms through technology centres and financing).

Operational goals are to keep the number of personnel working for ADITEC as small as possible. The closeness to the university and other research organisations enables the centre to utilise staff from the university and the research organisations. Thus, the staff required by ADITEC is kept to a minimum of about 5 permanent employees (3 engineers, 2 organisational).

Funding

The budget of the centre is financed to a considerable extent by leasing rooms and facilities in the building it owns. Additional income comes from projects and donations. The demonstration activity does not earn any money at this time. It is not believed that this will change in the future. The demonstration activities by themselves are not expected to actually provide any income.

The equipment being used for demonstration is either leased without charge from the equipment manufacturer or is a gift from the supplier. In a few cases the equipment is paid for by the centre.

Major Activities and Technological Fields

The main purpose of the centre is to run a complete model factory for the production of machine parts. As a model factory it is supposed to actually manufacture a product with all the necessary steps of the process involved. This includes the organisation, the materials' flow, the machining and the process control. This model factory is to be used as a demonstration project for SMEs and also to support the faculties of the university in that field. Students and assistants can actually learn from the real production process. Small and medium sized firms can observe the real thing and learn how modern technology is utilised in the production process and how modern organisation techniques and controlling methods can be employed to reduce overhead and increase productivity.

Besides demonstration activities the centre is involved in further education and training. They organise seminars for small and medium sized firms and provide courses on quality control in conjunction with the local Chamber of Commerce. Other courses and seminars are held on new cost structures for modern production techniques and organisational aspects as well as control systems and modern ways to produce and use production machinery.

Clientele/Promotion/Market

The centre was erected with funds (about 15 million DM for the buildings and infrastructure) from the regional and state government. The main objective is to transfer know-how from universities and research laboratories to small and medium sized firms.

There is quite a lack in this area, i.e. SMEs are very reluctant to approach universities or research organisations. They do not feel confident and have the impression that the research and the work done in these institutions is only for larger firms and will not be of any benefit to them (SMEs). Thus, one of the biggest problems for a TDAC is to approach their clientele and make them aware that they have services and information which will be especially of use to the SMEs.

One approach to attract clientele is to work together with organisations and bodies that are directly related to small and medium sized firms such as the Chamber of Commerce and Trade and the Chamber of Industry.

There are also invitations to SMEs for seminars and small congresses. All of these activities are free to the SMEs and are mainly geared to create confidence in the services offered by the centre.

Assessment of Activities

It is believed that demonstration activities, especially those being offered by a neutral body, are very important for SMEs. The neutrality aspect is one way to attract SMEs and to obtain their confidence.

The demonstration activity increases the acceptance and trust in a technology transfer centre. Offering a completely working production chain (small enterprise) increases the respectability and also differentiates this centre from other technology transfer centres in the region or the state.

Demonstration activities can only be part of a centre's activities as demonstration activities will not be self-financing. The equipment is very expensive. Personnel being highly trained will also obtain considerable salaries and unless there is support from a public place demonstration activities can only be carried out in the context of other more important and better financed activities.

This centre plays a rather unique role as it demonstrates an actual production line on how to utilise modern technology and organisational know-how to improve production.

Being rather new in this field there has not been enough experience. Little thought has been given to any methods for evaluating the demonstration activity.

5. Assessment and Conclusions

5.1 TDAC Performance and Effectiveness in View of Their Tasks and Goals

At the root of the establishment of publicly financed TDACs was the technology policy aim to complement the existing R&D infrastructure in Germany, in order to promote the transfer and diffusion of new technologies. Small and medium-sized enterprises especially should be provided with knowledge for their orientation and consulting in the early stages of application of new technologies. The TDACs have the task of contributing to the diffusion of new technologies by supplying information.

In general, the TDACs pursue higher goals such as (cf. Behringer et al. 1994: 28) to:

- eliminate information deficits as regards new technologies
- remove inhibition thresholds against new technologies and possible cooperations
- facilitate the transfer of technology from the basic research stage to practical/economic application or
- provide concrete solutions to problems in the form of joint projects with enterprises.

In order to answer the question how well the German TDACs have fulfilled the tasks set them, it is advisable to take the point of view of the different actors or interest groups into consideration. In the following the results of interviews with political decision-makers, managers and TDAC customers will be outlined.

Assessment from a Technology Policy Point of View

For the BMFT, the TDACs represented in the past ten years an important instrument of technology policy within the framework of state technology transfer efforts. Compared with information „events“ or so-called status seminars, the technology demonstration and application centres in Germany have proved successful in the BMBF's estimation, especially with regard to the wide audience reached. The evaluation of the performance of individual centres has only been partially attempted, due to the lack of methods and efficiency criteria. Thus for example TDACs are judged on the ability to acquire non-public funding, or if they are capable (after funding has ceased) to continue in business.

The marketing of the services on offer is regarded as a general problem. A tendency was noted to neglect, systematically, the question of demand. This can be explained on the one hand by the „prescribed“ concentration on the supplier role in the context of state driven technology transfer, on the other hand by management mistakes or marketing deficits on the part of the centres themselves. The failure to take demand sufficiently into consideration appears problematical in many cases after the BMBF funding has stopped. The question of the „right“ time to found TDACs in the course of diffusion of a technology, as well as the optimal duration of promotion for individual, centres is therefore of great importance for the BMBF. In view of the multiplicity of technologies and problematical situations, however, one generally valid answer to all questions is seen as difficult.

Assessment from a Customer Point of View

Enterprises which are dealing with the application possibilities of a still very young technology, as for example the virtual reality technology, see the TDACs as the only possibility at present to gain competent information on this technology, see its technical performance potential in demonstrations, exchange experiences with other enterprises (interested firms, pilot users), and reflect jointly on the profitable applications of the technology. The appropriate TDACs are at present the only institutions in Germany which offer information, demonstrations, and consulting for this new technology. TDAC direct approaches to companies was often the motive for them to investigate more fully a technology which was until then barely known through the media. In some cases companies worked on the development of a new product or a new service, based on the knowledge of the application possibilities. Without the active information policy of the TDACs and the demonstration provided, the whole subject would not (at least not yet) have been taken up - or it would have remained too abstract. The centres participate actively in the diffusion of these new technologies.

As appeared from talks with customers of a TDAC with the focus on CAD/CAM technology, TDACs are significant for more widely spread technologies. Those who made use of the TDACs' services valued most highly their technical competence (especially the knowledge of strengths and weaknesses of different offers on the market), the objectivity of the advice given and the demonstration set-up. The TDAC offer in this technology field is regarded as an interesting alternative to other forms of consulting on the market. According to the estimation of the firms questioned, the advisory service offered by the TDACs was more significant for their decision-making than other sources of information, such as fairs or specialist journals.

TDAC Self-Assessment

As the main tasks of (technology-centred) TDACs change in the course of diffusion of a technology, the question of goal attainment can only be answered in a differentiated manner. In the early stages of a technology diffusion the TDACs play an important role, according to the self-assessment of the centres questioned. Quite frequently, TDACs enjoy a semi-monopoly on information in this phase. The number of visitors to the centre which in many cases is used as a quantitative success criterion, is evidence of this. The demand for TDACs' services is greater, as experience shows, the better the founding of a TDAC and the start of an effective diffusion promotion programme are coordinated as regards time and concept.

With the increased spread of a technology a TDAC will be faced with other tasks as at the beginning of the diffusion curve, but as a rule other organisations with other consulting and service offers appear on the market. Due to their technology policy direction, the wide spectrum on offer and the neutrality towards manufacturers, it is sometimes difficult for TDACs to hold their own successfully with non-public contracts in the increasingly differentiated consulting market which develops as the diffusion of the technology increases.

5.2 Conclusions

The instrument of technology demonstration and application centres has been an element of the national technology transfer in the Federal Republic of Germany since the 1980's. In the course of a further differentiation in the field of technology policies, the demonstration of new technologies gained, among different instruments of technology transfer, an importance of its own. Demonstration centres were to complete the existing R&D infrastructure and should reduce obstacles especially on the level of small and medium sized enterprises as well as to impart orientation and knowledge in order to improve the diffusion of new techniques.

According to the investigations made, up to 100 institutions are at present acting as technology demonstration centres in the FRG. The written survey among the TDACs identified covering 48 bodies found more than three-quarters of the TDACs part of larger organisations (mainly universities or research institutes), nearly a quarter are individual institutions. In most cases, the institutions had received an initial financing from public funds, whereas over the last years the financing from revenues for the services offered and from project funding increased in their relative importance. Nearly half of the centres started its activities in 1986 - 1990, at a point of time, when the demonstration of technologies was gaining a considerable importance as an individual instrument within large technology push programmes. Most of the centres of the survey experienced an increase in terms of their turnover as well as in terms of staff.

The services offered by the centres are not only limited to the mere demonstration of technology, moreover, they give support to their clientele in such fields as the conception, development and implementation of technology solutions, they offer immediate advice and training and organize information seminars. Electronics, information and communication technology and manufacturing technology are in Germany by far the most common areas of demonstration activities. Two-third respectively three-quarters of the TDACs had these technologies in their portfolio. More than half of the centres of the survey concentrate on these two fields of technology. In most of the cases, demonstrations of new technologies are carried out with systems and equipment of different producers. More than half of the centres offer demonstrations of several technologies for an application field (application-centred TDACs), respectively less than one third of the institutions demonstrate only one technology or several technologies for a particular sector (sector-centred TDACs) or concentrate on one technology (technology-centred TDACs). Nearly all of the centres pursue a systematic commercial exploitation of their services. In most of the cases, the offer of the centres is directed to the needs of small and medium sized enterprises. Their financial situation is always mentioned as an essential bottleneck. Over the next years, the TDACs wish to increase their clientele and their turnover, emphasis is also being laid on the application of new and alternative ways in the demonstration of new technologies.

The establishment of the centres, whether on public or private initiative, was a matter of technological potentials and prospects. The endeavour to offer demonstration and information on new technologies was the thriving factor. This strong orientation towards technology supply had the effect that in the run-up to the foundation of the TDACs the demand aspect was generally neglected. According to the self-assessment of the centres TDACs in interviews play an essential role at an early stage of technology diffusion. In the further course of diffusion of a technology, the tasks of the TDACs are not only differing from those of the beginning of the diffusion curve, but there are also other competitors in the field. With regard to their special task in technology policies, the wide range of their offer and the neutrality towards producers, it is getting more and more difficult for some of the TDACs to maintain their position in the expanding consultancy market in the course of diffusion of a technology. At present, enterprises wishing to apply a brand new technology regard TDACs as the only possibility to receive competent information about it. The enterprises interviewed in the survey emphasize their special knowledge, the neutrality of their advice and their demonstration equipment. The political decision-makers emphasize the importance of the TDACs in the technology transfer. However, there are also complaints that due to a lack of methods and efficiency criteria no assessment of performance of the individual centres has been made so far. There is also a tendency to complain about a general neglection of the demand side.

In terms of technology policies it is the task of the TDACs to promote the transfer and diffusion of new technologies and to complete the existing R&D structure in this respect. It can be said that TDACs are in general an adequate concept to inform SMEs about the possibilities and prospects of new technologies and thus to initiate and accelerate the diffusion process. However, in order to further improve technology policy in this field and not least to help TDAC management the following should be of particular concern in the future:

- In the run-up of the establishment of TDACs a systematic analysis of the demand structure and the market potential should be carried out.
- The range of services offered should be carefully adapted to the respective diffusion stage of the technology in question. Early stages primarily require information and demonstration of a technoloy's potential whereas later organisational and implementation issues gain importance.
- In this context, it should also be highlighted that with broad diffusion of a technology there usually is less sense in the use of TDACs. Thus the question of termination or adoption of services should already be a concern when establishing TDACs.
- Methods and criteria have to be developed in order to allow a more adequate and pro-active assessment of TDACs' performance.

The study overall shows that TDACs have, largely through public promotion and in a great variety of organisational solutions, become a significant element of the technology transfer infrastructure in Germany.

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ANNEX A:

List of German TDACs

German TDAC's

(March 1995)

INSTITUTE: ADITEC GmbH

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52074 Aachen

PHONE: 0241/803614

FACSIMILE: 0241/83769

INSTITUTE: CIM-TT

Werkzeugmaschinenlabor WZL

RWTH Aachen

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52056 Aachen

PHONE: 0241/80-74 50

FACSIMILE: 0241/88 88-293

INSTITUTE: Demonstrationszentrum für

Faserverbundwerkstoffe

FhG-IPT

ADDRESS: Steinbachstraße 17

52074 Aachen

PHONE: 0241/8904-112

FACSIMILE: 0241/8904-198

INSTITUTE: Dienstleistungszentrum Mikrosystemtechnik

Werkzeugmaschinenlabor WZL

RWTH Aachen

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52056 Aachen

PHONE: 0241/80-7450

FACSIMILE: 0241/8888-293

INSTITUTE: CIM-TT

Institut für Werkzeugmaschinen und

Betriebswissenschaften, TU München

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85609 Aschheim

PHONE: 089/90994-0

FACSIMILE: 089/90994-118

INSTITUTE: CIM-TT

Technische Universität Berlin

Institut f. Werkzeugmaschinen u. Fertigungstechnik

ADDRESS: Pascalstr. 8-9

10587 Berlin

PHONE: 030/31424127

FACSIMILE: 030/3911037

INSTITUTE: Demonstrationszentrum für

Faserverbundwerkstoffe

Institut für Werkzeugmaschinen und

Fertigungstechnik der TU Berlin

ADDRESS: Pascalstraße 8/9

10587 Berlin

PHONE: 030-3140

FACSIMILE: 030-3911037

INSTITUTE: WOP-Zentrum Berlin

FhG-IPK

ADDRESS: Pascalstraße 8-9

10587 Berlin

PHONE: 030/39006-121

FACSIMILE: 030-3911037

INSTITUTE: Transferstelle für regenerative Energiesysteme,
neue Werkstoffe und neue Verfahren
an der FH Rheinland Pfalz, Abt. Bingen

ADDRESS: Rochusallee 4
55411 Bingen

PHONE: 06721/409-135

FACSIMILE: 06721/409-129

INSTITUTE: CIM-TT
Ruhr-Universität Bochum
Institut für Produktionssysteme und Prozeßleittechnik

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44780 Bochum

PHONE: 0234/7007096

FACSIMILE: 0234/7094157

INSTITUTE: CIM-TT
Institut für Werkzeugmaschinen und Fertigungstechnik
TU Braunschweig

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38106 Braunschweig

PHONE: 0531/391-7604

FACSIMILE: 0531/391-5842

INSTITUTE: Demonstrationszentrum für
Faserverbundwerkstoffe
DLR
Institut für Strukturmechanik

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38022 Braunschweig-Flughafen

PHONE: 0531/295-2310

FACSIMILE: 0531/295-2838

INSTITUTE: CIM-TT

Universität Bremen

Institut für Betriebstechnik und angew. Arbeitsw.

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28359 Bremen

PHONE: 0421/218-5514

FACSIMILE: 0421/2200979

INSTITUTE: Dienstleistungszentrum Mikrosystemtechnik

FhG-IFAM

Abt. Struktur- und Verbundwerkstoffe

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28719 Bremen (Berg)

PHONE: 0421/63896-41

FACSIMILE: 0421/63896-30

INSTITUTE: Demonstrationszentrum

für Faserverbundwerkstoffe

FhG-IFAM

ADDRESS: Neuer Steindamm 2

28719 Bremen (Berg)

PHONE: 0421/63896-37

FACSIMILE: 0421/63896-30

INSTITUTE: Dienstleistungszentrum Mikrosystemtechnik

Chemnitzer Werkstoffmechanik GmbH

Centrum für Mikromechanik

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09126 Chemnitz

PHONE: 0371/5624-462

FACSIMILE: 0371/5624-463

INSTITUTE: Dienstleistungszentrum Mikrosystemtechnik

Fraunhofer-Einrichtung für Umformtechnik und

Werkzeugmaschinen (IUW)

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09126 Chemnitz

PHONE: +49 (0) 371/5624-401

FACSIMILE: +49 (0) 371/5624-404

INSTITUTE: GFE e. V. Transferzentrum

Produktionstechnik und Mikroelektronik

Außenstelle Chemnitz

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09130 Chemnitz

PHONE: 0371/411954

FACSIMILE: 0371/411959

INSTITUTE: Dienstleistungszentrum Mikrosystemtechnik

Technische Universität Chemnitz

Zentrum für Mikrotechnologien

ADDRESS: Reichenhainer Str. 70

09125 Chemnitz

PHONE: 0371/531-3130

FACSIMILE: 0371/531-3131

INSTITUTE: CIM-TT

Technische Universität Chemnitz

Sektion Fertigungsprozeß und Fertigungsmittel

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09126 Chemnitz-Zwickau

PHONE: 0371/531-8077

FACSIMILE: 0371/531-2221

INSTITUTE: CIM-TT

TH Darmstadt

Institut für Produktionstechnik und Spanende Werkzeugmasch.

ADDRESS: Petersenstraße 30

64287 Darmstadt

PHONE: 06151/16-2156

FACSIMILE: 06151/16-3356

INSTITUTE: CSCW-Labor

FhG-IGD

ADDRESS: Wilhelminenstraße 7

64287 Darmstadt

PHONE: 06151/155-213

FACSIMILE: 06151/155-199

INSTITUTE: Demonstrations- und Schulungszentrum

für Computeranimation und Design

FhG-IGD

ADDRESS: Wilhelminenstraße 7

64283 Darmstadt

PHONE: 06151/155-132

FACSIMILE: 06151/155-199

INSTITUTE: Demonstrationszentrum Virtuelle Realität

FhG-IGD

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64283 Darmstadt

PHONE: 06151/155-124

FACSIMILE: 06151/155-199

INSTITUTE: HD und SHD Demonstrationszentrum

FhG-IGD

ADDRESS: Wilhelminenstraße 7

64283 Darmstadt

PHONE: 06151/155-132

FACSIMILE: 06151/155-199

INSTITUTE: Demonstrationszentrum für

Faserverbundwerkstoffe

FhG-LBF

ADDRESS: Bartningstraße 47

64289 Darmstadt-Kranichstein

PHONE: 06151/705-262

FACSIMILE: 06151/705-214

INSTITUTE: CIM-TT

Institutsverbund

Universität Dortmund

ADDRESS: Postfach 50 05 00

44221 Dortmund

PHONE: 0231/7551

FACSIMILE:

INSTITUTE: Demonstrationszentrum Materialfluß

und Logistik MATLOG

FhG-IML

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44227 Dortmund

PHONE: 0231/9743-219

FACSIMILE: 0231/9743-211

INSTITUTE: Fuzzy Demonstrations Zentrum

im Informatik Centrum Dortmund e.V.

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44227 Dortmund

PHONE: 0231/9700920

FACSIMILE: 0231/9700929

INSTITUTE: CIM-TT

Technische Universität Dresden

Institutsverbund Fertigungstechnik und Werkzeugmaschinen

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01069 Dresden

PHONE: 0351/4630

FACSIMILE: 0351/4710294

INSTITUTE: Dienstleistungszentrum Mikrosystemtechnik

Technische Universität Dresden

Institut für Halbleiter- und Mikrosystemtechnik

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01062 Dresden

PHONE: 0351/463-5161

FACSIMILE: 0351/463-7172

INSTITUTE: Dienstleistungszentrum Mikrosystemtechnik

CIS Institut für Mikrosensorik e. V.

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99097 Erfurt

PHONE: 0361/420510

FACSIMILE: 0361/4205113

INSTITUTE: Dienstleistungszentrum Mikrosystemtechnik

MST Gaswarnsystem GmbH

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99099 Erfurt

PHONE:

FACSIMILE:

INSTITUTE: Dienstleistungszentrum Mikrosystemtechnik

Applikations- und Demonstrationszentrum

Mikrotechnik

FhG-IIS-B

ADDRESS: Artilleriestraße 12

91052 Erlangen

PHONE: 09131/8586-42

FACSIMILE:

INSTITUTE: BLZ Bayerisches Laserzentrum gGmbH

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91058 Erlangen

PHONE: 09131/85-8326

FACSIMILE: 09131/85-8328

INSTITUTE: CIM-TT

Lehrstuhl Fertigungsautomatisierung / Produktionssystematik

Universität Erlangen-Nürnberg

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91058 Erlangen

PHONE: 09131/85-7713

FACSIMILE: 09131/302528

INSTITUTE: Dienstleistungszentrum Mikrosystemtechnik

Demonstrationszentrum für

IC-Anwendungen (DIA)

FhG-IIS

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91058 Erlangen

PHONE: 09131/776-777

FACSIMILE: 09131/776-499

INSTITUTE: Demonstrationszentrum für

Faserverbundwerkstoffe

Universität Erlangen

Institut für Fertigungstechnik/Kunststoffe

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91058 Erlangen

PHONE: 09131/859700

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91058 Erlangen

PHONE: 09131/858693

FACSIMILE: 09131/858699

INSTITUTE: Dienstleistungszentrum Mikrosystemtechnik

Universität Erlangen-Nürnberg

Lehrstuhl für Strömungsmechanik

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91058 Erlangen

PHONE: 09131/859501

FACSIMILE: 09131/859503

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Lehrstuhl für Angewandte Optik

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91058 Erlangen

PHONE: 09131/858372

FACSIMILE: 09131/13508

INSTITUTE: Zentrum für angewandte Mikroelektronik und

neue Technologien der Bayerischen Fachhochschulen (ZAM)

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91058 Erlangen-Tennenlohe

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24941 Flensburg

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INSTITUTE: Demonstrationszentrum für

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79110 Freiburg

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INSTITUTE: CIM-TT

Technische Universität Hamburg-Harburg

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21071 Hamburg

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FACSIMILE: 040/7718-2500

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30419 Hannover

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30159 Hannover

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Technische Universität Ilmenau

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INSTITUTE: Dienstleistungszentrum Mikrosystemtechnik

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PHONE: 03641/657640

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07743 Jena

PHONE: 03641/30230

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INSTITUTE: CIM-TT / CIM-Centrum Kaiserslautern (CCK)

Centrum für Produktionstechnik

Universität Kaiserslautern

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67653 Kaiserslautern

PHONE: 0631/205-4285

FACSIMILE: 0631/205-3304

INSTITUTE: CAD/CAM Labor

Kernforschungszentrum Karlsruhe GmbH

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76131 Karlsruhe

PHONE: 0721/6623-14

FACSIMILE: 0721/6623-25

INSTITUTE: CIM-TT

Institut für Werkzeugmaschinen und Betriebstechnik

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INSTITUTE: Dienstleistungszentrum Mikrosystemtechnik

Forschungszentrum Informatik (FZI)

an der Universität Karlsruhe

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76131 Karlsruhe

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FACSIMILE: 0721/965409

INSTITUTE: CIM-TT

Fachhochschule Kiel

Institut für Produktionstechnik

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24149 Kiel

PHONE: 0431/2000-23

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INSTITUTE: CIM-TT

Technische Universität "Otto von Guericke"

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39016 Magdeburg

PHONE: 0391/55920

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INSTITUTE: Dienstleistungszentrum Mikrosystemtechnik

Otto-von-Guericke-Universität Magdeburg

Institut für Maschinen- und Antriebstechnik

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39016 Magdeburg

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INSTITUTE: Dienstleistungszentrum Mikrosystemtechnik

FhG-IFT

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80686 München

PHONE: 089/54759-004

FACSIMILE: 089/54759-100

INSTITUTE: Dienstleistungszentrum Mikrosystemtechnik

Centrum für Mikroverbindungstechnik

in der Elektronik GmbH (CEM)

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24536 Neumünster

PHONE: 04321/93780

FACSIMILE: 04321/93780

INSTITUTE: NU-Tech GmbH

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24536 Neumünster

PHONE: 04321/30620

FACSIMILE: 04321/38435

INSTITUTE: Institut für theoretische und

angewandte Informatik e.V.

ADDRESS: Schmiedestraße 13

25899 Niebüll

PHONE: 04661/96960

FACSIMILE: 04661/8085

INSTITUTE: Innovationszentrum Plauen

im GWI Gesellschaft zur Wirtschafts- u. Innovationsförderung

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08525 Plauen

PHONE: 03741/5810

FACSIMILE: 03741/581203

INSTITUTE: CIM-TT

Universität des Saarlandes

Institut für Wirtschaftsinformatik

ADDRESS: Altenkesseler Str. 17

66115 Saarbrücken

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INSTITUTE: Dienstleistungszentrum Mikrosystemtechnik

Universität des Saarlandes

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70569 Stuttgart

PHONE: 0711/970-1247

FACSIMILE: 0711/970-1005

INSTITUTE: Beratungszentrum Informationstechnik (BIT)

FhG-IAO

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70569 Stuttgart

PHONE: 0711/970-2143

FACSIMILE: 0711/970-2299

INSTITUTE: CIM-TT

Institutsverbund Fertigungstechnik

Universität Stuttgart

ADDRESS: Holzgartenstr. 17

70174 Stuttgart

PHONE: 0711/121-3866

FACSIMILE: 0711/121-3858

INSTITUTE: Demonstrationslabor Virtuelle Realität

FhG- IPA

ADDRESS: Nobelstraße 12

70569 Stuttgart

PHONE: 0711/970-2090

FACSIMILE: 0711/970-1399

INSTITUTE: Demonstrationslabor Virtuelle Realität

FhG-IAO

ADDRESS: Nobelstr. 12

70569 Stuttgart

PHONE: 0711/970-2087

FACSIMILE: 0711/970-2299

INSTITUTE: Demonstrationszentrum für Faserverbundwerkstoffe

Deutsche Forschungsanstalt für Luft- und Raumfahrt

Institut für Bauweisen und Konstruktionsforschung

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70569 Stuttgart

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INSTITUTE: Informations- und Beratungszentrum

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70569 Stuttgart

PHONE: 0711/970-1759

FACSIMILE: 0711/970-1004

INSTITUTE: Institut für Steuerungstechnik

Universität Stuttgart

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INSTITUTE: WOP-Zentrum

Werkstattorientierte Produktionsunterstützung (WOP)

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INSTITUTE: CIM-TT

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Institut für Präzisionstechnik und Automation

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INSTITUTE: ATZ-EVUS

Applikations- und Technikzentrum für

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FACSIMILE: 09661/6889

INSTITUTE: AWZ Trier

Technologie Transfer Trier GmbH (ttt)

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54290 Trier

PHONE: 0651/82709-0

FACSIMILE: 0651/31003

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Gesellschaft für Mikroelektronik-

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82008 Unterhaching

PHONE: 089/6118282

FACSIMILE: 089/6118477

INSTITUTE: Dienstleistungszentrum Mikrosystemtechnik

Hahn-Schickard-Gesellschaft

Institut für Mikro- und Informationstechnik (IMIT)

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78052 Villingen-Schwenningen

PHONE: 07721/9430

FACSIMILE: 07721/943210

INSTITUTE: Dienstleistungszentrum Mikrosystemtechnik
Institut für Mikrostrukturtechnologie
und Optoelektronik (IMO)

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35578 Wetzlar-Blankenfeld

PHONE: 06441/97880

FACSIMILE: 06441/978817

INSTITUTE: CIM-TT
Technische Hochschule Wismar
Fakultät Maschinenbau

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23966 Wismar

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FACSIMILE: 03841/753383

INSTITUTE: Telekommunikations-Zentrum
der Fachhochschule Rheinland-Pfalz

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67549 Worms

PHONE: 06241/505-210

FACSIMILE: 06241/505-140

INSTITUTE: Anwenderzentrum Beschichtungen (AWZ)
FhG-ISC

ADDRESS: Neunerplatz 2
97082 Würzburg

PHONE: 0931/41909-84

FACSIMILE: 0931/41909-80

INSTITUTE: Demonstrationszentrum für Faserverbundwerkstoffe

Süddeutsches Kunststoffzentrum Würzburg

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97082 Würzburg

PHONE: 0931/4104-142

FACSIMILE: 0931/4104-177

Technology Demonstration and Application Centres in Greece

Country Report in the Framework of the SPRINT EIMS Project 94/71

Center of Financial Studies, Department of Economics

Athens University, Greece

June 1995

CONTENTS

1. INTRODUCTION

Being one of the less favoured regions (LFRs) of the EU, Greece presents all the key characteristics of a country where productive activities are not rapidly adapted to technological change :

- The classical RTD indicators, like GERD, BERD, research employment, patenting, etc. are very low, compared to EU average.
- The rise of technological awareness and the relative importance of R&D, as well as innovation and technology transfer policy in recent years is strongly related to the influence of the EU and in particular the ample funding by the Community Support Framework (CSF) and the opportunities of participation in the Framework Programme and other competitive calls of the Commission of the EU.
- The recent establishment of the components of a national innovation system is very strongly based on public infrastructure and supply side mechanism (with much lower awareness from the side of business firms) of which only a small share reacts to incentives.

The national innovation system being both very recent and strongly supply driven, market mechanisms work inadequately and this explains why demonstration is a rather neglected function in the plans of both the infrastructure and private companies. As there are no technology fairs, or well known demonstration activities, nor any public schemes that support such a function, it was necessary to approach all technology infrastructure institutions, in two stages, in order to decide on the most suitable population to address :

- *First* contact by phone all institutions (as presented in Appendix 1) that could theoretically have demonstration activities, as defined for the purposes of this study, i.e. sectoral research associations, the major research centres, technology parks, BICs and public utilities ; all these institutions and policy makers were asked to point out whether they knew of other institutions or private firms that are active in technology demonstrations and applications.
- *Then* visit those which replied that demonstration is part of their activity (presented with bold letters in Appendix 1). Although it was obvious from the beginning that most of them would not have a dedicated centre and budget, at least they considered technology demonstration as one of their functions.

The very small size of the total population, double-checked with interviews with policy makers in order to make sure that there were no relevant activities escaping our investigation, led to the decision not to use a postal questionnaire, for institutions which on the phone explained that they had no demonstration activities as defined from the angle of the present study, but to proceed with interviews with the total population of what should be called "*ad hoc technology demonstration*", rather than "technology demonstration centres". In this way, the Greek report is based on interviews only, and no written survey.

These interviews were used to fill up the standardised questionnaire, prepared by Centrale Management, but were also partly conducted as a free discussion, in order to identify the particularities of the Greek case. The results of these interviews are presented in Chapter 3 as far as quantifiable aspects are concerned. The full description of the relevant institutions as well as qualitative themes and the results of interviews with policy makers are presented separately in Chapter 4. The final Chapter is dedicated to conclusions referring to the key issues in Greece, together with the possibility of some methodological generalisations and recommendations for future EU policies on the particular subject.

2. TECHNOLOGY TRANSFER ACTIVITIES IN THE COUNTRY

Greece, as one of the less favoured regions (LFRs) suffers not only from a considerably below EU average GDP per capita, macroeconomic unbalances and persistently low growth rates, but also from major structural problems related to the relative weight and organisation of manufacturing activities. Industry contributes only by 27.2% to employment, compared to 32.5% EU average, and it is composed in its overwhelming majority by very small SMEs (the share of companies with 1-9 employees is twice as high as in Ireland, and considerably higher than in Portugal) active in traditional sectors, in particular textiles, food production, wood processing and metal production. A few large, successful native companies perform well in specific areas (such as food processing, telecommunications, plastics, mineral processing) but without any tendencies to cluster formation or inter-company alliances.

In this environment, technology could not be demand driven and as a response the state has introduced several initiatives to promote a supply push model, based initially more on R&D and less on innovation and technology transfer policies. The latter have only started in the late '80s, and may be described as following an empirical, ad hoc model, rather than long term policies based on government resolutions or white papers. The overall situation of technology transfer may be described as follows.

The main actors for technology transfer were expected to be the sectoral research associations, initiated by the state in the late '80s. In particular the General Secretariat for Research and Technology (GSRT) has formed 5 research associations, in metal processing, marine technologies, ceramics and refractories, textiles and food. While the GSRT was the major shareholder with a right to nominate the board, the target was to involve as many industries as possible. Although all five research associations are active, major political uncertainty (frequent change of the board and managers, absence of a clear, long term framework of operation, etc.) has prevented them from spectacular results, though their degree of success varies substantially. In particular the transfer of some of them under the umbrella of HEIs has diminished their technology transfer mission in favour of pre-competitive research activities.

A number of sectoral associations were promoted by the Organisation of SMEs (EOMMEX) with the same philosophy as that of the GSRT, but in sectors where a large number of very small companies are active, such as shoe and leather industries, clothing, jewellery, wood, furniture etc.. From a considerable number of initiatives only the shoe and leather association is still active and can demonstrate some successful activities, the rest have either been dissolved, or are in a pending status, after a very long period of uncertainty.

In order to link research activities and transfer their know how to their environment, four research institutions in the country have proceeded with the creation of technology parks. While the parks are already operational they are at very initial stages and have a very small number of projects and demonstration with worthy results. In fact, only one ad hoc demonstration was identified in all four parks contacted.

As the demand-led philosophy was maturing in the national authorities, many research centres started a modest scope of technology transfer efforts. In most cases this effort was connected to the need of new institutional set ups (ideas about industrial liaison offices, BICs etc.), which more often than not did not materialise.

In the early '80s, public utilities and public procurement in general were expected to play an active role for technology transfer in the sense that they demanded the creation of consortia between foreign and local companies. The primary aim was to execute public works, but with a secondary target of supporting the local actors in adapting to technological change. Partly because of EU rules, and partly because of a lack of capabilities, this policy was abandoned, but utilities continue to be important sources of technology which are transfered to local actors under several modes (e.g. suppliers' quality control, marketing to wider circles of users etc.).

Technology transfer is directly promoted by the state through grants offered directly to companies for innovation and technology transfer (PAVE-2), and also through open calls in priority areas (materials, microelectronics etc.) to HEI-industry consortia. A first pilot of this kind was attempted through the Greek STRIDE, and its success has led to its replication, with a much higher budget under the new CSF (EPET II).

In a broad sense technology transfer activities are institutionally and financially based. Demonstration activities could not be identified as a major function in any of the institutions approached, and policy makers consider the demonstration activities as part of the plans of each unit, which are not entitled to a specific support by the state.

The second CSF, which includes an action line (Sub-programme 2) specifically dedicated to industrial research, technology transfer and innovation, foresees the following actions for the future :

- The major target of Sub-programme 2 is the enhancement of technology transfer mechanisms (e.g. purchase of licensing and know-how, technical assistance, implementation of demonstration programmes and participation in specific actions of intra-community technology transfer, as well as the creation of new structures which will facilitate the efficient adoption of new technologies by the companies.

- The sub-programme will support electronic networking and other tools of promotion of technical information and dissemination.

- Within the same framework, support is foreseen for consulting and technological services to industry.

As yet there are no new elements at the programme implementation phase, and only the traditional PAVE programmes are launched under Sub-programme 2.

3. SURVEY RESULTS

A first remark, before describing the survey results, is that there was only one technology demonstration centre identified in Greece, which would fully conform with the definition of a TDAC, as suggested by CM. In all other cases some demonstration activities are part of the operations of the technology transfer agents, but with no separate institution, no business plan, nor even a clearly defined budget for the demonstration activities. For this reason, in many cases the remarks about quantitative data needs to be interpreted more carefully, as compared to member states, where the demonstration activities have a more formalised nature.

Finally, it should be noted that all activities identified are in the public sector. Private companies have demonstration activities, in the classical sense of marketing, but not alternative technology demonstrations of the operability, competitiveness and specific applications of new technologies. Some of the companies contacted (in particular companies whose sales are a package of product, service and installation) have undertaken projects which they like to demonstrate to new potential clients, through site visits to the premises of previous clients (in particular in the area of environmental protection, industrial gases, automation and robotics), but this was not considered as an organised demonstration activity, but as an ad hoc, customer specific demonstration, if required.

Nine questionnaires were filled in and are analysed in the present report. Five of them regard public laboratories, three industrial associations and one was a subsidiary of a public utility. Their *regional distribution* presents the highest possible concentration, since all of them were located in the broader area around the capital. In fact not a single demonstration activity was identified in other regions, not even the industrially prosperous zone of Thessaloniki, although specific telephone interviews were undertaken with all potential actors. This may be partly explained by the absence of a potential demand, since productive activities are also concentrated in the Athens area.

Six of the nine centres interviewed consider demonstration of advanced technologies as a very important activity for them, more important than RD and as equally important as information dissemination through seminars and workshops (Table 1). To some extent this priority is in contradiction with the demonstration activities, as it will be described later in this chapter.

Table 1 : Relative importance of demonstration activities, as compared to all activities of the centres interviewed

	Very important	Important	Less important	Not important	Not applicable
Demonstration of advanced technologies	6	1	2	0	0
Research and technological development	2	5	0	0	2
Information seminars and workshops on TT	6	2	0	1	0
Short term consulting	5	2	1	1	0
Assisting firms in technological solutions	2	3	1	0	3
Testing and certification	3	2	0	0	4
Training in the use of new technologies	4	0	4	0	1
Agents for public promotion schemes	2	1	0	2	4
Renting of technological platform by clients	1	1	0	0	7

The technological fields demonstrated present also a certain similarity (Table 2). Although only one of the centres is dedicated to information and telecommunications technologies, more TDACs consider that as a demonstration area which is of major interest to their clients. Environmental technologies and energy are the most important ones, for example, as demonstration is a priority in the Centre for Renewable Energy Sources. An interesting conclusion from the technological fields for demonstration is that traditional activities, which interest the majority of the productive sector in the country are practically absent (e.g. agricultural technologies) and demonstration concentrates in sectors with a small share in the local industry.

Table 2 : Main activities of the centres interviewed

	Very important	Important	Less important	Not important	Not applicable
Electronics, communication and information technologies	3	1	0	0	5
Manufacturing technologies	2	2	0	0	5
Materials	3	2	0	0	4
Environmental technologies	5	2	1	0	1
Energy	4	1	0	0	4
Agricultural technologies	0	1	1	0	7
Chemicals and pharmaceuticals	2	0	0	0	7

Regarding the organisation of the centres and their demonstration activities, most interviewees had difficulties in describing strategies, because there is a very clear element of opportunity in all demonstration projects: if specific clients address them with a demand or if a particular manufacturer asks them to demonstrate a technology on a project basis, they try to react in the best possible way. In that sense two centres considered themselves as "client oriented" rather than technology, application or centre oriented (Table 3). Furthermore, only one centre is a single manufacturer equipment demonstrator, the others use, as opportunities occur or specific events are organised, all means of demonstration available (Table 4).

Table 3 : Centre description

Technology centred	3
Application centred	1
Sector centred	3
Other	2

Table 4 : Means of demonstration activities

Single manufacturer equipment	1
Different manufacturers equipment	6
Physical models	4
Media based presentations	6

Given the ad hoc nature of demonstration activities, the centres could not give a specific budget or personnel number. The institutions interviewed range from a budget of 100 KECU to several thousand KECU and 2 to 80 employees. The demonstration activities are budgeted on a project basis, and the personnel involved is the usual R&D personnel, pursuing demonstration tasks, when necessary. In that sense most centres declared that less than one full-time equivalent man-month per year was dedicated to demonstration activities, which gives an approximate budget of 10-15.000 ECU, to be raised by an estimate of 10-20% for operational requirements. The only demonstration centre responding to the strict definition has an operational budget of 40000 ECU.

Funding for start up mainly came from European sources (CSF plus DG XI, XII and XVII), coupled with national matching funds, with only one case reporting regional funding as well. Equally, an overwhelming majority of operational funding comes from public sources. All institutions interviewed were set up after 1984, most of them though around 1987, and the demonstration activities were first adopted with a time lag of approximately 2 years.

The client basis is mainly composed of SMEs and public organisations. This was to be expected, given the lack of technology orientation and awareness in the country. In all TDACs the majority of clients were SMEs, followed by public organisations in particular local authorities. The telecommunications demonstration centre receives also organised school visits.

Table 5 : Breakdown of clientele by size of companies and type of visitors

Very small	15
Small enterprises	500
Medium enterprises	10
Large enterprises	2
Public organisations	40
Private households	0
Schools	25

The majority of clients are of a regional or national origin. In three cases a low share of international clients was reported, one from several Mediterranean countries and two from Cyprus. In one case contacts with India were reported as well.

It was a rather astonishing feature to find out that for this very limited organisation of demonstration activities, all means are used to a large extent. It may well be interpreted as a way of ad hoc coverage of needs, since there is no specified strategy on how to market demonstration activities, and most interviewees gave almost all well known means a high weighting of use :

Table 6 : Means of promotion of TDAC services

Publications in relevant journals	5	2	1	0	1
Advertising in relevant media	3	2	1	0	3
Conferences, fairs	6	2	0	0	1
Direct mailing	3	2	0	0	4

Bottlenecks were given low consideration. In fact all interviewees agreed that there is no strategy development for demonstration activities and the volunteer-element within them makes it impossible to have coherent future plans. Nevertheless only five of the institutions interviewed considered it as the most important bottleneck because for the others, the lack of strategy is not a result of insufficient management but an element related to strong deficiencies in the overall technology market, reflected in the inability to attract new clients or to assess demand (Table 7). This rather pessimistic view is the reason behind the absence of intensified demonstration activities.

<u>Table 7</u> : Bottlenecks and strengths affecting the TDAC centres in the coming years

Recruitment of qualified staff	1
Financing personnel	3
Financing demonstration equipment and facilities	4
Development of services complementing demonstration	4
Strategy development	5
Attracting new clients	2
Assessment of demand	2

At the same time most of the institutions declared very ambitious targets for the future, but they were more related to the expectations for an overall growth of their institution and the new CSF (which offers important financial opportunities) than to demonstration activities in the narrow sense.

4. DESCRIPTION AND EVOLUTION OF TDACS

The quantitative results presented in Chapter 3 indicate that a very low share of demonstration activities can be found in Greece. In terms of institutional descriptions, the differentiation of the evolution can be identified as follows :

- Only one public utility has implemented the idea of an autonomous TDAC in telecommunications and information technologies. While this centre started in a promising environment, excellent premises and a sufficient budget, it very rapidly diminished its activities and it has hardly any visits now, except those organised by schools. The public power corporation who often introduces new technologies, in particular in soft forms of energy that interest local authorities (in particular generation of aeolian energy), has no organised demonstration and its policy is that *anyone who is interested may come and see us and will accompany them to an existing site.*

- The three research associations which have demonstration activities combine them very strongly with seminars and workshops, the latter being the real target and demonstration being rather an accompanying measure. It is astonishing that not all research associations in the country have proceeded with at least some kind of demonstration for their clients.

- The case of research institutions is more diversified. In fact three research centres, in biomass, electric cars and photovoltaics, believe that demonstration will allow them to increase their clientele and improve their performance in targeting applied research of interest to the local community, through feed-back mechanisms. One example is the Greek Solar Village, a bilateral German-Greek research project on solar energy for housing has kept one of the apartments constructed empty in order to use it for demonstration purposes.

More precisely :

The only TDAC, which totally meets the definition of the study is a demonstration centre established by the **Organisation for Telecommunications (OTE)** in the port of Piraeus. The idea was to offer users a friendly way to see how they could use new telecommunication technologies, the target population being businesses and, in particular, the Greek shipping industry, from where the idea to locate the centre in the port area came.

The project, financed as a STAR action, started ambitiously in 1992 with the target of organising seminars and workshops, creating dedicated groups and disseminating new technologies, in particular through the demonstration of fax, packet switching, ISDN and Hellastel (the Greek minitel). It was a technology centred institution, using the same equipment as OTE itself, i.e. systems from a variety of manufacturers. The original budget of 100000 ECU is decreasing constantly, because the operation has very rapidly run out of steam and two employees hired for demonstration purposes are the only current expenditure. About 20 SMEs visited the installations in 1994, mainly from the tertiary sector and, in particular, maritime services. The existence of the centre is further justified by a few school visits.

The main reason of failure is related to internal organisational problems of the OTE, which had to undergo several restructuring processes, partly for political reasons and partly in view of privatisation. Thus there is no strategy development and no plans for the future.

Clothing, Textile and Fibre Technological Developments (CLOTEFI) is a research association founded by the GSRT in 1986, with the aim of becoming the prime technology and research centre, providing support to the companies in the textile and clothing industry. It operates in four divisions :

- *Quality*, for testing, analysis, certification and quality control.
- *Research, Development and Technology Transfer,* for new product development, productivity increase and quality improvement.
- *Assistance* to companies with technology, marketing, finance and organisation.
- *Training* in new technologies, symposia, seminars, workshops and meetings with experts.

In this context CLOTEFI participates in many EU programmes, like SPRINT, COMETT, FORCE, EUROFORM, and national programs co-financed by the Greek CSF.

As can be seen from its organisation, CLOTEFI does not have a separate technological demonstration activity. Nevertheless, demonstration is one of the means used, when it seems appropriate, for either technology transfer or for training purposes. In that sense all 20 employees who are the technical staff, out of a total of 25, carry out technology demonstration activities occasionally.

Demonstrations refer mainly to the use of electronics, communication and information technologies in new vintage equipment, manufacturing techniques and ways to better dispose of environmentally polluting waste. When it is decided to launch demonstration activities this is done either by using the equipment of a single manufacturer or the systems/equipment of different manufacturers. This is not a contradiction, as the decision is taken on a case-by-case basis. Media-based representations are also used.

While this way of proceeding does not allow to keep a separate budget for demonstration activities, it is estimated that they are 70% project funded and 30% core funded. It is further believed that approximately the equivalent of one person in full-time employment works on demonstration activities. The clients range from very small to large enterprises, as far as product improvement is concerned and public organisations, for the improvement of environmental conditions. The overwhelming majority of clients are Greek companies and service providers, and only minor demonstrations were presented to clients from Cyprus. The demonstrations activities, which though ad hoc, are systematically promoted and marketed via publications in relevant journals, advertising in the media and direct mail.

In an overall assessment one may see that CLOTEFI cannot separate the demonstration activities from the rest of its performance. As it sees no specific bottlenecks except finance, the company has ambitious plans for overall growth determined by the expectations of an increased flow of EU funds, and in particular the new CSF.

The **Hellenic Leather Centre (ELKEDE)**, founded in 1985 by EOMMEX, the Organisation for Small and Medium Sized Enterprises is active in six major areas :

- *Quality control*, for the physical and chemical processes of leather and synthetic fibres production, used as input to the shoe industry.
- *Technical support* for tanneries, shoe manufacturing and leather goods, through training and feasibilities.
- *Fashion and design*, through presentations of new collections, consulting, publications and CAD-CAM.
- *Development and technology transfer*, in co-operation with trans-European programmes, RTOs in other member states and workshops on new technologies and production processes.
- *Marketing support*, through collective participation to fairs within and outside Greece.
- *Promotion of studies* for policy purposes, such as sectoral studies, global market research, etc.

Within this scope ELKEDE has established and runs a College of Footwear Manufacturing and Design and a College of Leather Goods. The total budget has reached approximately 1 MECU with 20 technical staff, 10 administrative staff and 20 people used for training purposes (not in full time occupation).

The demonstration activities are seen as a specific action within the training or the technology transfer function and they concentrate on manufacturing technologies (tanning, cutting), materials (modelling) and environmental technologies (tanning). All activities are sector centred and the demonstrations are based on systems/equipment from different manufacturers and media-based presentations.

There is no separate budget for the demonstrations which address mainly SMEs and, to a limited extent, public organisations for environmental control purposes, but it is believed that this type of activities has remained constant over the last years. The clientele is Greek, with an exception of bilateral contacts with India. TDAC services are systematically promoted by all available means, but the overall financial problems of the centre do not allow for systematic strategy development and services complementing demonstration that would lead to a precise business plan. This may change as high expectations for future growth were expressed.

The Centre of Hellenic Garment (CHG) is the last research association that has declared that it actively pursues demonstration activities. Like ELKEDE the Centre was created by EOMMEX in 1984, but its overall activities are decreasing, so it survives as a marginal institution with 6 full time employees and some associated consultants and a budget just above 100000 ECU. Despite the limited means CHG has branches in Thessaloniki and Patras (in co-operation with the local EOMMEX offices).

Its main services are :

- organisation of fashion seminars,
- promotion of young Greek designers,
- market research and identification of fashion trends,
- technical information promotion,
- individual collections support,
- publications.

Demonstration of advanced technologies was suggested to be one of the major targets, together with information seminars, workshops and short-term consulting aiming at :

- making Greek garment producers aware early enough of the directions of fashion,
- training them in using new fabrics and adopting new styles.

The centre is practically 100% funded by the national budget and the EU, and demonstration activities in particular are 100% covered by EOMMEX, its mother organisation. In that sense the CHG hardly merits the term research association, as there are no company-members. In its ten years of operation the centre claims to have created contacts with about 2500 SMEs, Greek mainly with some expressions of interest from Cyprus. It is suggested that it systematically promotes TDAC services directly via telephone, fax, mailing of information procedures, publications, participation in conferences etc. The reason there are no more organised demonstration activities relates to the absence of financial means, and in the hope of regaining growth in the next three years the CHG believes it will also improve TDAC services.

The **Centre of Renewable Energy Sources (CRES)** is a public research centre, founded in 1987 under the GSRT. Its basic aim is the promotion of the applications of renewable energy sources and rational use of energy. Its mission is to :

- support applied research and development,
- organise, execute and supervise demonstration and pilot programmes,
- materialise commercial applications,
- disseminate technology,
- provide technical services,
- organise training activities,
- create joint ventures,
- participate in the formulation of national policy and planning.

CRES is subdivided in six different institutes and, though demonstration activities were initially conceived as a central function to be supported by the board, they are currently operated by each institute independently. No central strategy was developed as yet, so it was suggested to interview each head of division separately. From the institutes interviewed three offer TDAC services, with different target groups, as they are described below.

The **Division for Biomass** has three major technologies, which it demonstrates: teleheating, biomass heating for greenhouse and production of fertilisers from biomass. In all three cases the Biomass Division has acquired the necessary know how, often in co-operation with other research centres and has established the first pilots, which are also used for demonstration purposes. In that sense it is one of the rare cases where demonstration is really a priority and physical models of technical systems are systematically used to prove the feasibility of the technology. The activity is project funded, and though there is no separate budget, it is clear that the time dedicated to demonstration is constantly growing since 1990, when such activities first started (three years after the establishment of the division in 1987). Clients are medium sized enterprises in the primary sector (for the green house applications), public organisations and in particular regional authorities interested in recycling biomass for heating and conversion purposes. TDAC services are systematically promoted via participation in fairs and conferences, direct mailing but also to a large extent through a combination of training and demonstration to employees of the regional authorities.

While the Division of Biomass is a successful undertaking, and it expects to grow further in the future, since a critical mass of projects has by now contributed to an excellent reputation in the market, a major bottleneck for TDAC services is seen in the absence of strategy development, not only within CRES, but mainly arising from the very weak organisational structure of local authorities. Other important bottlenecks are the difficulties in assessing demand and attracting new clients.

The **Division of Solar Energy** emphasises demonstration activities as well, though in a different way. In this case the potential clientele is very high, as solar energy applications address households as well as public utilities. However, the market is very volatile, depending on the evolution of oil prices, a factor totally exogenous to solar research.

The personnel of the division is highly aware of the need for promoting demonstration as one of their main tasks, but financial and strategy constraints do not allow them to proceed full scale and they are obliged to remain on an ad hoc basis. The time dedicated to demonstration is not recognised as part of research activities and as such it is practically offered on a volunteer-basis.

The main technologies demonstrated range from photovoltaics for home appliances (solar refrigerator, smart houses), bigger systems to be incorporated in regional/national networks (desalination, 25 KW energy stations) and electric cars. The most important means to promote TDAC services is through participation to fairs and conferences, but as there is also a lot of demand by individuals addressing the division, almost one third of the time of the 6 technical employees is devoted to demonstration. As a result a proposal was made to the board to support a permanent exhibition activity, but it has not been followed up as yet. This is expected to create a demonstration culture which currently is a general barrier for the function in Greece (e.g. the absence of a demonstration culture has led to a theft of demonstration equipment at an earlier stage).

The **Wind Energy Division** has a demonstration centre near Athens, covering an area of 70000 sq, metres, initially financed by VALOREN and producing energy which it sells to the Public Power Corporation. The Centre's main objective is to demonstrate the Wind Energy Technology involved in order to encourage the participation of the Greek manufacturing sector. It is within its immediate plans to install a small size Wind Energy Converter demonstrating the behaviour of wind and how it can be utilised.

The centre is only two years old, and it is visited mostly by schools, but it is envisaged, through appropriate advertising to increase its appeal to the general public. As yet the means used are via physical tools and media representations, but this may improve, in particular for attracting companies and public organisations form the Balkan countries. The lack of strategy development is the single most important bottleneck.

The **Science Park of Attica** is an independent company promoting the science park created by the biggest national research centre, Dimokritos. The Park became operational in 1993 with the first tenants being small new technology based firms, and immediately decided to adopt demonstration activities as a means of both increasing the park image and supporting sales of tenants. Nevertheless, as the park is still very small, with one manager (who is also a researcher in Demokritos), one technical employee, two administrative staff, and very few small companies in it, there was only one practical case where demonstration activities were applied ; a multi-purpose drier for agricultural products.

In areas more important for the park, such as information and communication technologies, materials and environment/energy, no systematic demonstration activities have taken place. In that sense, the TDAC service may be described as *opportunity centred,* as opposed to sector or application driven, and such opportunities are expected to be initiated by client demands (the client of the park being a tenant or a potential buyer from the private or public sector).

Thus, TDAC services are not systematically promoted, but the interview was of some value, as it demonstrated the possibility of opportunity centred demonstrations in science parks, which the other parks in the country are not yet envisaging.

Equally the **Solar Village**, a joint technology demonstration project resulting from a bi-lateral Greek-German research co-operation, is an activity which does not totally conform to the definition of TDACs, but is an interesting case study.

The solar village project is a housing complex, co-financed by the GSRT, the German Ministry for Research and Technology and the Greek Workers Housing Organisation. A co-operation agreement was signed in 1981 and construction was completed in 1988. In a site area of 90440 sq. meters 435 flats were constructed, covering a total building area of 47798 sq. meters. The idea was to test solar architecture and rationalisation of energy applications, designing the space in such a way that it is well protected by winds and allows best conservation of energy. The active systems of the village supply energy for solar heating and domestic hot water. They include a conventional part, and a non-conventional part delivering energy either from solar radiation (vacuum and flat plate collectors, air collectors etc.) or environmental energy through heat pumps.

Although the initial idea was to use the project for testing the technologies and studying social parameters related to the inhabitants' attitudes towards the energy systems, with the aim to reproduce the experiment, the decreasing oil prices have diminished the importance of the project, and no demonstration activities were actively organised. An apartment is kept open to the public for ad hoc demonstration purposes, but the most frequent visitors are schools or scientists, not potential clients.

5. CONCLUSIONS AND RECOMMENDATIONS

Market conditions and work practice in the technology infrastructure institutions and companies in Greece have not created a favourable climate for the creation of technology demonstration and application centres. In that sense identifying demonstration activities within technology or other organisations has been a problem. It could almost be described as a vicious circle : **technology demonstration activities are not offered, because there is no demand, while at the same time demand does not increase, as long as their is no coherent marketing of technology applications.**

In the relevant cases studied, it became evident that demonstration activities in the country are strongly interrelated with the other technology transfer functions of each institution and in that sense it is almost impossible to separate them from their overall performance. No dedicated structures, budget or personnel were identifiable, which leads to the assumption that **technology demonstration in Greece is characterised by an element of voluntarism and fragmentation**, based on ad hoc efforts or pressures rather than on strategies and concrete expectations. The ample funding opportunities created for technology transfer in recent years relative to the past, have resulted in substantial changes in other domains but not in this one. It is suggested to call this way of proceeding **opportunity centred demonstration** (as opposed to application or sector driven) and check to what extent this is an extensive practice in other LFRs as well. There is an element of amateurism which can be associated to that, while at the same time it cannot be denied that some individual efforts were remarkable. This is totally compatible with the conclusions of earlier evaluation studies in LFRs, which suggest that a disproportionately high effort is dedicated to the hard as compared to the soft elements of technology policy.

Under these circumstances no judgement can be made on the performance and management of the TDACs, as no precise indications are possible as to the budget and personnel dedicated to demonstration. But in general three remarks seem valid :

1. There are no public incentives for TDACs and the market has not reacted by itself to such a need. The state believes that demonstration activities are part of the operation of each institution, which should be free to decide whether and how to practice it, while central administrations delegate this decision to research units, without endowing them with specific means for demonstration activities. Thus, demonstration scores better as a declared priority than what actual figures suggest.

2. There is a vicious circle between the absence of clients and the absence of activities. Institutions expect demand in order to organise demonstrations, while clients expect high quality demonstrations in order to react. In that sense one can say that there is no demonstration culture in the country.

3. The identified demonstration activities, all started less than ten years ago, do not suggest any growth, but rather stagnation or a shrinking volume. While there are a lot of hopes for overall future growth of technology transfer, related to new funding opportunities from the second CSF, there are no concrete intentions or business plans on how to activate demonstration.

Given this situation, it is suggested that the GSRT surveys the situation and offers some policy guidelines in that direction to the centres it supervises. Ambitious targets would lead to the identification of activities that could address particular clienteles and further attract the Mediterranean countries and Cyprus. Nevertheless, it seems that the overall situation of the market in Greece does not at the moment permit serious technology demonstration activities with high expectations and one should avoid giving too high incentives for activities where no best practices can be identified in the country.

APPENDIX I : LIST OF INSTITUTIONS CONTACTED

(in bold : institutions visited and questionnaires completed)

1. METALLURGICAL INDUSTRIAL RESEARCH AND TECHNOLOGICAL DEVELOPMENT CENTRE S.A. (M.I.R.TE.C. S.A.)
   A' Industrial Area of Volos
   Volos 385 00
   Tel. 0421-95340, Fax: 95361
   Responsible person : Mr. Sp. Platias

2. MARINE TECHNOLOGY DEVELOPMENT COMPANY S.A. (MAR.TE.DE.C. S.A.)
   16, 2nd Merarchia
   Piraeus 18535
   Tel. 4526561-2
   Responsible person : Mr. Stolakis

3. CERAMICS AND REFRACTORIES TECHNOLOGICAL DEVELOPMENT COMPANY (CE.RE.CO. S.A.)
   72nd km National Road Athens-Lamia
   P.B. 146
   Tel. 0262-71226, 71811-15
   Responsible person : Mr. Spyros Dontas

4. FOOD INDUSTRIAL RESEARCH AND TECHNOLOGICAL DEVELOPMENT COMPANY S.A. (F.I.R.T.E.C. S.A.)
   7, Nymfeon str.
   Athens 115 28
   Tel. 7750097
   Responsible person : Ms Petrocheilou

5. **CLOTHING TEXTILE AND FIBER TECHNOLOGICAL DEVELOPMENT COMPANY S.A. (CLO.TE.FI. S.A.)**
   4, El. Venizelou str.
   Kallithea 176 76
   Tel. 9234932, Fax 9235603
   Responsible person : Ms. Manolaki

6. **SOLAR VILLAGE**
   1, Iliou str.
   Pefki 151 21
   Tel. 8055351-2
   Responsible person : Mr. Kosteas & Mr. Paradeisadis

7. **CENTRE FOR RENEWABLE ENERGY SOURCES (C.R.E.S.)**
   19th km Athens-Marathon Ave.
   Pikermi
   Athens 190 09
   Tel. 6039900, Fax 6039904
   Responsible person : Ms Mitsa Edge

8. ORGANISATION FOR PROMOTION OF ENERGY TECHNOLOGIES (O.P.E.T.)
19th km Athens-Marathon Ave.
Pikermi
Athens 190 09
Tel. 6039900, Fax 6039904
Responsible person : Ms Mitsa Edge

9. HELLENIC WIND ENERGY ASSOCIATION (H.W.E.A.)
19th km Athens-Marathon Ave.
Pikermi
Athens 190 09
Tel. 6039900, Fax 6039904
Responsible person : Mr. .Zorlos

10. HELLENIC BIOMASS ENERGY ASSOCIATION (H.B.E.A.)
19th km Athens-Marathon Ave.
Pikermi
Athens 190 09
Tel. 6039900, Fax: 6039904
Responsible person : Ms Mitsa Edge

11. HELLENIC GEOTHERMAL ENERGY ASSOCIATION (H.G.E.A.)
19th km Athens-Marathon Ave.
Pikermi
Athens 190 09
Tel. 6039900, Fax 6039904
Responsible person : Ms Mitsa Edge

12. HELLENIC SOLAR ENERGY ASSOCIATION
19th km Athens-Marathon Ave.
Pikermi
Athens 190 09
Tel. 6039900, Fax 6039904
Responsible person : Ms Mitsa Edge

13. SMALL HYDROELECTRIC ENERGY ASSOCIATION
19th km Athens-Marathon Ave.
Pikermi
Athens 190 09
Tel. 6039900, Fax 6039904
Responsible person : Ms Mitsa Edge

14. PUBLIC POWER CORPORATION (P.P.C.)
10, Navarinou str.
Athens
Responsible person : Mr. P. Ligoropoulos
Tel. 3636240

15. TECHONOLOGY PARK OF ATTIKA
Ag. Paraskevi
Athens
Responsible person : Mr. I. Siotis

16. TECHNOLOGY PARK OF PATRAS
EICHIMITH
Responsible person : Prof.. Verykios

17. TECHNOLOGY PARK OF THESSALONIKI
Responsible person : Prof. Vassalos

18. TECHNOLOGY PARK OF HERAKLION
Responsible person : Mr. Kyriakides

19. **OTE - Demonstration Centre**
Port of Pireus - Ag. Spyridon
Tel. 4280899, Fax 4281999
Responsible person : Mr. Tavoularis

20. GREEK CENTRE OF GARMENT
Tel. 9233048

21. **HELLENIC LEATHER CENTRE**
Tel. 9025595-7
Responsible : Mr Papakonstantinou

22. BUSINESS INNOVATION CENTRE OF ATHENS

23. GREEK FUR CENTRE
Kastoria

24. BUSINESS INNOVATION CENTRE OF PATRAS
Chamber of Industry and Commerce

25. CENTRE OF GREEK PUBLIC UTILITIES
Athens
Tel. 3642544

APPENDIX II : LIST OF ABBREVIATIONS

BERD	Business Expenditure on R&D
BIC	Business Innovation Centre
CLOTEFI	The Greek Research Association for Textile and Clothing
CRES	Centre for Renewable Energy Sources
CSF	Community Support Framework
ELKEDE	Hellenic Leather Centre
EOMMEX	The Greek Organisation for SMEs
EPET	The National Programme for R&D
EU	European Union
GDP	Gross Domestic Product
GERD	Gross Expenditure for R&D
GSRT	General Secretariat for Research and Technology
HEI	Higher Education Institutions
LFRs	Less Favoured Regions
OTE	The Greek PTT
R&D	Research and Development
RTO	Research and Technology Organisations
SME	Small and Medium Sized Enterprises
TDAC	Technology Demonstration and Application Centres

Technology Demonstration and Application Centres in Spain

Country Report in the Framework of the SPRINT EIMS Project 94/71

CM International
Centrale Management
Vélizy - Villacoublay, France

June 1995

CONTENTS

DEFINITION AND DIFFERENCES OF TDACs
Compared to Related Institutions

A « Technology Demonstration and Application Centre » (TDAC) is understood as an institution which mainly offers public or private enterprises demonstrations of new technologies and distributes these services in a systematic marketing approach. In addition to that, it can offer further services such as information about and advice or training on new technologies, testing and certification and so on. In detail, the services offered include the following aspects :

⇨ *Demonstration of New Technologies*
The operability, competitiveness or specific application of new technologies are demonstrated to back up the information and consultation offered. Different media methods may be used for this purpose.

⇨ *Information about New Technologies*
First of all, general information about how the new technology functions and its productivity. In addition, general information about aspects of application such as general prerequisites of implementation, organisation or qualification for using the technology.

⇨ *Advice about New Technologies*
Individual consultation is also offered alongside general information. This may relate to company-specific technical aspects as well as questions of utilisation (e.g. introduction strategies, training,..).

The services offered are generally neutral with regard to technology suppliers, are presented without sales intention and are aimed at public or private enterprises (i.e. private households are not included as a target group). Based on this definition, a TDAC has to be distinguished from institutions with similar aims and services such as :

⇨ *Technology Centres / Science Parks* : These institutions provide young companies developing new technology products and processes with a fully developed infrastructure as well as services and advice. In contrast to a TDAC, this is only offered to companies based within a technology centre.

⇨ *Technology Transfer Centres* : There are many different terms for this kind of institution such as technology transfer, technology advice, innovation advice or interface centre. Their common characteristic is that they all attempt to promote the transfer of information, knowledge and resources from Technological Resources Centres to companies. In contrast to a TDAC, the technology transfer centre does not necessarily have to be connected with the demonstration of systems or processes.

⇨ *Exhibition / Demonstration Centres of Technology Suppliers* : In contrast to a TDAC, these centres present manufacturer-related offers with the aim of selling new technologies.

⇨ *Consumer Advice Centres (e.g. local utilities, energy suppliers)* : In contrast to TDACs, the services offered are aimed primarily at private households.

1. INTRODUCTION

➔ **Objectives of the European Study**

For Public authorities concerned by Technology Transfer policies, one of the crucial and current questions is the following : ***How to enlarge the innovation fabric and how to reach traditional SMEs ?***

This study evolved from the hypothesis that demonstration activities could be an adequate solution to facilitate the diffusion of technologies towards enterprises who, up until now, have not aware of the existence, or the benefits, of such technologies. In this context, four main objectives formed the structure of the analysis :

- ⇨ *Characterise Technology Demonstration and Application Centres (TDACs) in the European Union* : Identifying technological and sectorial fields, status, regional distribution, activities, client base, finance structure, difficulties encountered and major trends.
- ⇨ *Compare TDACs with other types of Demonstration Tools, especially from the SME's point of view* : such as Company Visiting schemes, demonstration investment programmes, supplier commercial activities,..
- ⇨ *Compare existing public policies towards demonstrations.*
- ⇨ *From the lessons learned, identify some key areas for the Commission's policies (DG XIII).*

This study will also contribute to the share of experience / best practices between policy makers and TDAC managers at the European level.

1.1. Information Sources

The principal source of information on the Spanish TDACs came from a work previously commissioned by the Ministry of Industry which lists all the Research and Technolgical Organisations (Technology Transfer, Research & Development,...) in a directory.

➔ **The TDAC Survey**

An elimination process took place during which several centres were eliminated as being irrelevant to the study. The list of centres was supplemented by the managers of the centres contacted who identified other possible TDACs within their network.

TDAC INTERVIEW GUIDELINES

Objective	Topics / Questions
History	● Historic development of the demonstration activities - origin ? - evolution of client needs and anticipation of future client needs ? - investment strategy ?
Presentation of Demonstration Activities	● How important are demonstration activities compared to other services offered by your centre ? Brief description of the other services ● Description of the technology demonstrated. Why is a demonstration stage necessary for this technology? ● What is your definition of a demonstration activity?
Role in Innovation Process	● Role of TDAC in the dynamics of innovation, diffusion and technology transfer at sector and regional level ● Client base targeted ? Original expectations of the client ? ● Do you know of any other forms of demonstration ? ● Synthesis of the added value of a TDAC
Performance of Demonstration Activities	● Are the demands and the specific needs of the target groups (SMEs) met ? ● How successful has the TDAC been in providing innovation services ? ● Major bottlenecks ? What are the solutions envisaged ?
Management of Demonstration Activities	● Presentation of the different stages ● Key success factors ● Is this activity recognised by the institutions which finance you ? ● Any particular difficulties in obtaining financing for investment ? ● Methods to anticipate the future needs in terms of demonstration activities ? ● Methods used to attract potential clients ?
Public Policies	● Your evaluation of the position of TDACs in National technology transfer plans, ● Recommendations that can be given to regional, national and European policy makers ? ● Participation in any national / European TDAC network / Association ?

The large number of technology transfer structures in Spain and the various services they offer made it difficult to identify whether demonstration activities actually formed a principal activity for a centre or if it was just an activity performed in conjunction with another activity. The biggest problem subsequently revolved around the actual definition of "demonstration activity" and the study in fact succeeds in showing that the term evoked different images for different centres.

In total, 37 questionnaires were sent out of which 16 were returned and 15 were then analysed.

➔ The TDAC Interviews

The data from the returned questionnaires were entered into a database, along with the data from the other countries being analysed, and from this a typology of the TDACs was produced. Once all of the TDACs had been slotted into the typology, it was decided to visit some of the centres in order to carry out more in-depth face-to-face interviews to be able to get a better understanding of the centre and its demonstration activities.

Four TDACs were visited in Spain : Asociacion Catalana d'Empresas Constructoras de Moldes y Matrices (ASCAMM) (Barcelona), Asociacion de Investigacion de Optica (AIDO) (Paterna), Institutuo Espanol del Calzado y Conexas (INESCOP) (Elda), Asociacion de Investigacion de las Industrias de la Construcion (AIDICO) (Paterna).

The interviews with the centres were carried out using the guidelines shown in the table opposite.

➔ The Policy Maker Interviews

Similarly, the interviews with the Spanish policy makers were carried out along the guidelines shown in the table over the page.

1.2 Content of the report

Having identified in the first section the methodology followed in this survey and the various difficulties encountered, the second section will briefly cover the Technology Transfer activities in Spain. The third section provides mainly a quantitative presentation of the main results of the questionnaire survey.

The fourth section looks at the results from the interviews : a qualitative presentation and discussion of the field interviews will be given, focusing on the aspects of demonstration activities and using a detailed example of one centre complemented by the input from other interviews.

The fifth and final section contains the conclusions based on the survey.

POLICY MAKER INTERVIEW GUIDELINES

Objective	Topics / Questions
Role of TDAC	• Role of TDACs in public technology and innovation support programmes at sector and regional level, • Rationale for the existence of TDACs
Performance of TDAC	• Success of TDAC in supporting SMEs, • Are there technologies or applications which can be better diffused via TDACs ? • Effectiveness of TDAC activities, • Methodology and criteria used for the assessment of TDAC activities.
Public Policies	• Position of TDAC in National technology transfer systems / programmes, • Other related activities or measures in the area of technology transfer and innovation strategies promoted by the government, • Role of public authorities / sponsors (funding, strategies on technologies, application fields, target groups),, • Links with European policies (implications)..

2. TECHNOLOGY TRANSFER ACTIVITIES IN SPAIN

97% of Spanish companies are SMEs and difficulties have been encountered in the attempts to establish direct contact with a certain number of these companies; a possible solution to this comes in the form of the implementation of various organisms oriented towards technological services for SMEs : information , support and consulting adapted to their needs, etc. The arrival of such centres reinforces the effort made by Spain to develop its R&D expertise

Technology transfer organisms in Spain are of a very diverse nature from the point of view of their size, origin and their areas of expertise. The majority of these centres are recent creations (late 1980s or early 1990s) and in fact demonstration activities became an integral part of the services they offer either in the same year as the start-up or in the following year. Only 2 centres out of those analysed in the survey differed from this trend (because of their early start-up dates) ; the centre ITEB, set up in 1979, launched its demonstration activities in 1987 and the centre LABEIN, set up in 1955, began to offer demonstration activities as early as 1980.

They are founded from both public and private initiatives, Association of Companies, Chambers of Commerce and Industry, universities, etc., and, furthermore, the division of the country into Autonomous Communities means that the TDACs are concerned by the policies and initiatives of their Autonomous Community government.

A policy on innovation exists of which the aim is to favour and encourage the introduction of both process and product innovation, in order to promote a better quality of production and to reinforce the competitiveness of companies. The role of the Ministry of Industry, as national policy maker, has been to rationalise resources on a national scale taking into consideration the fact that the majority of these centres are of a regional origin. Furthermore, it encourages the constitution of networks and promotes co-operation between companies themselves and between companies and the centres.

The two principal types of technology transfer structure in Spain are :

⇨ *Technological Institutes*

Which primarily provide research services (basic and applied research) and technological development with, in addition, tests and access to facilities,

⇨ *Technological Service Centres*

Which engage less in development and innovation activities and more in diffusion activities (diffusion of the technologies, equipment,...).

These two types of centre have either been formed from Associations of Companies within a certain sector or are oriented towards a certain technology.

• ***Demonstration activities are quite new within technology transfer structures in Spain.***

More frequently than not, technological demonstration activities only form a part of the total activities of the technology transfer centre in Spain. These demonstration activities are located within the Technological Service Centres for 2/3 of Spanish TDACs and tend to be related to rupture innovations or technologies in industry (which render existing innovations or technologies obsolete).

However, the term rupture technology does not have the same meaning for traditional Spanish industry as it possibly does for other less traditional European industries. This is because the "new technology", although it may not be a revolutionising one for the industry as a whole (European or international level), still represents a rupture in the traditional processes / technologies for the small, traditional Spanish enterprise.

3. SURVEY RESULTS

The body of this section is based on the country particularities that have been identified from the results of the Spanish survey, compared to the overall results of the European countries analysed. For more detailed information on the overall results of the survey, please consult the synthesis of the study.

➔ The List of Spanish TDACs

The table on the following page lists the 15 TDAC centres that were analysed in the study and gives their address and area of activity.

➔ Map of Spain showing the locations of the Spanish TDACs identified in the Study

➔ The Organisation, Status and Size of Spanish TDACs

2/3 of the centres (10 out of 15) belong to larger organisations.

- 6 out of 14 centres declared themselves to be an industrial association and a further 6 to be a private or semi-public research institute.

List of the Spanish TDACs analysed

➢INESCOP
⇨ELDA
⇨CAD, prototype, cutting

➢AIDO
⇨PATERNA
⇨CAD, laser, image processing

➢ASCAMM
⇨BARCELONA
⇨Moulds

➢ASINTEC
⇨TOLEDO
⇨CAD, telecoms.

➢INTICAL
⇨VALLADOLID
⇨Demonstration activities in all sectors within the region

➢CTAV
⇨TERRASSA

➢INSTITUT ANDALUZ DE TECNOLOGICA
⇨SEVILLE
⇨Videotext server

➢INSTITUTO TECNOLOGICO DE MATERIALES
⇨ASTURIAS
⇨Materials characterisation - mechanical & thermal properties, microstructure,

➢LABEIN
⇨BILBAO
⇨CAD/CAM/CAE advanced software
⇨TQM - QFD

➢ITEB
⇨POIMA
⇨CAD/CAM, waste treatment

➢AIMEN
⇨VIGO
⇨Foundry, welding, instrumental chemical analysis

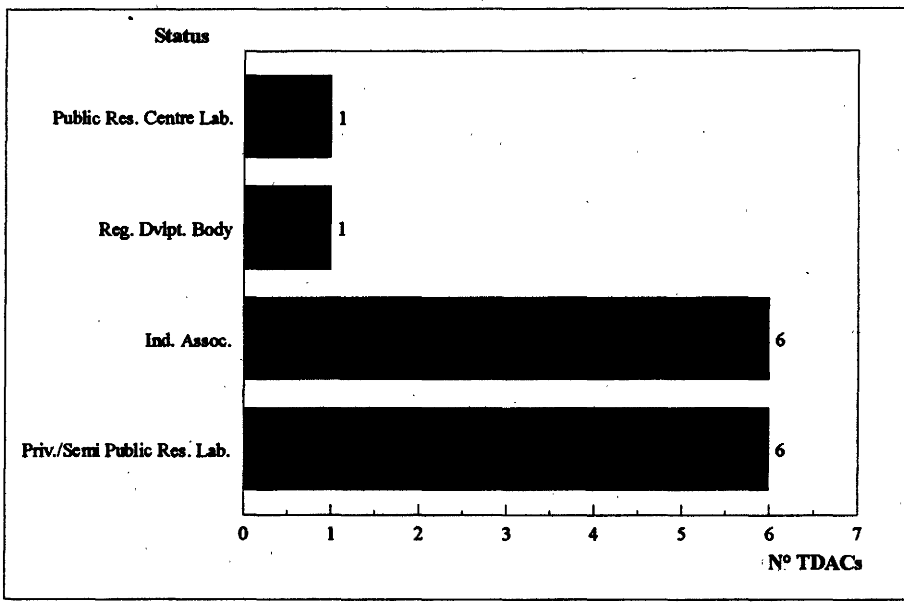
➢AFICEGA
⇨SANTIAGO DE COMPOSTELA
⇨Ceramics

➢INSTITUT DE AUTOMATICA Y FABRICACION
⇨LEON
⇨Image, production, robotics

➢AIDICO
⇨VALENCIA
⇨Design

➢ITER
⇨TENERIFE
⇨ Renewable energies technologies

Status of the Unit



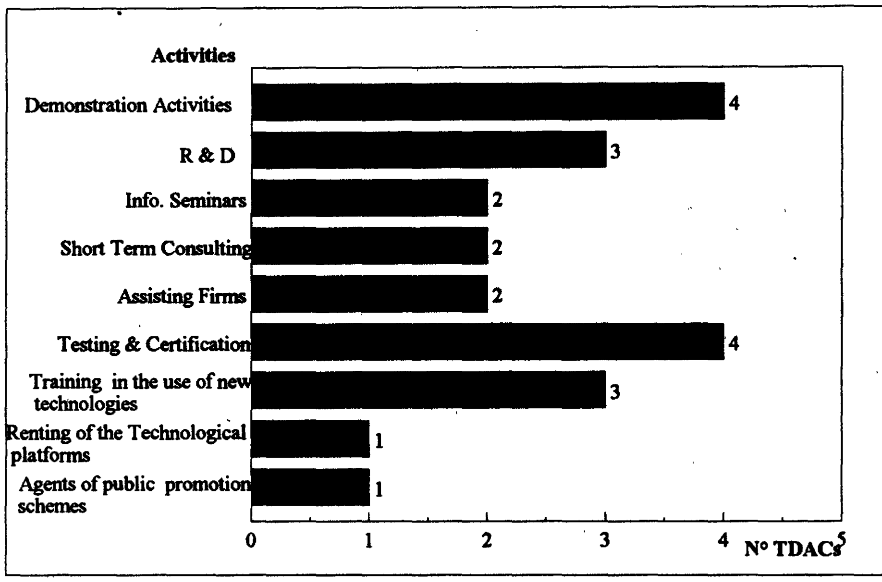
- In general, the Spanish TDACs are of a medium size (employing between 11 and 15 full time employees). Although, 7 centres out of the 15 fall into this category, it must also be stated that 5 centres did declare that they employed over 25 staff.

3.2. Activities of Spanish TDACs

The centres carry out numerous activities other than the demonstration of advanced technologies, although this activity, along with testing and certification, is considered to be very important by 4 of the 15 centres.

Contrary to the other European countries however, the TDACs in Spain do not place such an importance on Research and Development activities. Only 3 out of 15 centres class it as a very important activity (compared to the E.U. average of 57 %).

Activities mentioned as "very important" by Spanish TDACs

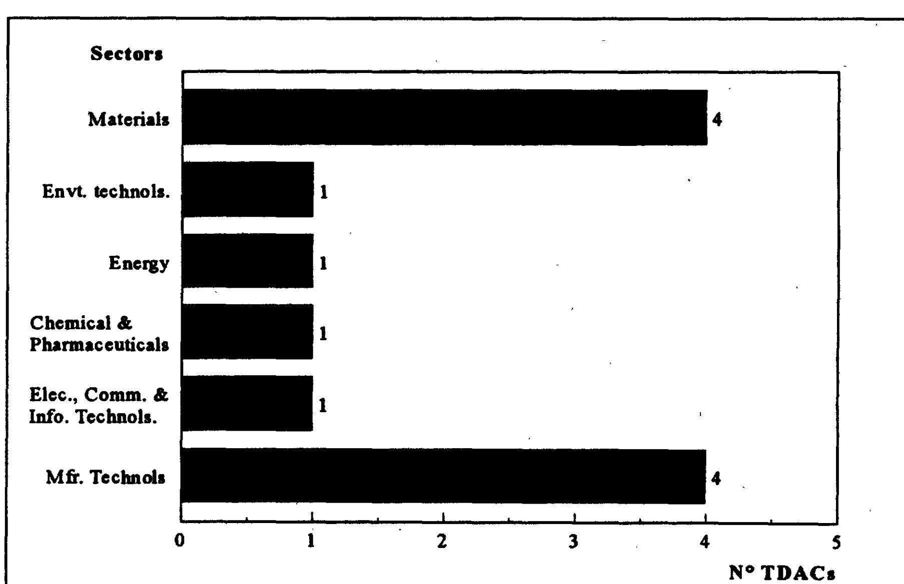


➔ Sectors and Technological Fields : Materials and Manufacturing Technologies

2/3 of Spanish TDACs are involved in either the fields of Manufacturing technologies or Materials.

Compared to the EU global situation, it appears that very few Spanish TDACs are developed in the fields of Electronics, Communication and Information technologies and Environmental Technologies.

Sectors and Technological Fields



➔ Typologies : Spanish TDACs are integration oriented and sector oriented

- The table on the following page describes the various typologies that were identified for the centres in the study.

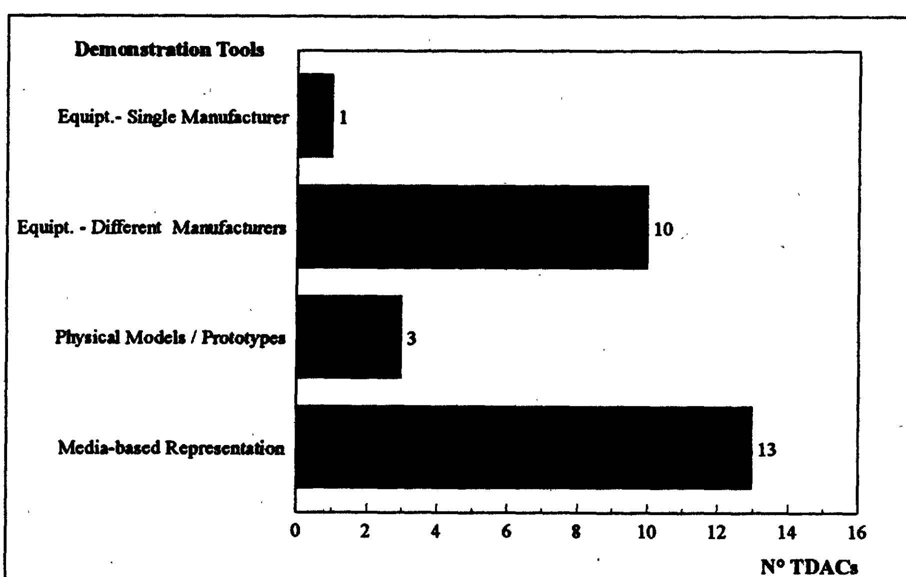
  Looking at the typology based on the associated activities, one Spanish TDAC can be classed as a "Pure Demonstration" centre whilst the majority (9) are "Integration" centres. Only 3 are classed as "Development Oriented" centres which reflects the lack of importance given by the centres towards R&D activities. This leaves 2 centres in the survey which can be classed as "weak definition" TDACs.

- **11 of the 15 Spanish TDACs work with a specific sector (sector oriented)**, such as the shoe sector (INESCOP centre) and only 2 are oriented towards a particular technology. Application oriented centres are fairly rare in Spain, and only 1 centre is oriented as such in the study.

➔ Methods of Demonstration : Media-based representations

In order to demonstrate these advanced technologies, 13 out of 15 Spanish TDACs declare to do so via media-based representations and, different from the EU average, only 3 use the tool of physical models.

Tools used to Demonstrate Advanced Technologies



Definition of the TDAC Typologies

Two main elements have been used to typify TDACs within the European Union :

1) The importance of the demonstration activity for the centre, which differentiates 3 classes :

- **Non TDAC** (15% of the first European sample) - where the demonstration activity is not important. These centres have been kept out of the analysis.

- **Weak definition TDAC** (18% of the first European sample) - where the demonstration activity is not one of the most important activities of the centre.

- **TDAC** (77% of the first European sample) - where the demonstration activity is strategic for the centre (one of the most important areas of activity for them).

2) The nature of the major associated activities within TDACs, excluding Non TDACs and Weak definition TDACs. From this, three new classes emerge:

- **Pure Demonstration Centres** (4% of European TDACs) - where demonstration is the only activity of the centre.

- **Integration Centres** (35% of European TDACs) - these centres are oriented towards helping the SME integrate new technologies (technical assistance, testing, training,..).

- **Development Centres** (57% of European TDACs) - these centres are oriented towards developing / adapting a new technology for the particularities of a particular industrial sector (R&D in particular)..

Typology of Spanish TDACs

Weak Definition Centres	**TDACs**		
	Pure Demo.	**Integration Centre**	**Development Centre**
ICT	ASINTEC	INESCOP	ITM
AIDICO		AIDO	LABEIN
		ASCAMM	AIMEN
		INTICAL	
		ITEB	
		AFICEGA	
		ITER	
		CTAV	
		Institut de Automatica y Fabricacion	

➔ Diffusion / Promotion Channels : Mailings and Conferences

In Spain, 11 of the TDACs systematically promote their TDAC services. **8 out of 13 centres regularly use the channel of mailings**, and 6 regularly participate at conferences/fairs. However, unlike a lot of the other European centres, Spanish TDACs do not use as much the promotion channel of placing publications in relevant journals. Only 3 out of the 13 regularly use this method compared to an E.U. average of 51 %.

3.3. Finance Structure

➔ Initial Investment : Strong regional links

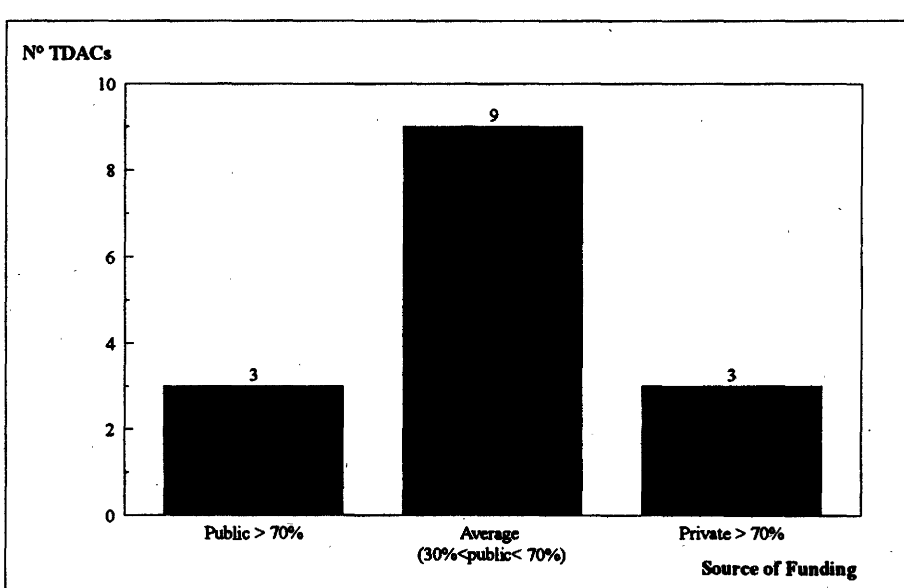
14 out of the 15 Spanish TDACs declared that, to some extent, the initial investment in their centre was financed by Public Regional Funding. This level is vastly superior to the E.U. average but it is not entirely surprising due to the strong power of the regions in Spain.

They did not benefit from the other sources of public funding quite to the same extent. Although 9 centres said their initial investment was financed by Public National funding, only 5 said the same of European Public funding.

➔ Budget Sources

9 centres out of 15 claim to have a balanced financing structure , which is a higher share than than the EU average.

Budgt sources of Spanish TDACs



3.4. Client Base : locally/regionally oriented

For 9 of 13 Spanish centres, over 60 % of their clients are small enterprises (those with less than 50 employees) and, in addition, 9 out of 13 also said that over 60 % of their clients were of a local and / or regional origin.

10 Spanish TDACs claimed to have not even one international client and in stark contrast to the EU average of 20%, only one centre claimed that over 20% of its client base came from abroad.

3.5. Conclusion

From the quantitative information given in the survey, the following points stand out as being fairly specific to the Spanish TDACs :

- The demonstration of advanced technologies is an activity considered "very important" by 4 of the 15 centres.
- 9 out of 15 TDACs are classed as Integration centres meaning that most of them are helping SMEs to integrate rather than develop new technologies.
- 11 out of the 15 Spanish centres are sector oriented.
- Public Regional Funding played a significant role in the initial investment in 14 out of the 15 centres.
- 9 centres declare that over 60 % of their client base are small enterprises and that over 60 % of clients are also of a local or / and regional origin.
- Spanish TDACs do not diffuse their activities at the international level.

INESCOP CENTRE

Status :	Industrial Association
Year of creation :	1971
Annual Turnover :	3.8 million Ecus (1993)
Initial Investment :	Regional and National Public funds, suppliers, users and self-financing
Budget sources :	Public core funding (25%), fees for services (40%) and Membership fees / donations (35%)
Principal activities :	Demonstration of advanced technologies, R&D, testing & certification, training in the use of a technology, technical assistance, short term consulting.
Technological domains :	Manufacturing technologies - rapid prototyping, CAD/CAM, cutting with water jets, Materials and Electronics, Communications and Information technologies.
Demonstration method :	Systems from different suppliers and media-based representations Systematic promotion principally through participation at conferences.
Total number of staff :	87
Client Base :	Total clients : 520 100% have less than 50 employees Shoe sector (100%) 100% national

4. INTERVIEW RESULTS

4.1. A case study of the Centre INESCOP (Instituto Español del Calzado y Conexas)

The INESCOP centre is a centre oriented towards the shoe sector. There is one main centre supporting several other smaller ones which are spread throughout Spain. An office / centre is set up in each region where there is a concentration of shoe enterprises. Grouped together, they form a kind of «Hub & Spoke» organisation, the hub of which is the main centre to whom all the smaller centres (the spokes) can turn to for further assistance and support. This particular industry is ideal for explaining the role of a demonstration centre as the shoe industry is very much a traditional one which is made up of many small enterprises.

The centre is oriented towards research and development and towards the diffusion of technologies applicable within the shoe sector.

➔ The Centre's Mission

"To develop different applications specific to the shoe sector and to diffuse the technology / equipment, making the enterprises aware of the potential of the new, and existing, technologies"

• ***A close relationship with equipment suppliers for adapting technologies to the shoe industry***

The technologies within the shoe sector, being a very traditional and artisan sector, are generally copied from other domains/industrial sectors. The INESCOP centre however, develops technologies or applications specifically adapted to the shoe sector. These developments can be financed by public funds in collaboration with the enterprises within the sector. Working in collaboration with the equipment suppliers, INESCOP will only develop a technology if there is a demand for it on the market and if there is no other supplier who is currently in the process of developing the same or similar technology. For this reason, INESCOP benefits from a privileged relationship with the industry equipment suppliers.

• ***A centre where demonstrations are the only effective means of making a technology known within an industry***

A very small percentage of the enterprises in the shoe industry are already considered to be up-to-date as far as technology and R&D are concerned. These enterprises therefore do not need to use the demonstration services available at the centre.

However, the majority of enterprises are considered to be lagging behind in terms of development but do not feel so concerned that they would pay for themselves or their employees to be trained in new technologies or processes.

INESCOP'S ACTIVITIES

QUALITY CONTROL

Of: Materials
Processes
Final Products

- Laboratories carry out more than 20,000 tests and analyses p.a. and produce more than 400 diagnostic reports each year.

TECHNICAL ASSISTANCE

- With materials used by the companies and their manufacturing processes

- With the management of regional, national and European technological development programes

FASHION / DESIGN

- Works in collaboration with the Centre for the promotion of shoe fashions (MODICAL)-the Spanish Fashion Institute

- Research and analysis of properties, trends in other sectors, shoe design. Diffusion of results through own publications, fairs, etc. ..

- Industrial and fashion design, technologies applicable in other sectors , implementation of new processes and products

NORMS & CERTIFICATION

- The centre's laboratories develop technologies based on international norms

- The centre is a member of the Spanish Normalisation Centre and participates in international Norm work groups

SPECIALISED TRAINING

- Through seminars, technical sessions, individual lessons

- Participation in European training programmes e.g. FORCE , COMMETT

- 2000 hours of classes p.a. attended by 300 people of all different levels

APPLIED RESEARCH

- Within national and European programmes such as BRITE and CRAFT in the fields of technology, materials and quality

- The centre collaborates with universities, the Superior Council for Scientific Research, other European Institutes and national and foreign companies

- Specific developments affecting the shoe industry and the application of it to the conventional leather makinh processes

DEMONSTRATION OF NEW TECHNOLOGIES

- Demonstrationn of new technologies such as
  - CAD/CAM,
  - cutting by water jets,
  - automatic stitching,..

DOCUMENTATION

- Bibliographical database set up in collaboration with other national and iternational associations

INFORMATION

- Through their own publications, industrial journals, conferences, exhibitions, participation in the European SPRINT programme, ...

The principal aim of the centre therefore, is to persuade these traditional enterprises which are run by people used to traditional methods (using basic technology) to participate in the demonstration activities. In doing so, the centre shows the enterprise how the technology actually works in production and explains how it could benefit the individual enterprise.

➔ The Principal Services offered by INESCOP

Demonstration activities are only one part of the large range of activities offered by INESCOP, as can be seen from the diagram opposite.

Focusing on demonstration activities however, one of the methods used by the centre involves installing the new equipment on the premises of a first-hand user. For example, INESCOP have created a technology/machine for sewing shoes and an "industrial platform" has been built up around it which is relatively innovative (compared to traditional methods). This technology has been installed in a company whose premises are situated just opposite the centre and the centre then invites other enterprises from the shoe sector to visit the technology and see it in full working operation.

The host company very often "sub-contracts" work out meaning that employees from other companies come to them and complete the job using the new technology. Not only does this help the host company during busy periods, but it also means that the employee is now trained in the new technology and if his own management decides to purchase the technology for themselves, they will already have one member of staff who is trained in the new technology.

ASSOCIACION INVESTIGACION DE OPTICA - AIDO

Status :	Industrial Association
Year of creation :	1988
Initial Ivestment :	Regional and National Public funds and users
Budget sources :	Public core funding (55%), fees for services (25%) and membership fees (20%)
Principal activities :	Demonstration of advanced technologies, training in the use of a technology, Information seminars, Renting of the technological platform by clients.
Technological domains :	Manufacturing technologies (CAD, laser, image-treatment), Materials, Environmental technologies
Demonstration method :	Systems from different suppliers and media-based representations. Systematic promotion of TDAC services through advertisements in relevant media and participation at conferences / fairs.
Total number of staff :	22
Client Base :	Total clients : 525 57% have less than 50 employees 100% national

4.2. Lessons from the TDAC Interviews

The results of the study show that in general, the Spanish TDACs prefer to consider themselves more in the role of an intermediary who works alongside rather than in competition with the various equipment suppliers. The centres also frequently collaborate with external companies who take on the task of commercialising and industrialising the technology/ equipment developed. The centre subsequently receives royalties from each sale made by the company.

The centres are appreciated by the enterprises especially for the consulting and support services they provide. SMEs differentiate TDACs from suppliers who, according to them, only sell the machines, not their expertise or advice and they also will not do anything on an individual demand basis. Companies also appreciate that the demonstration takes place on neutral ground where they feel more at ease to compare the different alternative technologies than if it took place on the supplier's premises.

Over the next three years, 4/5 of the centres indicated that they wanted to increase the number of technologies that they demonstrated and 3/5 wanted to develop their marketing activities. However, regarding the proportion of activities devoted to demonstration and the range of demonstration facilities used, 3/5 of the centres said that these would remain the same.

Two major problems were identified by the Spanish TDACs :

⇨ *The Financing of non profitable activities.*

The centres try to obtain financing from the state and from European programmes such as SPRINT for their internal development projects, but these projects do not directly include demonstration activities.

When the enterprises attend the demonstration sessions, the centre does not make any charge. It is only when the enterprises ask the centre to carry out complementary tests or organise some specific training session that the activities start to become profitable for the centre.

⇨ *Co-ordinating activities with structures of a similar domain / activity on a National and even European scale.*

Over the last ten years, numerous technology transfer structures have been created in Spain. The result is that very often there is a duplication of services offered by these structures because each Autonomous Community wants to have its own one. In order to reduce the level of investment needed, or to rationalise it, a better co-ordination of these structures must be organised not only in Spain, but also on the European level.

This co-ordination which could take place under the form of a Network (certain structures already belong to European Networks), would allow participating enterprises to be informed of the activities proposed by all the other centres whatever, their origin.

ASCAMM
ASSOCIACION CATALANA D'EMPRESESAS CONSTRUCTORAS DE MOLDES Y MATRICES

Status :	Industrial Association
Year of creation :	1990
Annual Turnover :	2 million Ecus (1993)
Initial Investment :	Regional and National Public funds, Self-financing
Budget sources :	Public project funding (51%), fees for services (45%) and membership fees / donations (4%)
Principal activities :	Demonstration of advanced technologies, testing & certification, training in the use of a technology, Information seminars.
Technological domains :	Manufacturing technologies
Demonstration method :	Systems from different suppliers and media-based representations. Systematic promotion of TDAC services through advertisements in relevant media
Total number of staff :	27
Client Base :	Total clients : 32 78% have less than 50 employees Informatics and machine tools sectors 31% international clients

4.3. Role of the Policy Makers

In Spain, the policy makers are the Ministry of Industry and Energy as well as the Regional Councils. From the interviews, it became clear **that neither of these national or regional policy makers have identified the activity of demonstrations as an activity in itself and have thus not integrated it in their policies**. They recognise the various activities of a technology transfer structure (development of a technology, advice and training for enterprises in this technology and the subsequent diffusion and possible commercialisation of it), but nowhere do they recognise demonstration activities as being a specific activity for the structure. If it is recognised at all, they consider that it is only as part of the diffusion activities.

However, a positive point is that even though the policy makers do not support or finance demonstration activities directly, there is some indirect financing whereby, for example, the Ministry of Industry contributes to the financing of a machine or equipment purchased by a centre within the framework of a specific project sponsored by the Ministry. For example, the Spanish government has financed some development projects for the shoe sector which have included to some extent demonstration activities.

- **Perspectives and Trends**

During the last decade in Spain, there has been an important increase in the resources devoted to R&D activities, as well as an enormous development of specific innovation support policies, such as the creation of TDACs. However, the Spanish Innovation system still has particularities and problems that must be smoothed out.

The policy makers recognise that a part of this involves **stimulating a higher degree of co-operation between the Central Government and the Autonomous Communities**. It is also recognised on the national level, as of the actions proposed within the National R&D Plan involves **promotion activities of new technologies** in which demonstration activities could play an active part.

5 . CONCLUSIONS

⇨ Spanish TDACs are not as well supported by public authorities as TDACs in some other countries (especially the Netherlands, Italy and Germany). In fact, the policy makers do not yet recognise demonstration activities as an activity in itself although they do finance indirectly development and investment projects

⇨ In general, the TDACs in Spain are principally small, young and regionally-based and a significant increase in the number of them is expected over the next few years.

⇨ The Spanish TDACs are an efficient tool for reaching regional SMEs : small enterprises represent over 60% of the client base for 60% of the TDACs and nearly 70% of clients are of a local / regional origin.

⇨ Over the next three years, 4/5 of Spanish centres have indicated that they want to increase the number of technologies that they demonstrate.

⇨ Globally, the amount of financial aid Spanish TDACs receive from public funds is increasingly diminishing and today, this tends to come only from public projects and no longer from public core funding. The result is that the centres are finding themselves being pushed further towards self-financing and therefore paying less attention to the promotion of demonstration activities.

⇨ Two major problems still remain :

- Without recognition and subsequent financial support from policy makers, the TDACs are going to find it increasingly harder to finance these non-profitable demonstration sessions.

- In order to capitalise on the centres' expertise and competencies and to avoid unnecessary duplication and waste of time and resources, the policy makers must make a conscious effort to create some form of network capable of co-ordinating the activities between structures on a national and European level..

Technology Demonstration and Application Centres in France

Country Report in the Framework of the SPRINT EIMS Project 94/71

CM International

Centrale Management

Vélizy - Villacoublay, France

June 1995

CONTENTS

DEFINITION AND DIFFERENCES OF TDACs
Compared to Related Institutions

A « Technology Demonstration and Application Centre » (TDAC) is understood as an institution which mainly offers public or private enterprises demonstrations of new technologies and distributes these services in a systematic marketing approach. In addition to that, it can offer further services such as information about and advice or training on new technologies, testing and certification and so on. In detail, the services offered include the following aspects :

⇨ *Demonstration of New Technologies*
The operability, competitiveness or specific application of new technologies are demonstrated to back up the information and consultation offered. Different media methods may be used for this purpose.

⇨ *Information about New Technologies*
First of all, general information about how the new technology functions and its productivity. In addition, general information about aspects of application such as general prerequisites of implementation, organisation or qualification for using the technology.

⇨ *Advice about New Technologies*
Individual consultation is also offered alongside general information. This may relate to company-specific technical aspects as well as questions of utilisation (e.g. introduction strategies, training,..).

The services offered are generally neutral with regard to technology suppliers, are presented without sales intention and are aimed at public or private enterprises (i.e. private households are not included as a target group). Based on this definition, a TDAC has to be distinguished from institutions with similar aims and services such as :

⇨ *Technology Centres / Science Parks* : These institutions provide young companies which developing new technology products and processes with a fully developed infrastructure as well as services and advice. In contrast to a TDAC, this is only offered to companies based within a technology centre. Please refer to page 7 for details on the complementary study carried out on the Science Parks population.

⇨ *Technology Transfer Centres* : There are many different terms for this kind of institution such as technology transfer, technology advice, innovation advice or interface centre. Their common characteristic is that they all attempt to promote the transfer of information, knowledge and resources from Technological Resources Centres to companies. In contrast to a TDAC, the technology transfer centre does not necessarily have to be connected with the demonstration of systems or processes.

⇨ *Exhibition / Demonstration Centres of Technology Suppliers* : In contrast to a TDAC, these centres present manufacturer-related offers which aim to sell new technologies.

⇨ *Consumer Advice Centres (e.g. local utilities, energy suppliers)* : In contrast to TDACs, the services offered are aimed primarily at private households.

1. INTRODUCTION

➔ Objectives of the European Study

For Public authorities concerned by Technology Transfer policies, one of the crucial and current questions is the following : ***How to enlarge the innovation fabric and how to reach traditional SMEs ?***

This study evolved from the hypothesis that demonstration activities could be an adequate solution to facilitate the diffusion of technologies towards enterprises who, up until now, have not been aware of the existence, or the benefits, of such technologies. In this context, four main objectives formed the structure of the analysis :

- ⇨ *Characterise Technology Demonstration and Application Centres (TDACs) in the European Union* : Identifying technological and sectorial fields, status, regional distribution, activities, client base, finance structure, difficulties encountered and major trends.
- ⇨ *Compare TDAC with other types of Demonstration Tools, especially from the SME's point of view* : such as Company Visiting schemes, demonstration investment programmes, supplier commercial activities,..
- ⇨ *Compare existing public policies towards demonstrations.*
- ⇨ *From the lessons learned, identify some key areas for the Commission's policies (DG XIII).*

This study will also contribute to the share of experience / best practices between policy makers and TDAC managers at the European level.

1.1. Information Sources

The initial information on the French TDACs came from two principal sources : the Ministry of Research and the Ministry of Industry, with the help of the CTI - Industrial Technical Centre - Network. This information was complemented by the knowledge that CM International already had in this field [1].

➔ The TDAC Survey

CM International prepared a list of centres to contact from its own data base and confirmed it with experts. Both Ministries also identified certain other structures whom to contact.

However, because transfer structures are so numerous in France, it was difficult in this sense to pinpoint and identify in the first place centres that actively participate in demonstration activities. The biggest problem subsequently came at the level of understanding what the term "demonstration activity" actually meant. On several occasions, having received the questionnaires, the centres would telephone to obtain a more detailed explanation of what the term meant and to decide whether they actually provided such a service.

[1] *"The characterization of French CRITTs in view of their evaluation" for the National Comitee of Evaluation and Research (CNER) at the Ministry of Research ; "Analysis of Technical Centres' Strategies" for the French General Board of Industry,...*

TDAC INTERVIEW GUIDELINES

Objective	Topics / Questions
History	● Historic development of the demonstration activities - origin ? - evolution of client needs and anticipation of future client needs ? - investment strategy ?
Presentation of Demonstration Activities	● How important are demonstration activities compared to other services offered by your centre ? Brief description of the other services ● Description of the technology demonstrated. Why is a demonstration stage necessary for this technology? ● What is your definition of a demonstration activity?
Role in Innovation Process	● Role of TDAC in the dynamics of innovation, diffusion and technology transfer at sector and regional level ● Client base targeted ? Original expectations of the client ? ● Do you know of any other forms of demonstration ? ● Synthesis of the added value of a TDAC
Performance of Demonstration Activities	● Are the demands and the specific needs of the target groups (SMEs) met ? ● How successful has the TDAC been in providing innovation services ? ● Major bottlenecks ? What are the solutions envisaged ?
Management of Demonstration Activities	● Presentation of the different stages ● Key success factors ● Is this activity recognised by the institutions which finance you ? ● Any particular difficulties in obtaining financing for investment ? ● Methods to anticipate the future needs in terms of demonstration activities ? ● Methods used to attract potential clients ?
Public Policies	● Your evaluation of the position of TDACs in National technology transfer plans, ● Recommendations that can be given to regional, national and European policy makers ? ● Participation in any national / European TDAC network / Association ?

In total, 63 questionnaires were sent of which 28 centres replied and 25 were then analysed.

➔ The TDAC Interviews

The data from the returned questionnaires were entered into a database, along with the data from the other countries being analysed, and from this a typology of the TDACs was produced. Once all of the TDACs had been slotted into the typology, it was decided to visit some of the centres in order to carry out more in-depth face-to-face interviews to be able to get a better understanding of the centre and its demonstration activities.

3 TDACs were visited in France : Pôle de Plasturgie de l'Est (St Avold), CRITT Laser (Illkirch), CRITT Bois (Epinal).

The interviews with the centres were carried out using the guidelines shown in the table opposite.

➔ The Policy Maker Interviews

Similarly, the interviews with the French policy makers were carried out along the guidelines shown in the table over the page.

1.2. Content of the report

The first section identifies the methodology followed in this survey and any difficulties encountered. At the end of this section there is also the results of the separate survey which was carried out within the Technology Park Population. The second section will briefly cover the Technology Transfer activities in France and the third section provides mainly a quantitative presentation of the main results of the questionnaire survey.

The fourth section looks at the results from the interviews : a qualitative presentation and discussion of the field interviews will be given, focusing on the aspects of demonstration activities and using a detailed example of one centre complemented by the input from other interviews.

The fifth and final section contains the conclusions based on the survey.

POLICY MAKER INTERVIEW GUIDELINES

Objective	Topics / Questions
Role of TDAC	● Role of TDACs in public technology and innovation support programmes at sector and regional level, ● Rationale for the existence of TDACs.
Performance of TDAC	● Success of TDAC in supporting SMEs, ● Are there technologies or applications which can be better diffused via TDACs ? ● Effectiveness of TDAC activities, ● Methodology and criteria used for the assessment of TDAC activities.
Public Policies	● Position of TDAC in National technology transfer systems / programmes, ● Other related activities or measures in the area of technology transfer and innovation strategies promoted by the government, ● Role of public authorities / sponsors (funding, strategies on technologies, application fields, target groups), ● Links with European policies (implications).

1.3. Technological Demonstrations in Technology Parks in the European Union

A further, smaller study was carried out in France concerning technological demonstration activities in the Technology Park population. Although this population had originally been excluded from the principal TDAC survey, we still wanted to test the level of involvement of these parks in demonstration activities. The objective of this study was not therefore to identify the demonstration activities of the parks, but simply to test whether such activities had a role in their structure.

A total of 72 questionnaires were sent out from which 16 replies were received.

Of the 16 replies :

7 parks had some form of demonstration activities

- ➤ **Espace Scientifique et Technologique d'Echanges et de Recherche**, Limoges*
- ➤ **ANTICIPA Technopole**, Lannion
- ➤ **PROMOTECH**, Villiers Les Nancy *
- ➤ **ACROPOLE Services**, Agen *
- ➤ **ADRIAC**, Reims
- ➤ **ATLANPOLE**, Nantes
- ➤ **CEREM**, Grenoble

7 parks had no demonstration activity

2 parks carried out demonstrations but purely in a commercial aim

Parks with Demonstration Activities

- For most of these parks, demonstration activities were launched in the early 1990s
- 3 parks claimed that demonstration activities were a "very important" activity for their park (indicated by an asterisk in the list above)
- The demonstration activities concern :
  - the promotion of new technologies
  - the demonstration of techniques in order to increase their diffusion within industry
- 6 of the parks indicated that their activities of demonstration were to some extent financed by Regional authorities
- The principal tool used to realise these demonstration activities is that of physical models/prototypes of new technical systems
- The two principal channels of promotion/diffusion used are mailings and participation at conferences
- For the majority of these Science Parks, their client base is made up of local/regional SMEs which come from specific sectors

Parks with no Demonstration Activities

- Reasons for not having demonstration activities identified from the survey include :
  - The lack of structure or human resources to take charge of such activities
  - The lack of financial resources
  - The park did not feel that its activities loaned themselves to demonstration activities

Conclusions

- From the survey, it can be said that Technology Parks are involved to varying degrees in demonstration activities, some much more than others and in fact, are capable of helping enterprises through these activities.
- It apears to us from the study that there is an issue at stake that needs further investigation : what the demonstration activities actually involve and how these can complement the activities of the TDACs identified in the principal study.

2. TECHNOLOGY TRANSFER ACTIVITIES IN FRANCE

A reform is currently underway in France concerning all of the technology transfer structures. The objective of the reform is to class these transfer structures into two sub-groups.

The first groups all the CRTs (Technological Resources Centre) which have sufficient, and large, means to offer a wide range of activities including Research and Development, Technical support, Control and testing,....

They have at their disposal a significant amount of equipment internally but they also work on equipment or systems that have been loaned to them, very often, by university laboratories.
Certain CRTs have invested in equipment or technologies that are either just emerging on the market or those that, up until now, have not benefited from a very wide diffusion. Bearing this in mind, some of these centres have developed demonstration activities for these technologies / equipment in order to make industry aware of the opportunities presented by them. (e.g., the new Resin Transfer Moulding technology in a Plastics centre).

The second sub-group is called the "Point d'Appui Technologique" (Centre for technological support) which has fewer means that the CRT and in fact has a completely different activity. The aim of the PAT is to put in touch, for example, a company which has a particular problem with a centre which has the means and capability to help it. They do, however, offer services such as technological diagnostics and advice. Different from the CRTs, the PATs are not as well equipped and they never have any high-tech equipment at their disposal

Through this reform, a clarification process aimed at sorting out the former CRITT population is taking place. A CRITT is a Regional Centre for Innovation and Technology Transfer and of which there are 120 in France. They exist since the mid 1980s and were initially developed to overcome the problems experienced by the CTIs, which were too sector oriented. The CRITTs were therefore developed to be technology oriented as opposed to sector oriented. In light of this distinction between the two sub-groups, it can be seen that technological demonstrations do only take place in the CRITT-CRTs, and not in the CRITT-PATs. 5 of the 25 analysed French TDACs are CRITTs.

- ***In a global context, it can be said that demonstration activities give the centres a national visibility...***

The technological demonstration activities only form a part of the total activities of Technology Transfer structures but, in general, it is these activities that give the structure its reputation and positioning amongst all the other structures (in simple terms, the centres become known because they offer these demonstration activities on a particular technology that requires equipment which they are the only centre to have). More frequently than not, technological demonstrations are related to rupture innovations or technologies in industry (which render existing innovations or technologies obsolete).

3. SURVEY RESULTS

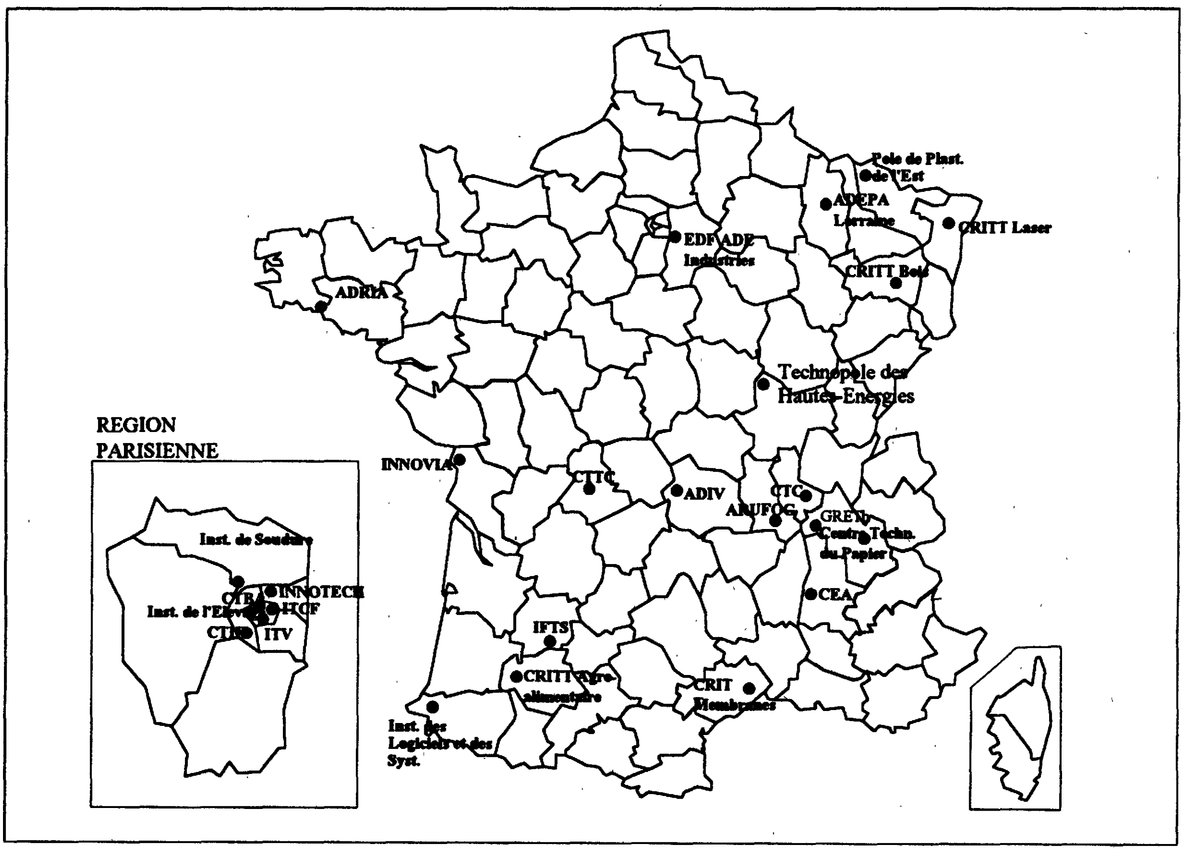
3.1. Introduction

The body of this section is based on the country particularities that have been identified from the results of the French survey, compared to the overall results of the European countries analysed. For more detailed information on the overall results of the survey, please consult the synthesis of the study.

➔ The List of French TDACs

The table on the following lists the 25 TDAC centres that were analysed in the study and gives their address and area of activity.

➔ Map of France showing the locations of the French TDACs identified in the Study



➔ The Organisation, Status and Size of French TDACs

Half of the centres declared to be an independent unit whilst the other half formed part of a larger organisation.

- 7 of the 14 centres who replied to this question classed themselves as being a private or semi-public institute, such as the CRITTs, and 3 as being an industrial association (e.g. Centre Technique du Papier or Pôle de Plasturgie de l'Est).

List of the French TDACs analysed

➢POLE DE PLASTURGIE DE L'EST
⇨57500 SAINT AVOLD
⇨ Resin transfer moulding for composite material

➢INNOVIA
⇨17000 LA ROCHELLE
⇨ New technologies for granulate

➢INSTITUT DES LOGICIELS ET DES SYSTEMES
⇨64102 BAYONNE
⇨ PMAO, CAD, CAM

➢ADIV
⇨63039 CLERMONT-FERRAND
⇨ Meat, heat transfer cooking

➢ADRIA
⇨29334 QUIMPER
⇨ New heating technologies : ohmic, I.R., Microwave

➢EDF ADE INDUSTRIES
⇨77250 ECUELLES
⇨ All technologies using electricity in industrial process

➢CRITT AGRO-ALIMENTAIRE
⇨32000 AUCH
⇨ Transformation, preserving and packaging of foodstuffs

➢CRITT LASER
⇨67400 ILLKIRCH
⇨ Power laser

➢CRITT MEMBRANES
⇨34394 MONTPELLIER
⇨ Membrane filtration

➢ADEPA LORRAINE
⇨
⇨ CAM / CA management

➢ITV
⇨75008 PARIS
⇨ Waste treatment

➢CTIF
⇨92132 SEVRES
⇨ Foundry, process

➢CTTC
⇨87000 LIMOGES
⇨ Ceramic materials

➢IFTS
⇨47510 AGEN
⇨ Filtration, separation techniques

➢ITCF
⇨75116 PARIS
⇨ Agriculture, first transformation

➢CTC
⇨69007 LYON
⇨ CAD, CAM

➢ARUFOG
⇨42023 ST ETIENNE
⇨ Optical telecomms.

➢CENTRE TECHNIQUE DU PAPIER
⇨33044 GRENOBLE
⇨ Paper treatment and manufacturing

➢INSTITUT DE L'ELEVAGE
⇨75595 PARIS
⇨Rearing techniques

➢INSTITUT DE SOUDURE
⇨95942 ROISSY
⇨ Metallurgy, soldering

➢CRITT BOIS
⇨88051 EPINAL
⇨ Wood techniques

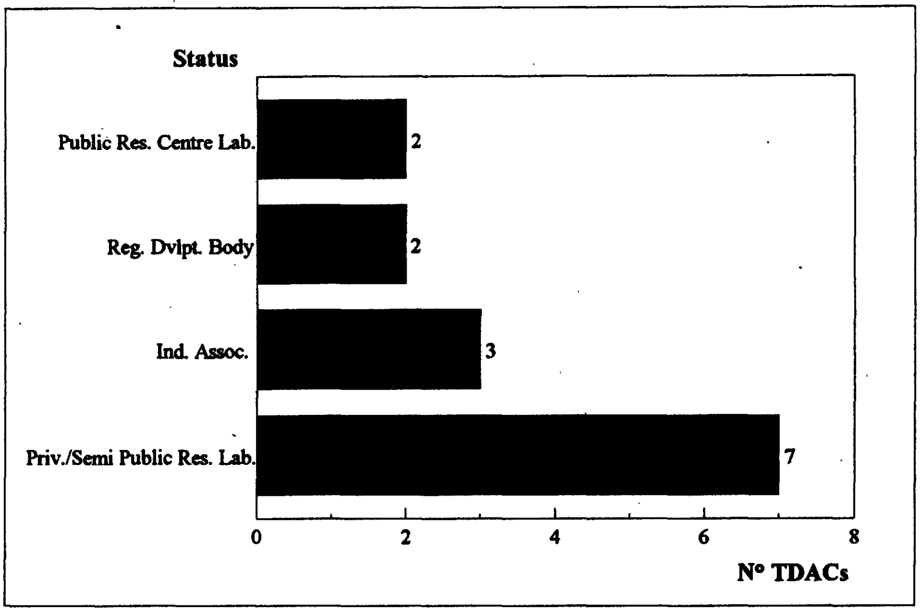
➢GRETh
⇨38041 GRENOBLE
⇨ Heat transfer

➢CEA
26702 PIERRELATTE
⇨ Separation techniques

➢CTBA
⇨75012 PARIS
⇨ Wood techniques

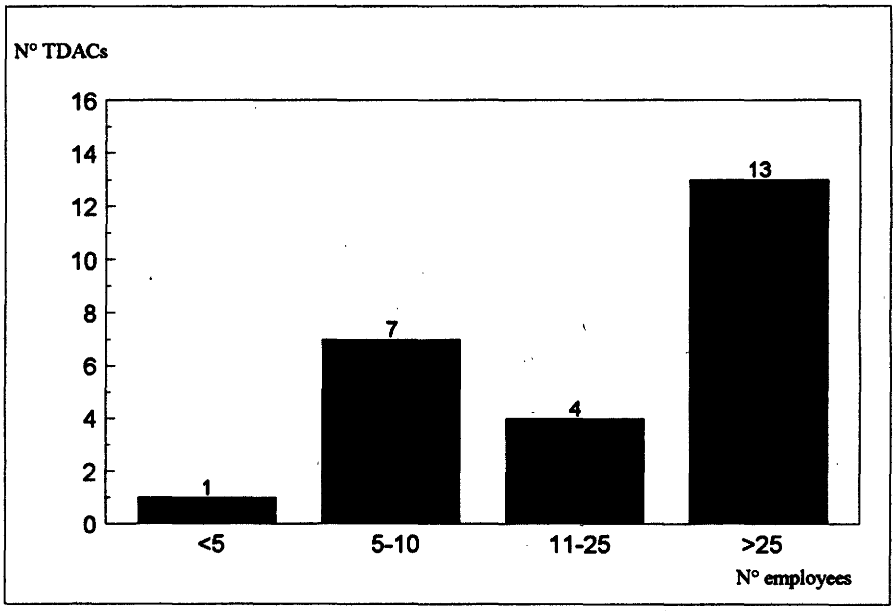
➢TECHNOPOLE DES HAUTES ENERGIES
⇨71200 LE CREUSOT
⇨ Industrial application of laser technology and electron beams

Status of the Unit



- In general, the French TDACs are either fairly large units, 13 out of the 25 employing over 25 people per unit (full time), or fairly small ones (7 declared only having between 5 and 10 full time employees).

Size of the Unit



3.2. Activities of French TDACs

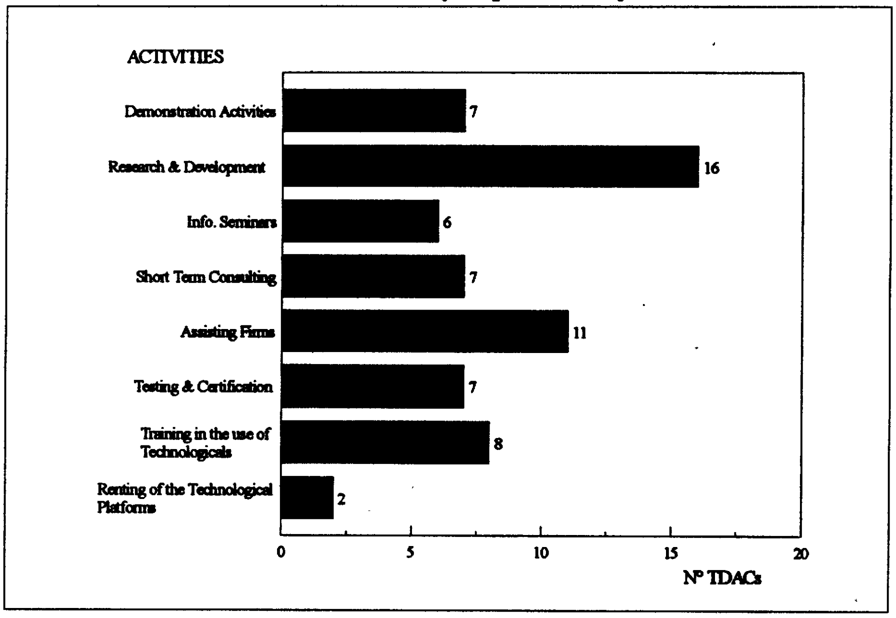
➔ R&D is the most prominent activity

Of the various activities carried out within the centres the activity considered by the majority to be "very important" (by 16 out of the 25 centres) is that of Research and Technological Development. Only 7 considered the demonstration of advanced technologies to be "very important". These tendencies are fairly much in line with the E.U. average.

From the results, it can be said that, **in general, French TDACs do not consider the demonstration of advanced technologies as being the most important activity for them, but rather the activities involving Research and Development.**

Assisting firms with the conception, development and implementation of technological solutions is also seen as equally important by 11 of the centres.

Activities mentioned as "very important" by French TDACs

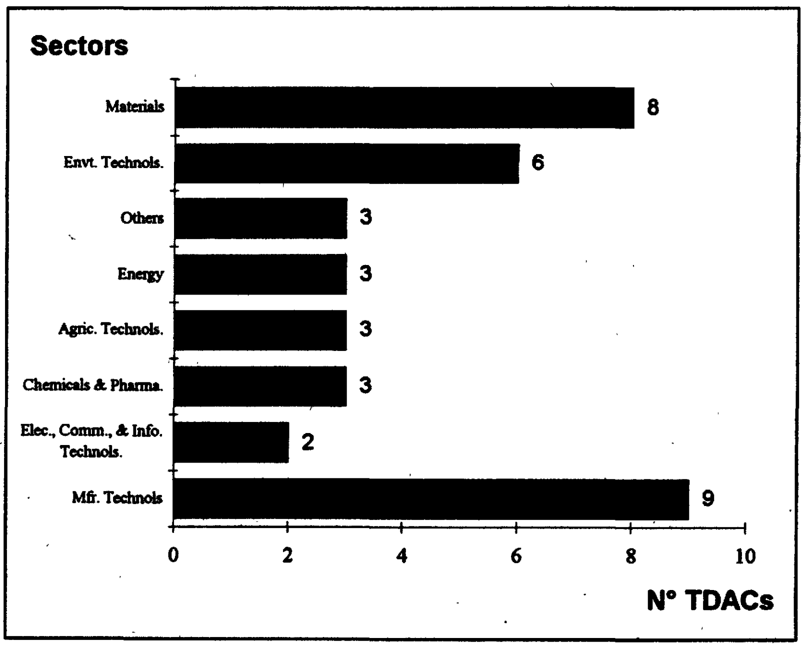


➔ Sectors and Technological Fields : Manufacturing Technologies and Materials

9 out of 25 French TDACs consider the technological field of manufacturing technologies to be a "very important" sector in which to offer their services. The materials sector is considered almost equally as important (by 8 centres).

Compared to the EU average, Electronics, Communication and Information technologies is a sector not particularly served by the French TDACs (only 2 out of 25 classed it as very important). However, the Environmental Technologies sector is seen as a much more important sector to the French centres than to their European counterparts.

Sectors and Technological Fields



Definition of the TDAC Typologies

Two main elements have been used to typify TDACs within the European Union :

1) The importance of the demonstration activity for the centre, which differentiates 3 classes :

- **Non TDAC** (15% of the first European sample) - where the demonstration activity is not important. These centres have been kept out of the analysis.

- **Weak definition TDAC** (18% of the first European sample) - where the demonstration activity is not one of the most important activities of the centre.

- **TDAC** (77% of the first European sample) - where the demonstration activity is strategic for the centre (one of the most important areas of activity for them).

2) The nature of the major associated activities within TDACs, excluding Non TDACs and Weak definition TDACs. From this, three new classes emerge:

- **Pure Demonstration Centres** (4% of European TDACs) - where demonstration is the only activity of the centre.

- **Integration Centres** (35% of European TDACs) - these centres are oriented towards helping the SME integrate new technologies (technical assistance, testing, training,..).

- **Development Centres** (57% of European TDACs) - these centres are oriented towards developing / adapting a new technology for the particularities of a particular industrial sector (R&D in particular)..

Typology of French TDACs

Weak Definition Centres	**TDACs**		
	Pure Demo.	**Integration Centre**	**Development Centre**
Institut de l'Elevage		PPE	Inst. de Logiciels et de Systèmes
ADEPA Lorraine		EDF ADE Industries	Innovia
ITV		IFTS	CRITT Agro-Alimentaire
CTTC		CTBA	CRITT IREPA-Laser
Institut de Soudure		CTC	CRITT Membranes
ITCF		ARUFOG	GRETh
		ADIV	CEA
			ADRIA
			CRITT Bois
			Technopole des Hautes Energies
			Centre Technique du Papier
			CTIF

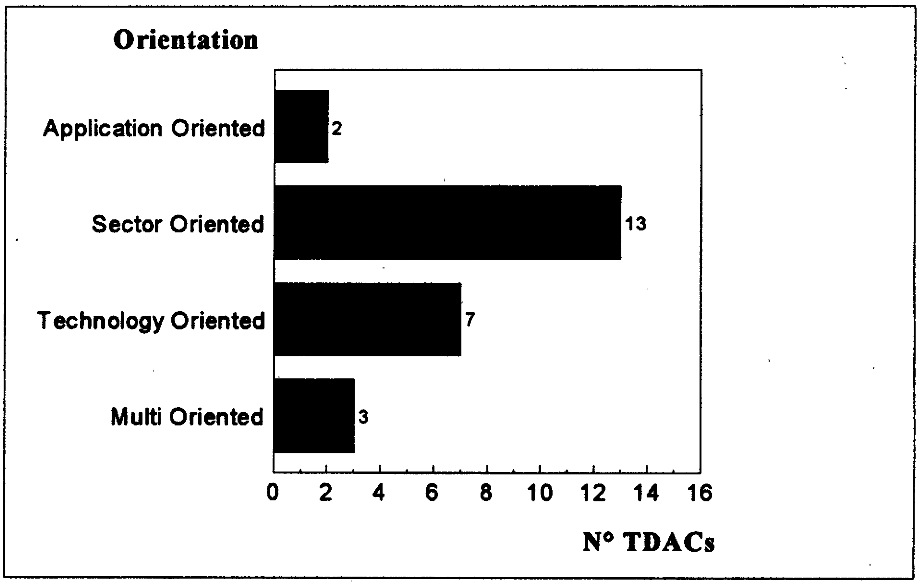
➔ Typologies : most of French TDACs are development oriented and sector oriented

• The table opposite describes the various typologies that were identified for the centres in the study.

Looking at the typology based on the associated activities, 12 out of the 25 French centres are classed as "Development Oriented" and a further 7 as "Integration" centres. This leaves 6 centres in the survey which can be classed as "weak definition TDACs".

• **13 French TDACs are classified as sector oriented centres, working with specific sectors such as wine and leather, whilst 7 are focused on one technology, such as membranes or lasers**. 3 centres described themselves as multi-oriented, not focusing on one particular area.

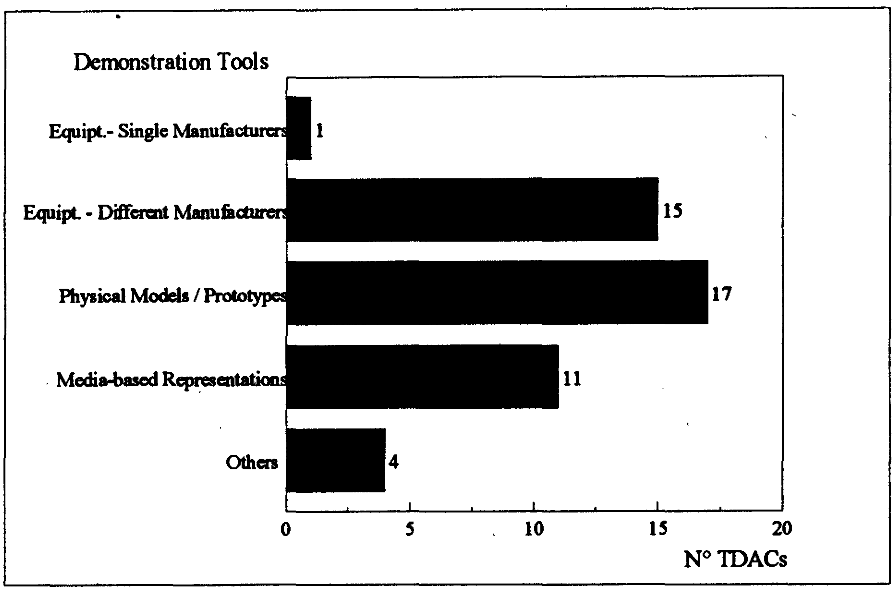
Strategic Positioning of French TDACs



➔ Methods of demonstration : Physical models or prototypes of new technical systems

In order to demonstrate the advanced technologies, 17 out of the 25 centres analysed (68%) used the tool of physical models / prototypes of new technical systems. Apart from Italy and Belgium, this method is used fairly rarely in the other European countries. The other popular method is that of using systems / equipment from different manufacturers (15 out of 25).

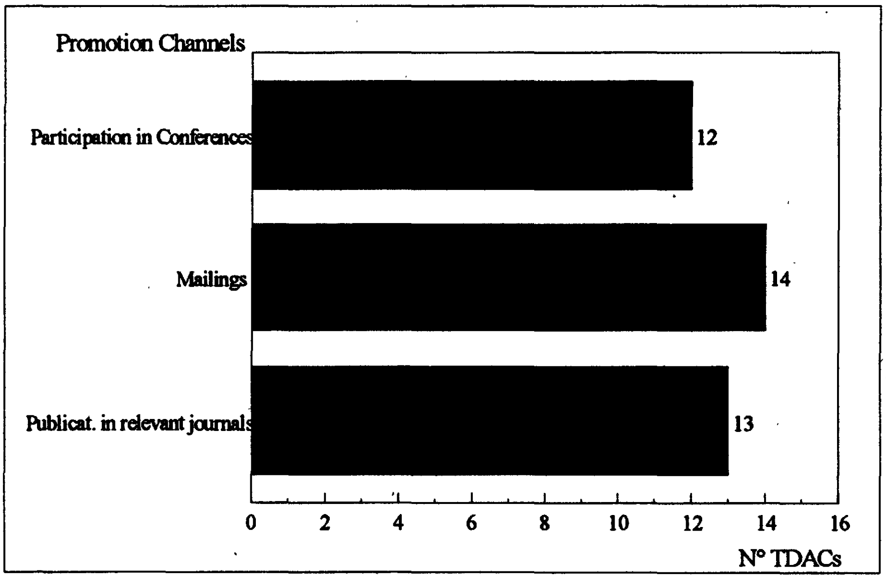
Tools used to Demonstrate Advanced Technologies



➔ Diffusion / Promotion channels

With the facilities to provide numerous activities and services, all of the French TDACs who replied to this question systematically promote their services. **14 out of 19 centres regularly use the promotion channel of mailings, followed by publications in relevant journals (13/19) and participation at conferences / fairs (12/19).** Not one French TDAC claimed to regularly use the channel of advertisements in relevant media.

Promotion Channels regularly used by French TDACs



3.3. Finance structure

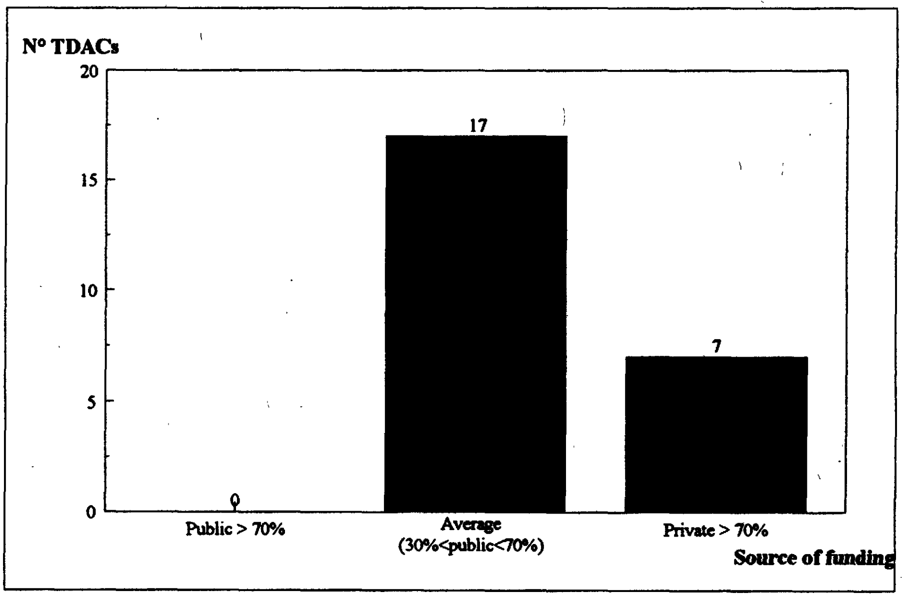
➔ Initial Investment : Primarily financed by Public Regional Funds

The French centres appear to have benefited from the different areas of Public funding (Regional, National and European) to a larger extent than the other European countries. In fact, **17 out of the 25 French TDACs declared that the initial investment in their centre was financed to some extent by Public Regional Funding**. This level is greatly superior to the E.U. average of 31 %. Also superior to the E.U. average is the number of centres in France (8 out of 25) who declared that the initial investment was co-financed by their suppliers.

➔ Budget Sources : Non public TDACs

The current financing structure of TDACs in France is slightly different to elsewhere in Europe. **Not one centre declared that it was financed by more than 70 % of Public funds,** but 17 out of 24 centres responded that they have a balanced financing structure, and the rest declared to be financed more than 70 % by Private funds.

Budget Sources of French TDACs



3.4. Client base : Very few French TDACs have international clients

For 18 of the French centres (nearly 3/4), small enterprises (those with less than 50 employees) are an important proportion of their client base (over 60 % of their clients are small enterprises). Furthermore, 9 centres declared that over 60 % of their clients were local and/or regional enterprises. Both these statistics are in line with the E.U. average.

With regard to international clients however, there is a dramatic difference compared to the E.U. average. Not one French TDAC has an international client base of more than 20 % whereas 20% of the E.U. average declares to have this amount, or more, of clients from abroad.

3.5. Conclusion

From the quantitative information given in the survey, the following points stand out as being fairly specific to the French TDACs :

- ⇨ Only 7 out of the 25 centres consider the demonstration of advanced technologies to be very important.
- ⇨ 12 TDACs are classed as "Development oriented" centres.
- ⇨ Just over half the centres work with specific centres (sector oriented) and 7 are technology oriented.
- ⇨ Public Regional Funding played a significant role in the initial investment in the centres.
- ⇨ Not one French centre declared being financed by more than 70 % of Public funds.
- ⇨ Small enterprises represent over 60 % of the client base for nearly 3/4 of French TDACs and 9 out of the 25 claim that over 60 % of their clients are of a local or regional origin.
- ⇨ The presence of international clients is minimal. Not one centre has over 20 % of its client base represented by international enterprises.

IREPA-Laser

Status :	Part of a larger organisation (semi-public institute)
Year of creation :	1982 (Demonstration activities began in 1983)
Annual Turnover :	760,000 Ecus (1993)
Initial Investment :	Regional and National Public funds
Budget sources :	Public core and project funding and fees for services
Principal activities :	Demonstration of advanced technologies, R&D, testing & certification, training in the use of a technology, technical assistance.
Technological domains :	Manufacturing technologies - industrial applications of Power Lasers
Demonstration method :	Systems from different suppliers. No systematic promotion but does use mailings and participates at conferences.
Total number of staff :	20 (17 technical, 3 administrative)

4. INTERVIEW RESULTS

4.1. A case study of the Centre "IREPA - Laser"

The IREPA - Laser Centre is a centre oriented towards a particular technology, the laser. It is one of the 120 CRITTs which are found in France, and is supported by the Regional Council of Alsace and the Regional Delegation for the Ministry of Research and Technology.

The centre is oriented towards research and development and towards the promotion of a particular technology which can be used in numerous sectors (e.g., metallurgy, printing, glass,..).

➔ The Centre's Mission

"To precede and accompany the development of these technology applications in the domain of industry, and to ensure the training and raise the awareness of future users of the potential of these new technologies".

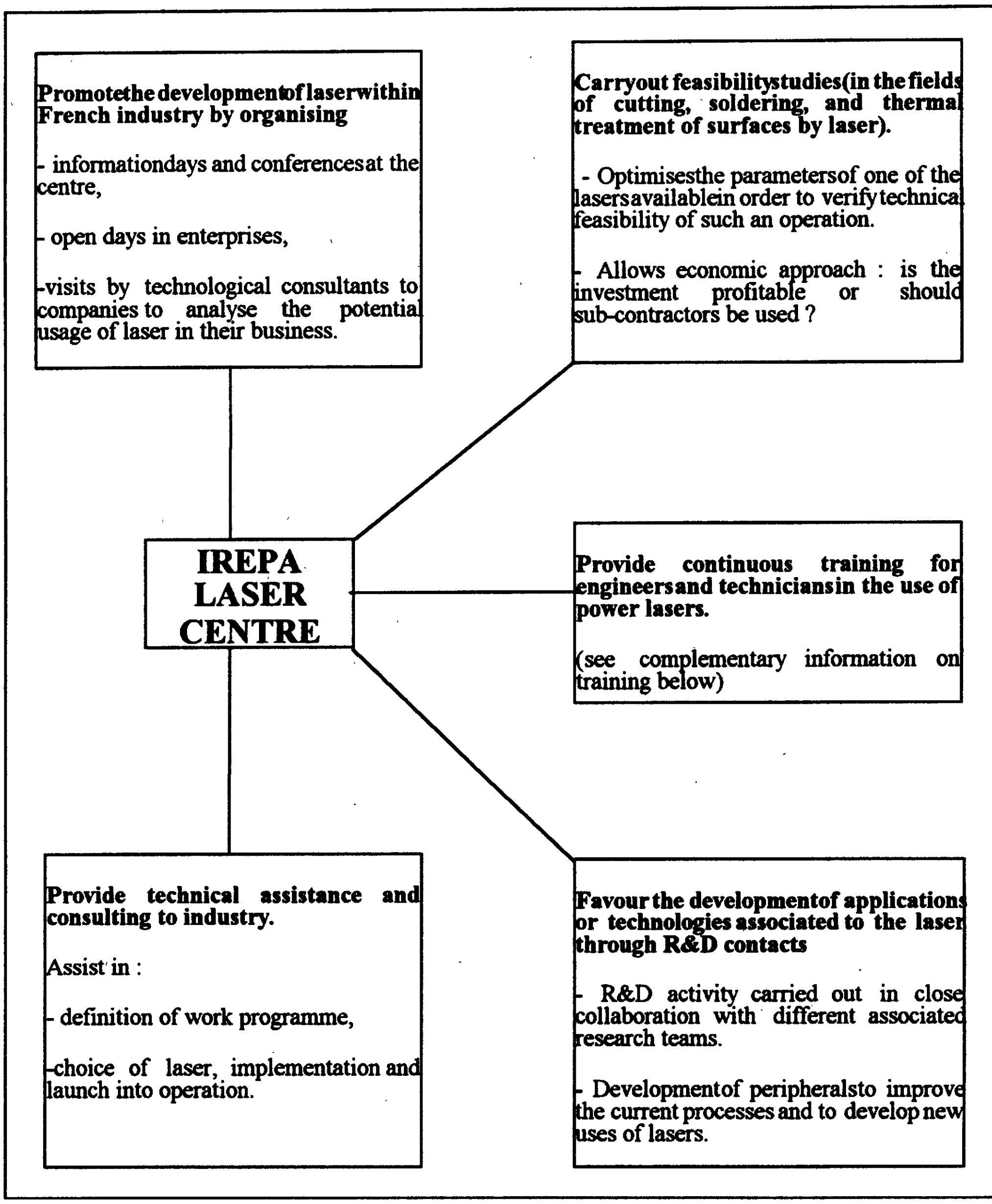
• A centre which gives a wide definition to the term demonstration...

In effect, the centre offers a complete service via their demonstrations, from the beginning where the needs of the enterprise are revealed (this stage is financed by public funds), through to the first steps of putting the technology/equipment into operation. These activities, however, are only offered in the domains of production technologies and materials that are associated with the industrial applications of power lasers.

➔ The Principal Activities of the IREPA - Laser Centre

The diagram over the page lists the various activities carried out within the IREPA-Laser centre.

The Principal Activities of the IREPA-Laser Centre



Complementary information concerning IREPA - Laser's training activities

Training sessions and placements are organised by IREPA - Laser in order to provide a practical and concrete training on the possibilities, implementation and profitability of a laser system. The sessions are aimed at all levels of personnel from the directors down to the machine operators. During the four days of one type of session, the aim is to show the companies attending the different applications of the laser and the possible usage of them.

Other types of training sessions are organised by IREPA - Laser which involve working with several different machines to get an understanding of the application or collaborating with external institutions in the case of a specialised application e.g. soldering. A further, more individual, training session can be organised which responds to the individual needs of a particular enterprise in a particular sector.

• ***A centre steadfastly oriented towards global assistance in investment projects...***

IREPA - Laser has equipped itself with numerous power laser equipment with the aid and support of the aforementioned Regional Council and Ministry delegation.

The actual demonstration activities are carried out via the use of systems or equipment from different suppliers and the centre regularly promotes its TDAC services through targeted mailings, participation at fairs/conferences and through permanent contact with industry and the producers of systems/equipment.

This TDAC develops the services it offers by keeping up to date with all the products and equipment offered on the international market. In effect, the centre has to follow the evolution of the supply of equipment from European, and even international, suppliers in order to be able to inform the client who wishes to invest following the demonstration/feasibility study phase.

Pôle de Plasturgie de l'Est (St Avold)

Status :	Part of a large industrial association
Annual turnover :	305,000 Ecus (1993)
Initial Investment :	Regional, European and National Public funding
Budget sources :	Public core funding (50%) and fees for services (50%)
Principal activities :	Open-days, training in the use of a technology, assisting companies,...
Technological domains :	Manufacturing technologies (Resin Transfer Moulding technologies for composite materials) Materials
Demonstration method :	Physical models or prototypes of technical systems No systematic promotion of TDAC services, although the centre does produce a newsletter
Total number of staff :	7 (5 technical, 2 administrative)
Client base :	Total clients : 30 33% have less than 50 employees Local / regional origin (75%)

Brief description of the main activities :

Different from the IREPA - Laser centre, the "Pôle de Plasturgie de l'Est" (P.P.E.) is not centred on a particular technology or the demonstration of it. This centre provides the plastic - transformer industry with technical assistance in their activities. Equally, it dedicates a lot of its time to the continuous training of the employees of this industry. Equipped with the latest up-to-date materials and machinery (the only equipment of its type available in France), the P.P.E. has acquired different expertise in the field of Resin Transfer Moulding technology.

This technology, developed within the aeronautic industry ten years ago and now beginning to find its way into more traditional sectors, allows industry to work in closed moulds thus limiting the level of solvent in the air. The new European regulations in theory should impose this new technology which offers numerous benefits, such as gains in productivity.

The P.P.E. centre is very well informed and up-to-date on the various stakes in the plastic - transformer industry and has fixed for itself the objective of preparing enterprises within the plastics industry for the future evolution of their industry. In the light of this, it has developed a demonstration activity which at the request of its client, leads it fairly often to be actively present and intervene right up to the launch of the first production series.

4.2. Lessons from the TDAC Interviews

In all of the cases analysed, the French TDAC declares that it does not want to by-pass or eliminate the equipment supplier; it sees itself, in fact, more in the role of an intermediary who :

- ⇨ creates interest by highlighting and showing the advantages of the technology,
- ⇨ studies objectively the interest for an enterprise to adopt this technology,
- ⇨ assists the enterprise in calculating and choosing its investment by defining with it the necessary selection criteria to use,
- ⇨ offers technical, organisational and psychological support to the enterprise when faced with change. In the case of the last aspect, the support offered involves conquering the reticence of the employees with regards to change, both human and technical.

The CRITT - Bois comments that **"the TDAC is an interesting and yet dangerous interlocutor for the equipment supplier because it provides objective and exhaustive presentations of products and equipment currently on the market".**

When asked what their plans over the next three years would include, 20 of the centres analysed indicated that they wanted to develop their marketing activities. A further 3/5 of the centres agreed that they would increase the proportion of activities devoted to demonstration, the range of demonstration facilities used and the number of technologies demonstrated.

Three major problems were identified by the French TDACs :

⇨ *Staying up to date.*

The centres must ensure that they stay up to date with all the equipment and systems available on the European and International markets. Even if some TDACs mention the assistance of public authorities including DG XIII - SPRINT, most of them consider it is insufficient for financing their permanent effort to stay up-to-date.

⇨ *To recruit and maintain ad-hoc people within the centre.*

Staff are needed who are experienced in both the field of technology and industry. Not only do they need to know in detail the technology, but they also need to be able to discuss, for example, the client's production process. Such knowledge and expertise requires an experience in industry for at least 10 years. To recruit and, more importantly, to maintain this type of highly skilled person is, in general, expensive and difficult for the centres.

⇨ *Obtaining Public Funding for non profitable activities.*

In addition to the above problems, centres also claim that they suffer from a lack of public funding for "revealing the needs of enterprises / clients".

CRITT Bois (Epinal)

Status :	Independent unit - industrial association
Annual turnover :	410,000 Ecus (1993)
Initial Investment :	Regional, National and European Public funds, users and self-financing
Budget sources :	Public core and project funding (40%) and fees for services (60%)
Principal activities :	R&D, assisting companies
Technological domains :	Manufacturing technologies (technologies employed by the timber industry in general) Materials
Demonstration method :	Systems from different suppliers, media-based representations Systematically promotes services through, mailings and publication in relevant journals
Total number of staff :	6 (5 technical, 1 administrative)
Client base :	Total clients : 98 31% have less than 50 employees 100% in the timber industry Local / regional origin (60%)

4.3. What do enterprises think of Demonstration Activities ?

Very often, the enterprises are already in contact with the technology transfer structure before they turn to them for demonstration activities (e.g. : P.P.E., CRITT Bois,...).

Having been made aware of the advantages of new technologies (both theoretically and by practical demonstration), enterprises are much less hesitant at asking for further demonstrations in response to specific problems.

The advantages offered by subscribing to the TDACs (according to the enterprises) are numerous and include :

⇨ "the certainty of being aware of new technologies and opportunities",

⇨ "finding an autonomous, professional partner with whom to share the responsibility of developing new products,... and who is not only centred on one component of the project, like the supplier",

⇨ "having support throughout all stages of the launch of the product or in the use of new technology for the production of new or old products",

⇨ "providing objective technical - economic diagnoses",

⇨ "helping in the breaking-down of reticence of both management and employees".

The ADEME Demonstration Operations (OD) Scheme

Launched in 1975 and ended in 1992, this scheme had the objective to financially support innovative projects which were subject to both technical and financial risk. The aim of the aid was to further the development of a technique, a process or a material. In return for this aid, the supplier and the final user (the enterprise) of the technology/equipment had to accept to allow other enterprises to visit the industrial site where the new equipment/technology has been installed.

During the period 1982-1991 for example, the aids were allocated principally to final users (enterprises) - 92% in numbers, of which half were small and medium sized industries.

The Agency subsidised up to 50% of the innovation investment and up to 100% of the additional demonstration costs (e.g. « Campaign of Measurement »). Globally, the average aid covered 20% - 25% of the costs incurred.

The initial decision to support a project was based on the following criteria :

- significant energy stake
- large diffusion of the new equipment / technology
- economic liability of the project

The follow up of each demonstration project and especially its diffusion towards other companies was a constant preoccupation of the Agency. They admitted, however, that the penetration of the market had not reached the level that they had hoped for. They put this down to several reasons :

- Time : the minimum delay between taking the decision to invest and obtaining results qualified by the campaign of measurement is at least 3-5 years and can even take longer,

- Several projects supported by the Agency were based on specific cases which were difficult to reproduce without carrying out further studies or additional tests. In general, the nature of the projects did not lead to the introduction on the market of technical products or catalogue procedures

- The difficulty encountered when a project is not followed up regularly.

When, however, a project did succeed and was considered to have a result which was judged globally as positive, the Agency promoted it on a wide scale under several forms :

- Produced a 4 page brochure providing full information
- Targeted mailing of these brochures
- Use of technical promotion channels (e.g. industrial / professional revues)
- Distribution of the information at various exhibitions / conferences
- Export promotion (translation of brochures into other languages)

The first ten years of the scheme could be depicted as below :

- 205 projects supported within different industrial sectors
- Total industrial investment of 650 MF
- Subsidy of 160 MF (average rate of aid of 22%)
- Out of 174 completed projects :
  - 129 - success
  - 31 - partial failure
  - 14 - total failure

From 1990, demonstration activities were encouraged and the Regional Delegations had the possibility of integrating them into a regional fund which they co-managedwith the regional Council.

4.4. Role of the Policy Makers

In France, the Policy Makers are the Ministry of Industry (which is associated mainly via the Technical Centres) and the Ministry of Research (which is associated mainly via the regional Technology Transfer structures - CRITTs). **From interviews with all the parties concerned, it is clear that technological demonstrations are not an activity recognised or identified as crucial by the Policy Makers.**

The research carried out regarding the Regional Authorities has shown that for certain regions, the technological support offered to SMEs implied the development of real technological platforms often equipped with technological demonstration activities. The activities of the Regional Authority of Lorraine is an example to be noted as they, since a few years now, have actively encouraged the development of such structures.

French national policy makers are quite reluctant to encourage technological demonstration activities however, because they often see them as a way of developing new products or offering new technologies irrespective of if there is a client demand or not. In spite of this however, they do engage in some activities of communicating industrial experiences of new processes or technologies (via press meetings in particular).

One public institution, the ADEME (Agency of Energy and the Environment) had a demonstration operation scheme from 1975 until 1992 in which they subsidised up to a maximum of 50 % of a global innovation project. These demonstration operations were considered to be helpful in perfecting new processes or equipment to reduce energy consumption (please refer to the table opposite for more detailed information on the ADEME).

5. CONCLUSIONS

⇨ French TDACs are not as well supported by public authorities as TDACs in some other European countries (especially the Netherlands, Italy and Germany). The French regional authorities however, do play a significant role in the initial investment.

⇨ TDACs appear to be an efficient tool to reach SMEs in France : small enterprises represent over 60% of the client base for nearly ¾ of French TDACs.

⇨ In general, demonstration activities of advanced technologies are considered positively by enterprises/clients and are well appreciated by them for their objectivity and neutrality with regards to giving information, technical support and advising on new products/technologies. They represent an activity which is seen as a needed, even indispensable part of the technology transfer structure.

⇨ The demonstration activity requires a big investment during the initial phases of the technology transfer in order to arouse interest in the new technologies/systems and to reveal the needs that have, up until now, not been expressed. However, because the activity is not openly recognised by the public financiers, many centres risk suffering from a lack of financial commitment from these public sources.

⇨ It does appear that the situation is evolving however, and the interest of demonstration activities is being more and more recognised by the policy makers at the Ministries and at the regional administrations.

⇨ Two major problems still remain however :

- In order to remain efficient vis-à-vis their competitors in their activity of demonstrating "disruptive technologies", the centre is obliged to stay up-to-date with all the new products and systems being brought onto the European and international market.

- The centre needs to recruit and, more importantly, maintain highly qualified staff who are experienced in both the field of technology and industry.

Both of the above demand a substantial effort from the centres in both time and energy which obviously need funding in some way. This problem with funding may explain in part why only 7 out of 25 French centres consider the demonstration of advanced technologies to be very important. The centres do not have the means (financial or human) to have demonstration activities as their principal activity.

Technology Demonstration and Application Centres in Ireland

Country Report in the Framework of the SPRINT EIMS Project 94/71

Technopolis Ltd., Technology Management Consultants,

Brighton, UK

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June 1995

CONTENTS

Technology Demonstration and Application Centres in Ireland

1. Introduction

Technology demonstration activities occur in Ireland, but they have not occupied a central position in the technology and business strategies of the organisations conducting them. Neither have they constituted a central plank of public policies to support innovation. Nevertheless, technology demonstration activities do have a role to play in the processes of technology transfer and diffusion, and the increasing importance these are assuming in the innovation policies of governments around the world merited a review of current technology demonstration practices in Ireland.

This review has been conducted as part of a broader review of technology demonstration practices in the European Union (EU). The first step involved the identification of organisations in the Irish technology infrastructure likely to be involved in technology demonstration activities. Assistance was sought from Forfás, which provided a list of potential Technology Demonstration and Application Centres (TDACs). Twenty-eight potential TDACs were identified.

The next step involved the preparation of a questionnaire designed to collect basic information on the scope and scale of technology demonstration activities in these organisations. The questionnaire was then sent to all potential TDACs in Ireland. Eighteen out of the 28 institutions replied (64% response rate), with all confirming that they undertook technology demonstration activities of one sort or another.

To add flesh to the skeletal information provided by the survey of Irish TDACs, interviews were conducted with senior personnel in four Irish TDACs and with a number of Irish policy makers. It was not possible to interview users of the TDAC services.

The results of all these steps are reported in the following sections. Section 2 covers the major points arising from the interviews with policy makers and TDAC managers. It provides a broad, qualitative overview of technology demonstration activities in Ireland and public support for them. In Section 3, the quantitative results of the questionnaire survey are presented. Finally, in Section 4, the results of the study are summarised.

2. Technology Demonstration Activities in Ireland

This Section covers the main points arising out of the interviews with policy makers and TDAC managers. It covers the nature of technology demonstration activities in Ireland and the policies in place to support them.

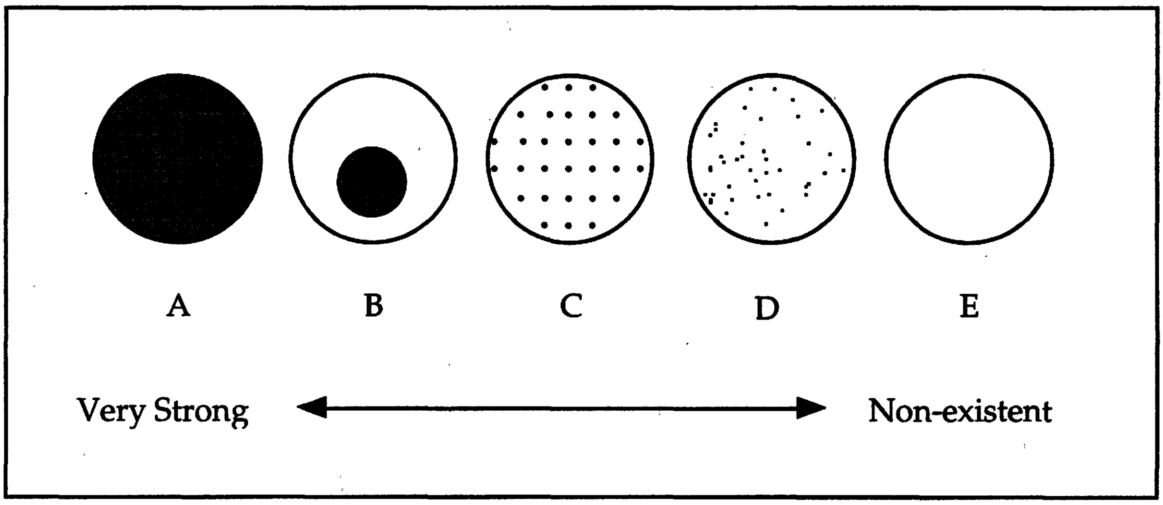
- Technology demonstration activities occur in a number of organisational settings within the Irish Technology Infrastructure

- The main organisations in the Technology Infrastructure which conduct technology demonstration activities are university departments and public research centres. Typically these are technology-centred laboratories funded out of the public purse to conduct research and promote the diffusion of specific technologies from academic to industrial sectors. Much of this support is public core funding and project-based financing

- Exhibit 1 shows figuratively how technology demonstration activities in these organisational settings can be

  A - the sole or primary function of the organisation (i.e. the whole organisation can be considered a Technology Demonstration and Application Centre (TDAC))
  B - concentrated in a particular TDAC within the organisation
  C - distributed around the organisation
  D - an infrequent occurrence in the organisation
  E - non-existent

Exhibit 1 Technology Demonstration Activities within an Organisation



- In Ireland, there are very few A- and B-type organisations in the Technology Infrastructure, i.e. there are few true TDACs. Technology demonstration is normally an intermittent activity which is distributed around an organisation over space and time (Type C and, more frequently, Type D)

- The role of technology demonstration in an organisation's overall strategy is rarely considered. It is an activity which occurs alongside and in consequence of other activities, often in an *ad hoc* fashion

- Government spend on science and technology in Ireland can be split broadly into support for **Technology Generation** measures (e.g. R&D programmes); for **Environment and Infrastructure** measures (e.g. education and measurement and certification services); and for **Technology Diffusion and Adoption** measures

- In the area of **Technology Diffusion and Adoption**, Ireland has a proliferation of policy measures. Some of these overlap because funding opportunities have arisen and been exploited *ad hoc*, notably from European Structural Funds. Additional opportunities are exploited in European Union programmes for technology transfer

- While Ireland boasts a broad range of **Diffusion and Adoption** measures, the programmes total only some £48m per annum (approximately 7.5% of the annual government spend on science and technology). Of this, agricultural extension programmes account for 40% (£19m). EOLAS (now Forbairt and Forfás) accounted for some 45%, with the balance fragmented across a small number of other agencies

- In Exhibit 2, we show how Irish diffusion and adoption Programmes fit conceptually into **Action Categories** and **Policy Packages**. The Action Categories are explained further in Exhibit 3, and Exhibits 4 and 5 depict how the various Action Categories can be combined into Policy Packages aimed at particular types of firm

- Although our analysis is not exhaustive, it can be seen that quite a few programmes fit, at least conceptually, into a **Demonstration and Awareness** package, chiefly by providing technology centre services which are relevant to the full range of Irish companies

- However, it must be stressed that there are no coordinated policies in Ireland covering technology demonstration or technology demonstration centres. Demonstration occurs, but usually within the context of other programmes, e.g. as part of the activities of R&D centres receiving funding from the Programmes of Advanced Technology (the PATs)

- This gap suggests that there is a need for the provision of 'reference points' for new technology: demonstrations (preferably in the form of working products and processes) of the technology levels for which companies should be striving, and awareness campaigns centred on both the national reference points and international practice

Exhibit 2 Examples of Current Irish Diffusion & Adoption Programmes

Categories of Action	Programmes	Policy Packages D&A	Nwk	SME
Institute/University Linkage	Higher Education-Industry Cooperation		X	
	Programmes in Advanced Technology		X	
Technical Information	EOLAS* Information & Advisory Service		X	X
	EOLAS Technology Transfer		X	X
Capability 'Bootstrap'	TechStart			X
Technology Audit	National Technology Audit Programme			X
Manufacturing Consultancy	EOLAS Manufacturing Consultancy		X	X
	EOLAS R,D & Demonstration Progs.		X	X
	Microelectronics Application Centre			X
	AMT PAT		X	X
Feasibility Study Programmes	IDA	X		
Technology Centres	EOLAS S&T Service Centres	X		
	Some PATs	X		
	EOLAS R,D & Demonstration Progs.	X		
	EOLAS S&T Services	X		
Awareness, Technology Demonstration	Department of Agriculture			X
	Department of Marine Affairs			X
Education**	BIM			X
	NMRC		X	X
	Some PATs		X	X
	SFADCO		X	X
Coordination	N/A			
Government Informatics.	Local Govt. Computer Services Board			
Science Park	Plassey	X		
	Dublin Science Park	X		
Inter-Agency Programmes	N/A			

* Now FORBAIRT and Forfás; ** Mainly Infrastructure spend; . Outside S&T Budget

Key: D&A - Demonstration and Awareness Package; Nwk - Network Package; SME - SME Package

Exhibit 3 Technology Diffusion & Adoption Programme Types

Category of Action	Description
Institute/University Linkage	Uses a research institute or higher education establishment as a source of skills and technology for transfer to industry
Technical Information	Provides information access or tracks technological developments
Capability 'Bootstrap'	May support supply or diffusion objectives Creates initial technology/engineering expertise to permit technological learning and development
Technology Audit	Diagnostic service, identifying improvement opportunities in the use of technology. Normally also covers 'soft' issues
Manufacturing Consultancy	Helps users implement good manufacturing practices and technology using state-sector or managed private-sector consultants May follow up technology audit
Feasibility Study Programmes	Fund analysis of process or product change in order to help business make better technology investment decisions
Technology Centres	Small, generally locally-based technology advice, consulting or referral centres. Normally state-supported. May be privately operated
Awareness, Technology Demonstration	Propagandises about virtues of new technology through the media, conferences etc. and by creating demonstration sites at end-users or special demonstration centres
Education	Provides specialist vocational or technical training outside normal education channels
Coordination	Coordinates other actions
Government Informatics	Defines technical standards and maintains good standards in the diffusion of IT within government organisations
Science Park	Property development with a charter to foster growth of high-technology firms
Inter-Agency Programmes	Large-scale technology programmes May involve coordinating efforts of different agencies or the creation of a joint/central programme management

Exhibit 4 Potential Make-up of Diffusion & Adoption Policy Packages

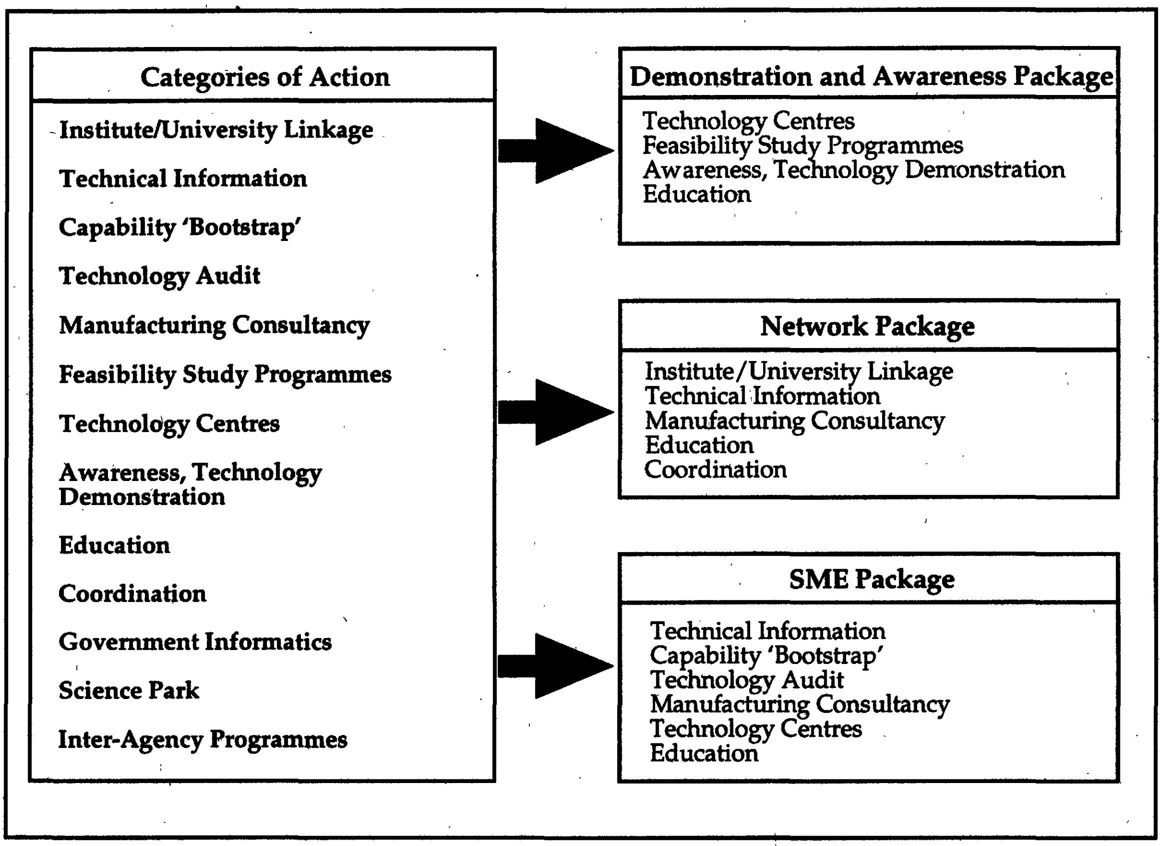
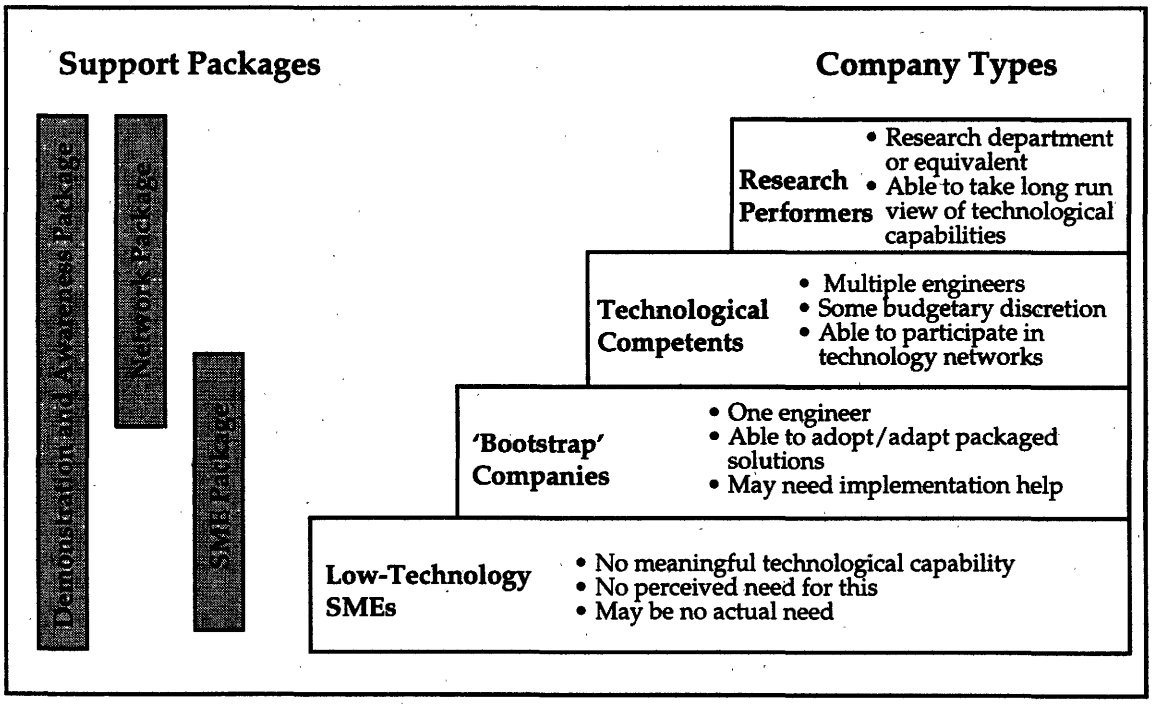


Exhibit 5 A Segmented View of Diffusion Policy Packages



3. Survey Results

The purpose of the survey was to collect basic information on Technology Demonstration and Application Centres (TDACs) in Ireland. The questionnaire was designed to gather information in the following main areas:

- Organisation - (status & type of institution, establishment, finance, personnel)
- Services - (main activities, technological fields, promotional activities)
- Client Base - (by type, sector, size)
- Future Developments - (strengths and bottlenecks, future plans)

3.1 Organisation

Of the 18 Technology Demonstration and Application Centres in Ireland which responded to the questionnaire, 78% (14) stated that their centre forms part of a larger organisation. The remaining 22% (4) stated that their centre is an independent body which concentrates on technology-related services, including demonstration. Exhibit 3.1 indicates how the centres are split according to type of institution, and it can be seen that most TDACs in Ireland are either university labs (6) or public research centre labs (5). The remaining centres are either private or semi-public research institutes or fall outside the categories listed.

Exhibit 3.1
(n=18)

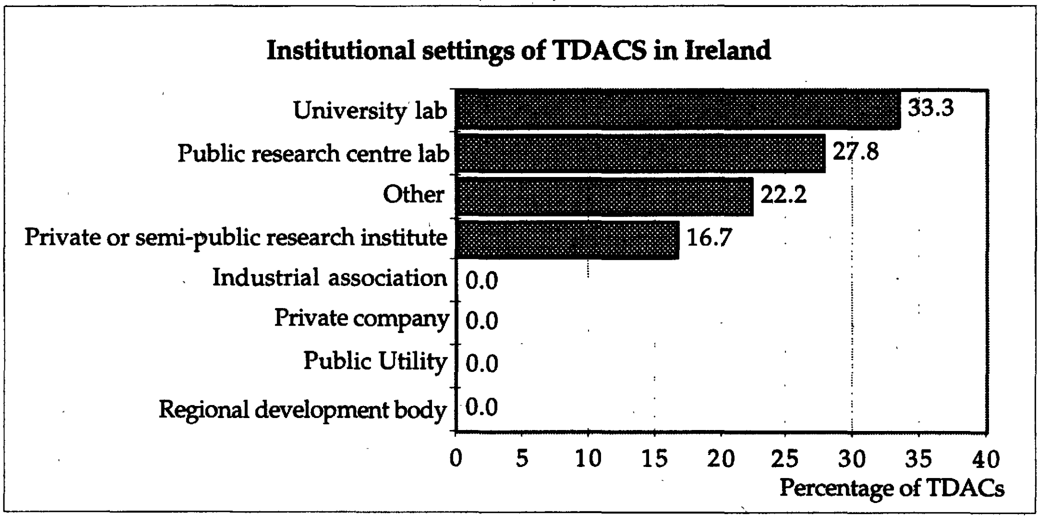
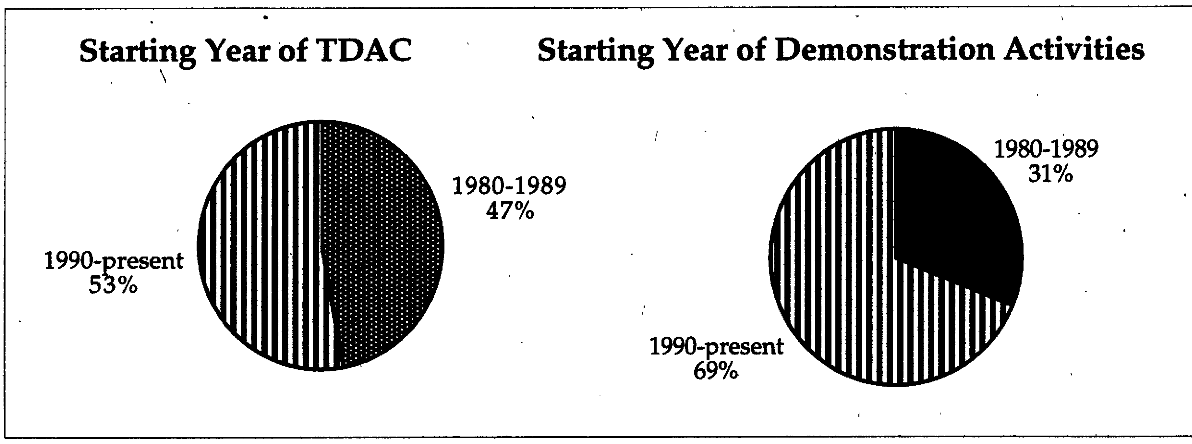


Exhibit 3.2 gives an indication of when the TDACs in Ireland were established and when they initiated their demonstration activities. All of the centres in the survey were established within the last 15 years, and just over half (9) were established in the last five years. As regards commencement of demonstration activities, it was found that only 29% (5) of the centres began to demonstrate advanced technologies in the same year as they were established. However, all of the centres but one had commenced demonstrations within their first two years.

Exhibit 3.2
(n=17)



The sources of the TDACs' budgets are shown in Exhibit 3.3. Public core funding represents the largest single source of revenue for the centres, comprising on average just over half of all income. Fees for services fund almost one third of budgets, and public project funding makes up most of the remainder. Only one of the centres in the survey was found to generate revenue through the charging of membership fees.

Exhibit 3.3
(n=18)

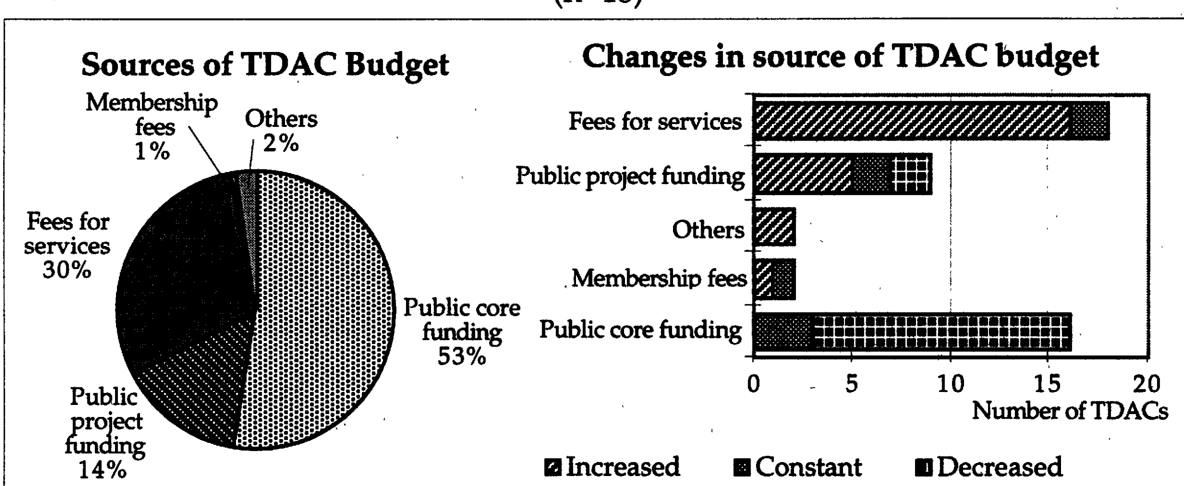
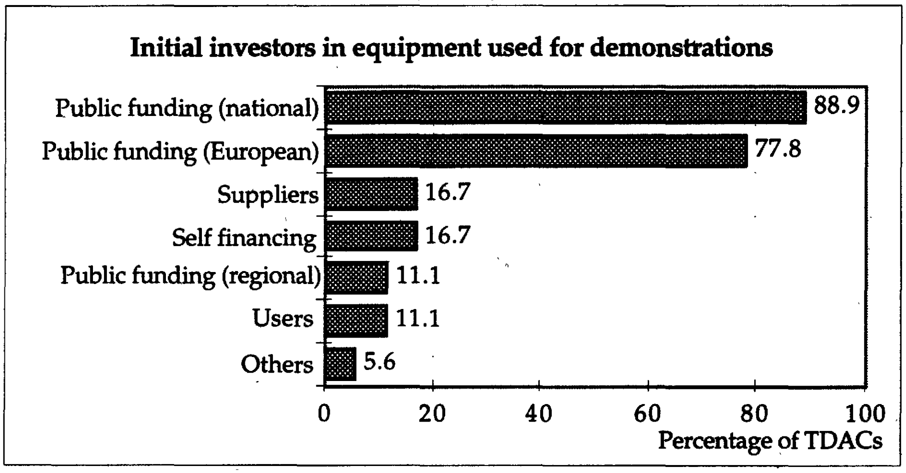


Exhibit 3.3 also shows how the sources of the centres' budgets have changed over the last three years. Here it can be seen that despite public core funding being the main source of income of the centres, it is definitely on the decline. Of the 16 centres that received public core funding in 1993, 13 stated that it now represents a proportionately smaller share of their budget than it did three years ago. Offsetting this, fees for services now play a more significant role in the financing of 16 of the centres. Public project funding has also shown a slight overall increase.

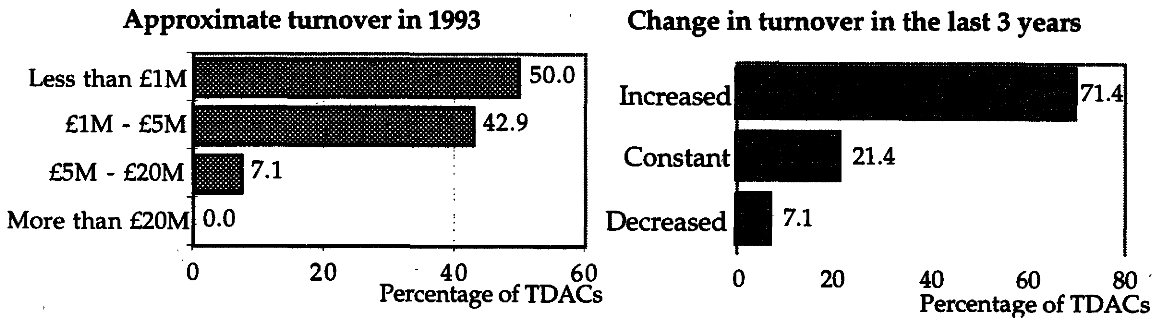
The initial investors in the equipment used to demonstrate technologies are shown in Exhibit 3.4. Most of the centres reported that investment had come from a variety of sources, but in the vast majority of centres it was public money that financed the purchase of demonstration equipment. Eighty-nine percent (16) of the centres had received money from the Irish government, and 78% (14) had received money from Commission sources. Only a few of the TDACs, however, had purchased equipment with money from suppliers (3), or from their own budgets (3).

Exhibit 3.4
(n=18)



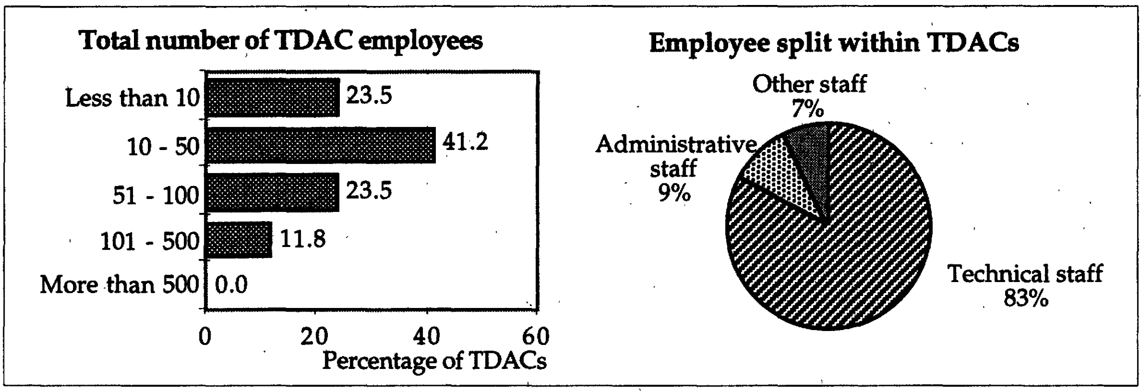
The average turnover of the centres taking part in the survey was found to be approximately £1.3M. Exhibit 3.5 shows that out of the 14 centres who responded to this part of the survey, exactly half (7) had turnovers of less than £1M. Six of the centres had a turnover of between £1M and £5M, and just one centre had a turnover greater than £5M. Exhibit 3.5 also shows how these turnovers have changed in the last three years. Over 70% (10) of the centres reported that their turnover had increased, while only 7% (1) reported that turnover had fallen.

Exhibit 3.5
(n=14)



The centres were asked to provide details about their employees, and the results are shown in Exhibit 3.6. Of the 17 centres responding, 23% (4) had less than 10 employees, 41% (7) had between 10 and 50 employees, 23% (4) had between 51 and 100 employees, and 12% (2) employed over 100 people. The average number of employees in an Irish TDAC was roughly 50. Exhibit 3.6 also shows that technical staff comprise on average 84% of the TDAC work force, with administrative staff and other employees making up the remainder in roughly equal proportions.

Exhibit 3.6
(n=17)



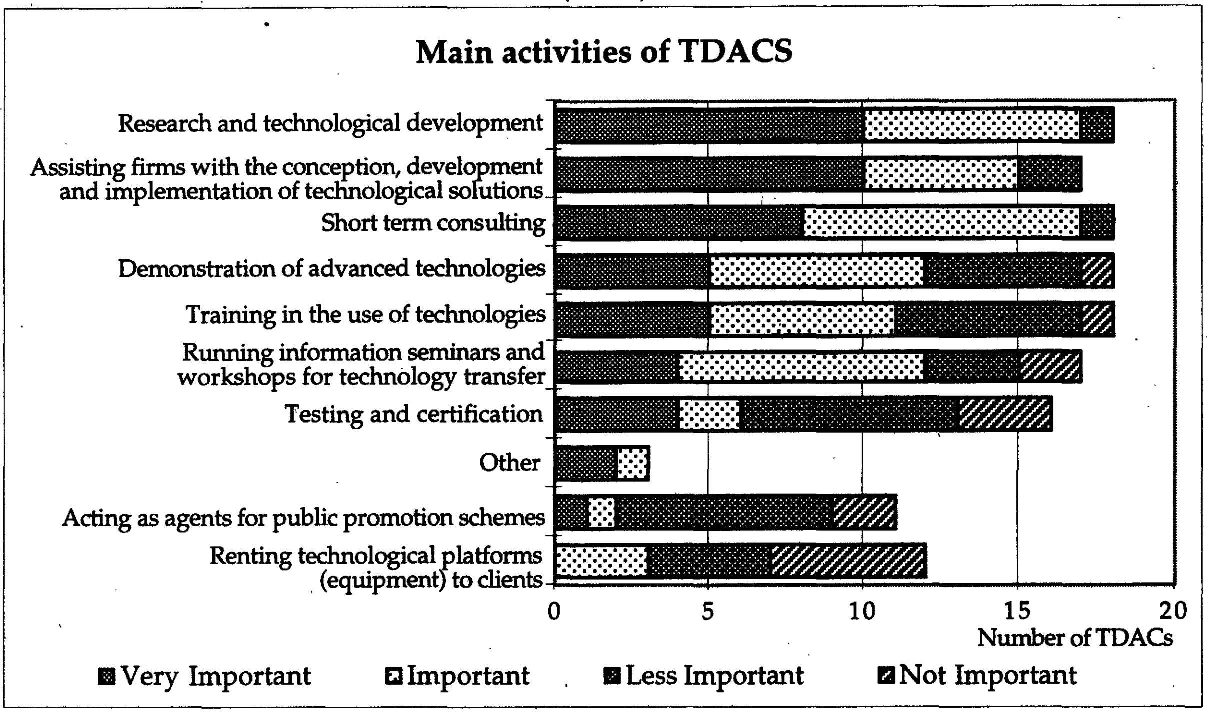
The survey revealed that the number of employees working in the centres is on the increase, with 11 of the 16 responding centres stating that their work force had increased over the last three years. The total decreased in only one of the centres. This upward trend in the number of staff working in the TDACs also applies to the number of staff undertaking demonstration activities in the centres. Twelve of the centres reported an increase here, with only one reporting a decrease.

3.2 *Services*

The TDACs were asked to rate the relative importance of a number of activities on a scale ranging from 'Very Important' to 'Not Important'. The results are shown in Exhibit 3.7 and it can be seen that the three main activities of the centres in the survey are R & D ('important' or 'very important' to 18 of the centres), short term consulting ('important' or 'very important' to 17 of the centres), and assisting firms with technological solutions ('important' or 'very important' to 15 of the centres). Demonstration of advanced technologies was found to be an important activity for two thirds of the centres (n=12) but only five centres considered it to be very important. Training in the use of technologies and running information seminars and workshops for technology transfer received similar ratings to demonstration activities. Exhibit 3.7 also reveals that testing and certification and acting as agents for public promotion schemes are, for the majority of TDACs, only a minor activity. The TDACs in the survey do not, on the whole, rent technology platforms to their clients.

No significant differences were found between the main activities of the independent TDACs in the survey and those that are units of larger organisations.

Exhibit 3.7
(n=18)



The TDACs were also asked to rate the importance of a number of technological fields in which demonstration and application services may be offered. Exhibit 3.8 shows the percentage of TDACs who rated each field as either 'Very Important' or 'Important'. Two thirds of the centres (12) rated electronics, communications and information technologies as an important field in which they provide their services, and services in the fields of materials and manufacturing were offered by almost half of the centres (8). Services relating to environmental, energy, chemicals and pharmaceuticals, and agricultural technologies were also offered, but only by a minority of the centres.

The centres were asked to classify themselves according to whether they were technology-centred (i.e. they demonstrated a single technology across multiple application areas and sectors), application-centred (i.e. they demonstrated multiple technologies in a single application area across multiple sectors), sector-centred (i.e. they demonstrated multiple technologies in multiple application areas relevant to only one sector), or other. Exhibit 3.9 shows the percentage of centres falling into each category, and it can be seen that one third of the TDACs (6) are technology-centred, one third are either sector-centred (4) or application-centred (2), and one third do not fall into any one of these categories. The six centres who rated themselves as 'other' all explained that they demonstrate multiple technologies in multiple application areas across multiple sectors.

Exhibit 3.8
(n=18)

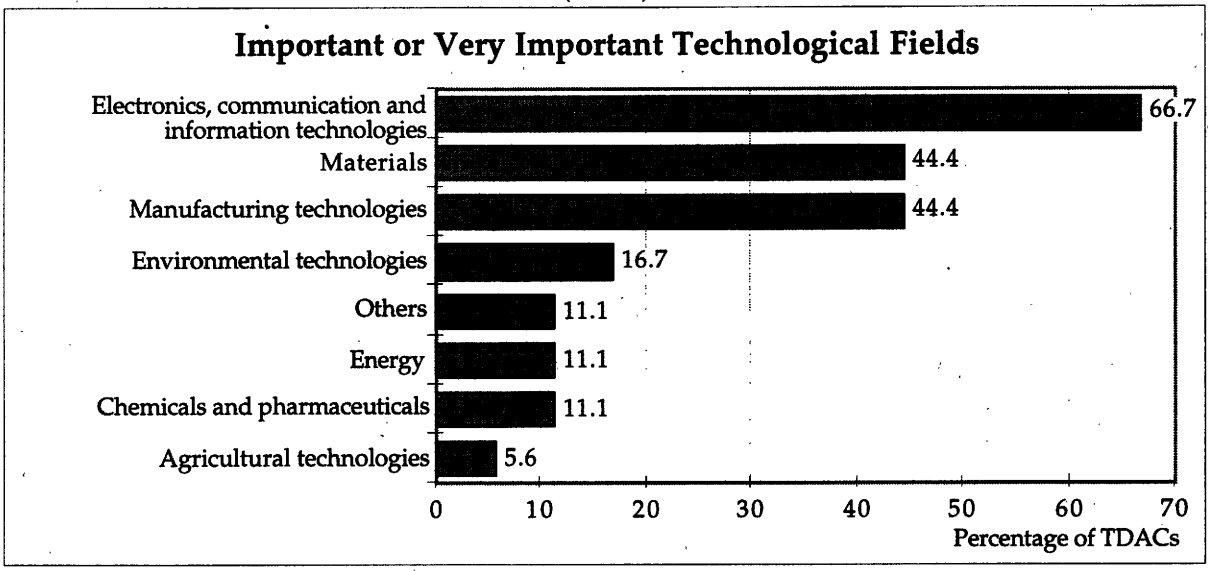
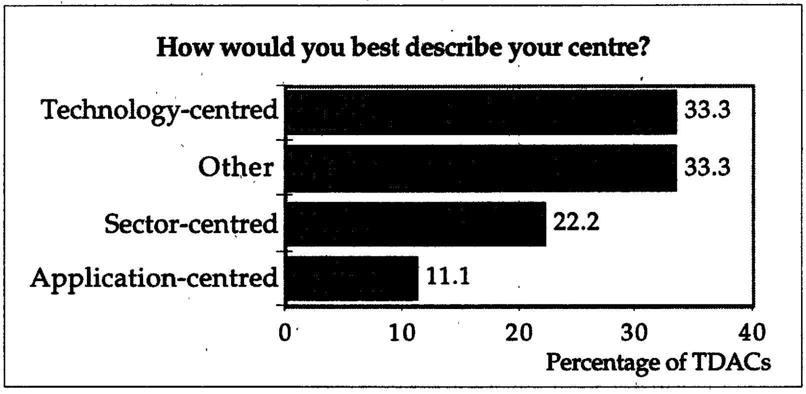


Exhibit 3.9
(n=18)



The means by which the TDACs in the survey demonstrate advanced technologies are shown in Exhibit 3.10. Two thirds of the centres use systems and equipment from a variety of manufacturers to demonstrate technologies, whereas none of the centres use systems and equipment from a single source. Almost half of the centres (8) use media based representations such as videos, charts, and computer simulations, and over a third (7) of the centres use physical models to represent the technologies demonstrated.

Exhibit 3.11 gives an indication of the marketing activities of the TDACs in Ireland, though only 10 of the centres responded to this part of the survey. Ninety percent (9) of the centres systematically promote their services. The ways in which these services are promoted are also depicted. Direct mailing of specific information is the most popular method, used by half (5) of the centres. Four of the centres said that they regularly advertise via publications in relevant journals, and the same number regularly participate in conferences and fairs to promote their activities. Only one of the centres places advertisements in the relevant media.

Exhibit 3.10
(n=18)

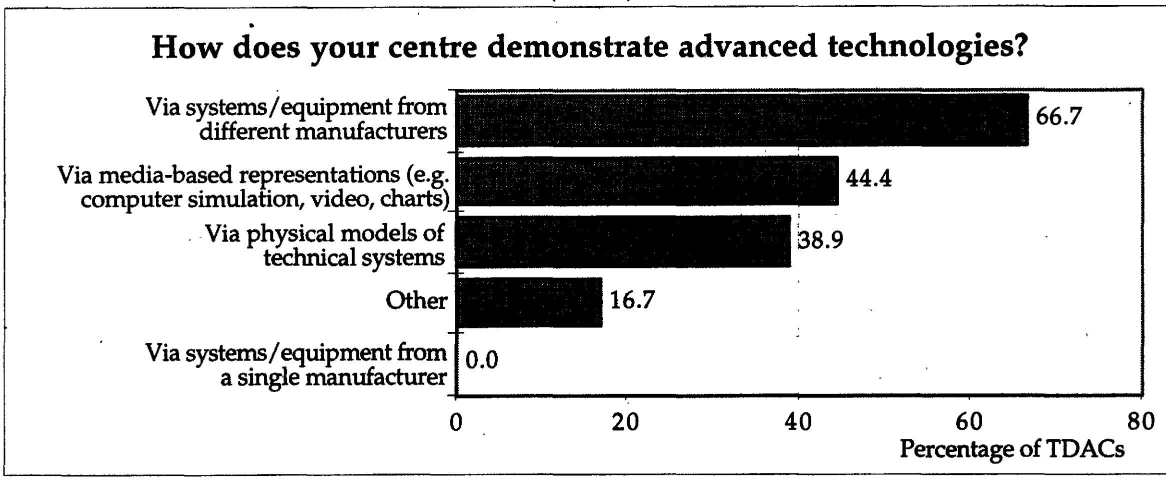
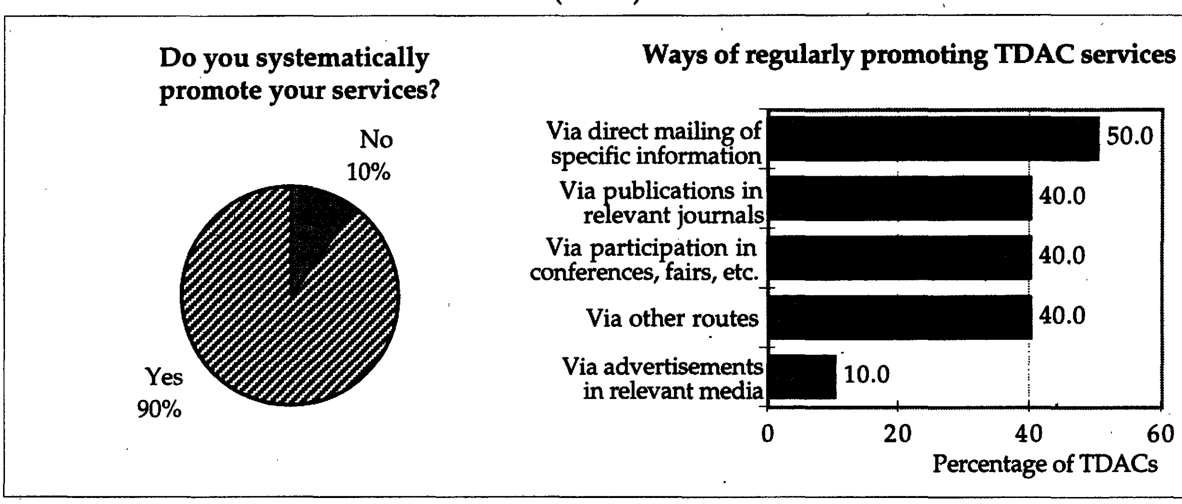


Exhibit 3.11
(n=10)



3.3 *Client Base*

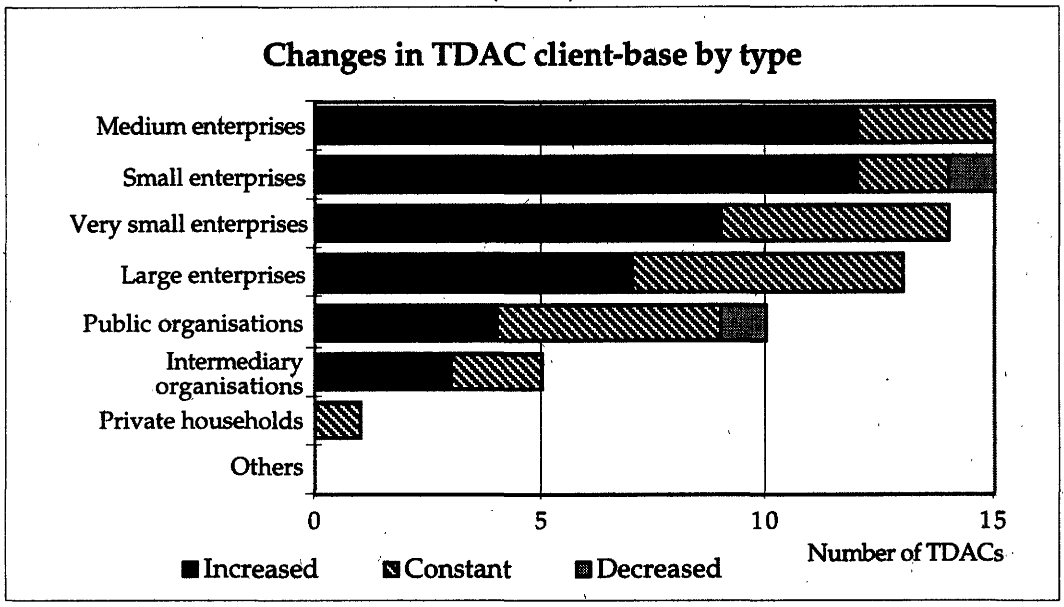
The client base of the TDACs was investigated by type, by sector of industry, and by geographical origin.

It was found that the average number of clients of a TDAC in Ireland is just over 100, and that 80% of the centres in the survey have increased their total number of clients over the last three years. None of the centres reported an overall drop in the number of clients.

The most common clients are medium sized enterprises (50-500 employees), representing 37% of all TDAC clients. Next most common are small enterprises (less than 50 employees), representing 31% of clients, and then very small enterprises (less than 10 employees), 20% of clients. Large enterprises, employing more than 500 people, represent 7% of the TDAC client base and public and intermediary organisations make up the rest with less than 5% each.

The survey also revealed how this client base has changed over the last three years (Exhibit 3.12). The majority of centres have increased the number of clients who are medium, small or very small enterprises. For most centres, the number of clients represented by large enterprises, public organisations, and intermediary organisations has remained the same.

Exhibit 3.12
(n=18)



The approximate share of clients by industrial sector, along with changes over the last three years, is shown in Exhibit 3.13. Almost three quarters of TDAC clients (72%) are from the secondary industries (manufacturing etc.), almost a quarter (24%) are from the tertiary industries (i.e. service-sector), and the remainder (4%) are from the primary industries. With the overall number of clients (for most of the centres) showing an upward trend, it is not surprising to find that more of the centres reported gains than losses. Of the centres with clients from secondary industries, five reported an increase, seven reported no change, and one reported a decrease in the number of clients from this sector. Of those centres with clients from the tertiary industries, half reported an increase in clients from this sector and there were no decreases. Numbers of clients from the primary industries have remained the same for most of the centres involved.

The approximate share of clients by geographical origin, along with changes over the last three years, is shown in Exhibit 3.14. Over three quarters of TDAC clients come from Ireland and almost one third are in the locality of the centres. Approximately one fifth of clients are based outside of Ireland. Exhibit 3.14 also shows that more of the centres are gaining clients than losing them, particularly in respect of international and other national clients.

Exhibit 3.13
(n=16)

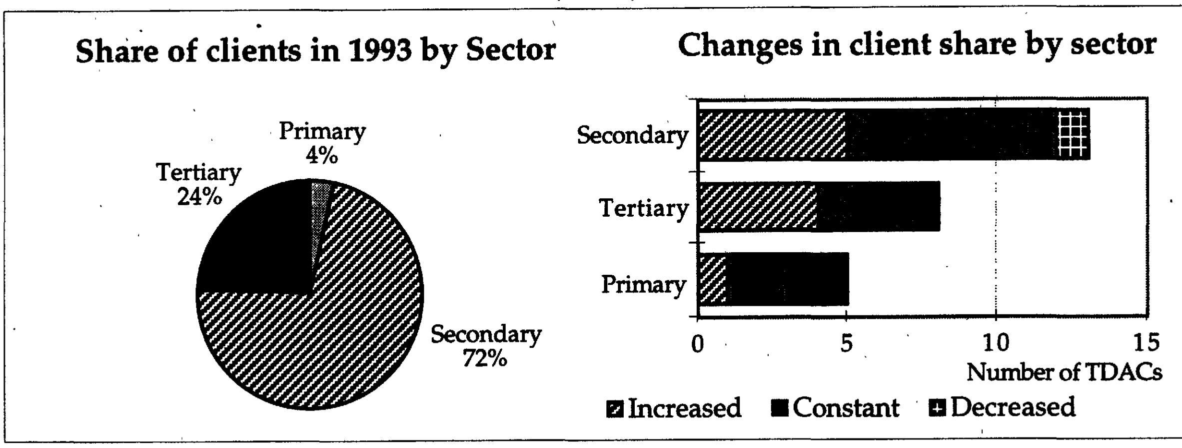
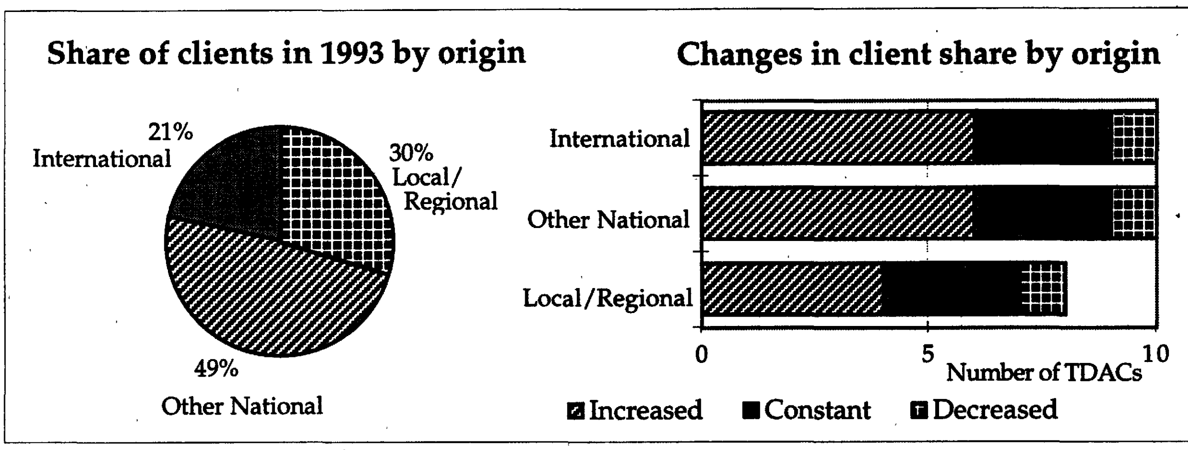


Exhibit 3.14
(n=11)



3.4 *Trends and Developments*

The centres were asked about a number of factors likely to affect the TDACs in the coming years, and were asked to rate each factor according to whether they perceived it as a major or minor potential strength/opportunity or a major or minor potential bottleneck/weakness. The percentage of centres rating each factor a potential major or minor bottleneck/weakness is shown in Exhibit 3.15. What is immediately obvious is that every single centre envisages problems in the future over the financing of demonstration equipment and facilities. All but one of the centres (10) see the financing of personnel as a potential bottleneck and almost three quarters (8) are concerned over the future recruitment of qualified staff. Most of the other factors are only viewed as potential bottlenecks, albeit minor ones, by a few of the centres. Although three of the centres expressed concerns over future developments in the national TDAC infrastructure, no such concerns were expressed in relation to developments in the EU TDAC infrastructure. None of the centres viewed the development of cooperative relationships with other TDACs as a potential threat.

Exhibit 3.15
(n=11)

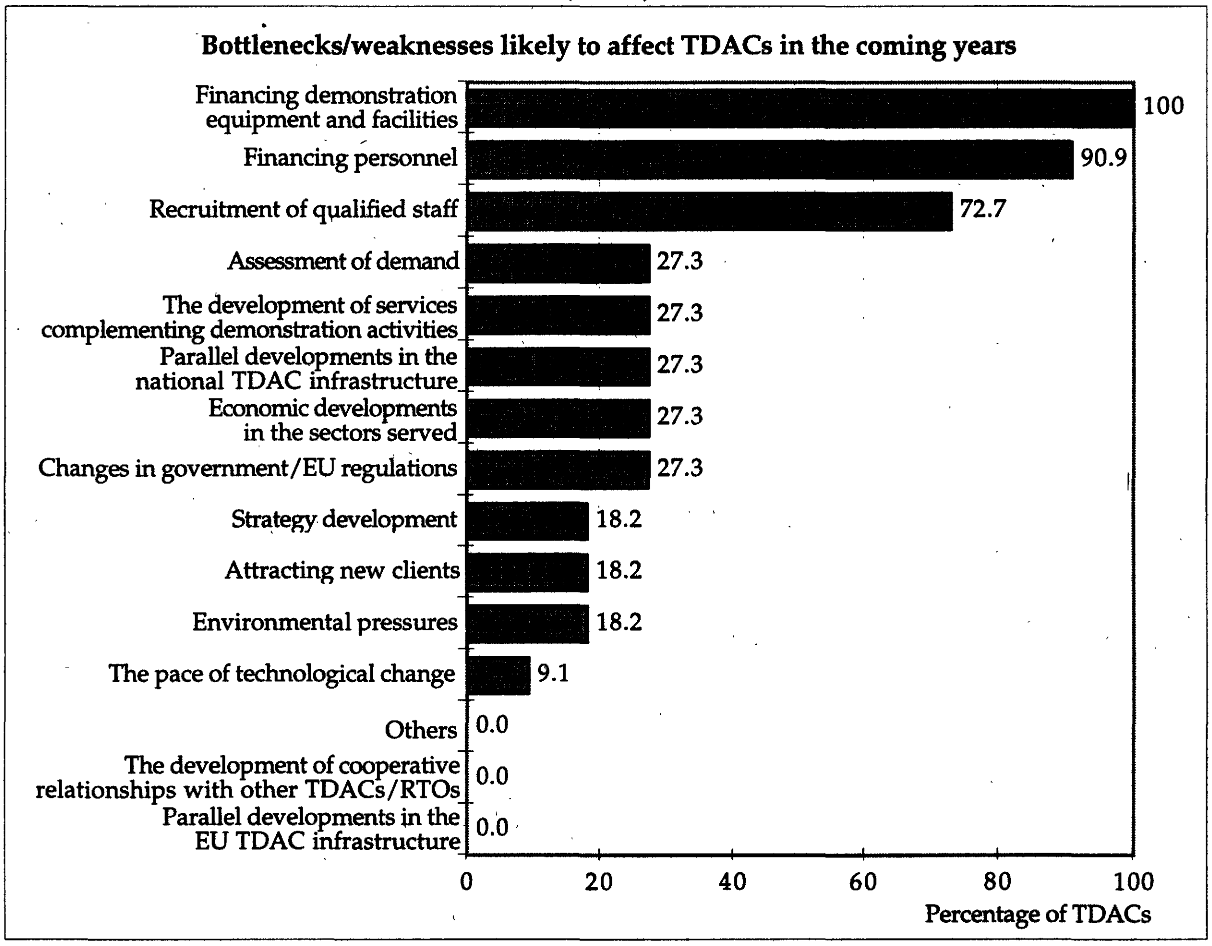
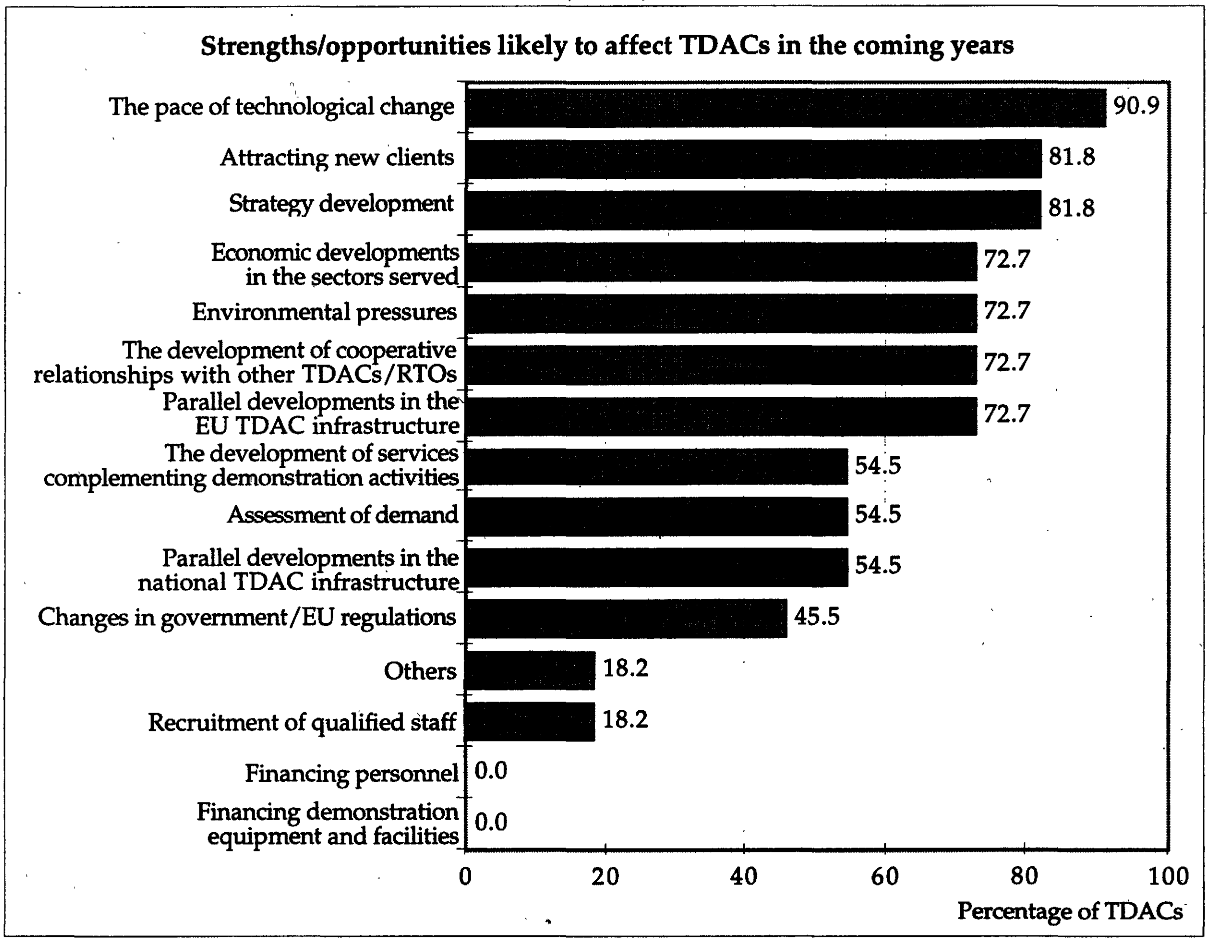


Exhibit 3.16 shows the percentage of TDACs rating each factor as a potential strength or opportunity. The main opportunities are the pace of technological change (10), attracting new clients (9), and strategy development (9). Economic developments in the sectors served were seen as an opportunity by almost three quarters of the centres, as were environmental pressures, the development of cooperative relationships with other TDACs, and parallel developments in the EU TDAC infrastructure. Over half of the centres (6) were optimistic about their ability to assess demand and develop services complementing demonstration activities, and a similar number view parallel developments in the national TDAC infrastructure as an opportunity in the future. Changes in government/EU regulations were seen as a potential opportunity by less than half of the centres (5).

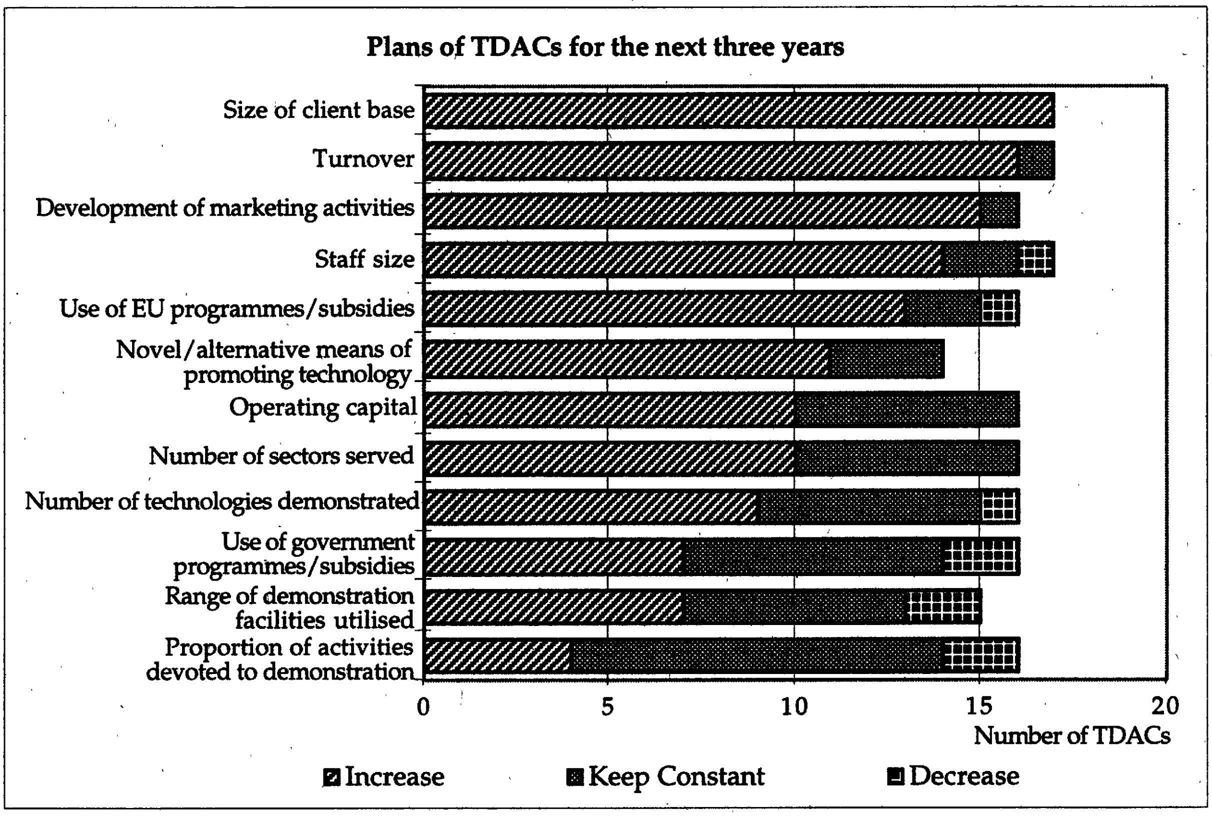
Exhibits 3.15 and 3.16 show clearly that on the whole more TDACs see the factors listed as opportunities than as bottlenecks. The only factors perceived by more centres as a bottleneck than as an opportunity were financing demonstration equipment and facilities, financing personnel, and the recruitment of qualified staff.

Exhibit 3.16
(n=11)



Finally, the TDACs were asked about their expectations for the next three years. Exhibit 3.17 shows that all of the centres who responded to this question (17) plan to increase the size of their client base. All but one of the centres (16) plan to increase turnover, and a similar number (15) expect to develop their marketing activities. The vast majority of the centres have plans to increase their staff size (14), as well as their use of EU programmes and subsidies (13). However, less than half of the centres (7) plan to increase their use of comparable national schemes, and two plan to reduce the assistance they get from the Irish government. The majority of TDACs hope to develop new or alternative means of promoting technology, as well as increasing operating capital, the number of sectors served, and the number of technologies demonstrated. On the other hand, the majority of centres do not foresee increases in the range of demonstration facilities used, or in the proportion of activities devoted to demonstration.

Exhibit 3.17
(n=17)



5. Summary

5.1 *The Status of TDACs in Ireland*

- Technology Demonstration and Application Centres (TDACs) in Ireland are embedded in a variety of institutional settings, the majority of which are university departments, public research centres and Research and Technology Organisations (RTOs). Some are independent bodies focusing on technology-related services, including demonstration, but the majority are component parts of larger institutions

- The Ireland TDAC scene is dominated by technology-centred institutions, i.e. centres demonstrating a single technology in multiple application areas and multiple sectors. Sector-centred and application-centred institutions are also represented, though to a lesser extent

5.2 *The Activities of Irish TDACs*

- Although technology demonstration activities are important in Ireland TDACs, they are secondary to primary activities such as R&D, short-term consultancy and assisting firms with the conception, development and implementation of technical solutions. Demonstration of advanced technologies, along with running information seminars and workshops for technology transfer, training in the use of technologies, and testing and certification are secondary activities of TDACS in Ireland

- Some Irish TDACs do act as agents for technology-related public promotion schemes, but for the majority it is a minor activity. Irish TDACs do not, on the whole, rent technology platforms to their clients

- Although there are RTOs in Ireland which focus on specific technological fields such as chemicals and pharmaceuticals, agricultural technologies and energy-related technologies, the majority of the institutions included in the survey offered demonstration and application services in the broad fields of IT, manufacturing, and materials-related technologies. Environment-related technologies were also offered, though to a lesser extent

- Almost all TDACs in the survey demonstrated systems and equipment from a range of manufacturers. Many used physical models and multi-media based representations, e.g. computer models, charts and videos as tools to demonstrate the relevant technologies

- The vast majority of TDACs do promote their services in a systematic fashion. The most popular mechanism is direct mailing of specific information. Publication in relevant journals and participation in conferences and fairs are also very popular promotion tools. Advertisements are also used, but their use is not as frequent

5.3 *Finance and Employment*

- On average, just over half of TDAC incomes are derived from public core funding. Just under one third comes from fees for services, and the remainder comes largely from public project funding

- Revenue from fees and public project funding of TDACs in Ireland have shown an overall increase over the last three years, though public core funding has decreased

- The majority of TDACs in Ireland experienced increases in turnover and staff numbers over the last three years

5.4 *The TDAC Client Base in Ireland*

- The TDAC client base in Ireland consists mainly of medium-sized (50-500 employees) and small organisations, with large organisations comprising only about 10% of the client base. There has been an increase over the last three years in all client categories

- Three-quarters of the TDAC client base are secondary industries, with tertiary industries comprising most of the remainder. Client share by sector has remained constant for most TDACs over the last three years

- Just under one-third of TDAC clients were local or regional organisations, almost half were other national organisations, and the remainder were international organisations

5.5 *The Future for Irish TDACs*

- Most of the TDACs in Ireland are optimistic about the future in terms of growth opportunities. They envisage increases over the next three years in operating capital, staff size, turnover and size of client base

- The majority of TDACs also plan to demonstrate more technologies across more sectors, using a wider range of demonstration facilities and new or alternative means of promoting these technologies. However, the majority of TDACs plan to keep constant the proportion of activities devoted to demonstration

- The majority of TDACs foresee an increase in their use of EU programmes and subsidies, while many see no increase in their use of comparable national support schemes

- The major constraint on the growth of technology demonstration activities is lack of finance for equipment and facilities. This is exacerbated by the availability of finance for skilled personnel and problems recruiting appropriate staff

- Changes in the external environment, such as the economic health of the sectors served, changes in government and EU regulations, and infrastructural developments affecting TDACs, offer both opportunities and threats. Although many TDACs in the survey did feel threatened by external changes outside of their direct control, most saw these changes as opportunities for expansion

- The majority of TDACs see environmental pressures and the pace of technological change as opportunities rather than threats

- The majority of TDACs are confident of their own abilities to assess demand, attract new clients and develop strategies capable of implementing services complementary to demonstration activities

4.6 *Technology Demonstration Policies in Ireland*

- There have been few policies focused on technology demonstration in Ireland. Support for R&D projects has often led indirectly to demonstration activities in TDACs, but there have been no policies geared directly towards the support of technology demonstration activities in recognised TDACs

- This situation is unlikely to change radically. There may be more opportunities for TDACs to participate in demonstrator programmes as the emphasis in Irish innovation policy continues to shift towards technology transfer and diffusion, but there is little indication that technology demonstration activities in TDACs are likely to occupy centre stage in policy terms

Appendix A

Survey Results - Summary of Main Findings

Organisation	
Status	Mainly sub-units of larger organisations
Type	Mainly university or public research centre labs
Establishment	Half 1980s; half 1990s
Funding	Mainly public core funding and fees for services
Investors in equipment	Public funding (National & European)
Turnover	Ranges from £90,000 - £5.3M. Average of £1.3M
Personnel	Ranges from 3 - 210. Average of 50 employees
Services	
Main activities	R & D, short term consulting, assisting firms with technological solutions
Technological fields	Electronics, comms & IT; materials; manufacturing
Demonstration methods	Systems from different manufacturers, media, models
Promotional activities	Direct mailing, journal publications, conferences/fairs
Client Base	
Number	Ranges from 11 - 330. Average of 110 clients
Type	Medium, small, and very small enterprises
Industrial sector	Mainly secondary (manufacturing etc.), some tertiary
Geographical origin	Mainly national, some international and local/regional
Future Developments	
Bottlenecks	Financing demonstration equipment, financing personnel, recruiting qualified staff
Opportunities	The pace of technological change, attracting new clients and strategy development
Future plans	Increasing size of client base, turnover, staff size and use of EU programmes. Developing marketing activities

Appendix B

List of Irish TDACs

Company	AMT Ireland
Address	Forbairt
	Glasnevin
	Dublin 1, Ireland
Tel	01 8370101
Fax	01 8367028

Company	AMT Ireland (Limerick)
Address	University of Limerick
	Limerick
	Ireland
Tel	061 331588
Fax	

Company	BioResearch Ireland
Address	Forbairt
	Glasnevin
	Dublin 11, Ireland
Tel	01 8370177
Fax	01 8370176

Company	Ceramics Research Centre
Address	Forbairt
	Glasnevin
	Dublin, Ireland
Tel	01 8370101
Fax	

Company	Ceramics Research Unit (Limerick)
Address	University of Limerick
	Plassey Technological Park
	Limerick, Ireland
Tel	061 333644
Fax	061 330316

Company	Materials Ireland
Address	Forbairt
	Glasnevin
	Dublin 11, Ireland
Tel	01 8372552
Fax	01 8372483
Company	Microelectronics Applications Centre
Address	Plassey Technological Park
	Limerick
	Ireland
Tel	061 334699
Fax	061 330316
Company	Multimedia Technologies Ireland Ltd.
Address	Robert Schuman Building
	University of Limerick
	Ireland
Tel	061 335140 or 333644
Fax	
Company	Optronics Ireland
Address	Forbairt
	Glasnevin
	Dublin 11, Ireland
Tel	01 8370740
Fax	01 8370845
Company	Plastics Centre
Address	Garry Castle Industrial Estate
	Athlone
	Co Westmeath, Ireland
Tel	0902 73088
Fax	0902 73090

Company	Power Electronics
Address	Forbairt
	Glasnevin
	Dublin 9, Ireland
Tel	01 8372326
Fax	01 8372411
Company	Power Electronics (Limerick)
Address	Dept. of E&CE
	University of Limerick
	Limerick, Ireland
Tel	061 333644 ext.2245
Fax	
Company	Software PAT
Address	Wilton Park House
	Wilton Place
	Dublin 2, Ireland
Tel	01 6686633
Fax	01 6605095
Company	Teagasc
Address	19 Sandymount Avenue
	Ballsbridge
	Dublin 4, Ireland
Tel	01 6688188
Fax	01 6688023
Company	Teltec Ireland
Address	Forbairt
	Glasnevin
	Dublin 11, Ireland
Tel	01 8370101
Fax	01 8377648

Company	Teltec Ireland (Limerick)
Address	University of Limerick Plassey Limerick, Ireland
Tel	061 333644
Fax	
Company	University College Cork
Address	Western Road Cork Ireland
Tel	021 276871
Fax	021 274420
Company	University College Galway
Address	Industrial Liaison Office University College Galway Ireland
Tel	091 24411
Fax	091 26388
Company	Waterford CAD Centre
Address	IDA-WRTC Innovation Centre Industrial Estate IRL-Waterford
Tel	051 54578
Fax	051 54601

Technology Demonstration and Application Centres in Italy

Country Report in the Framework of the SPRINT EIMS Project 94/71

CM International
Centrale Management
Vélizy - Villacoublay, France

June 1995

CONTENTS

DEFINITION AND DIFFERENCES OF TDACs
Compared to Related Institutions

A « Technology Demonstration and Application Centre » (TDAC) is understood as an institution which mainly offers public or private enterprises demonstrations of new technologies and distributes these services in a systematic marketing approach. In addition to that, it can offer further services such as information about and advice or training on new technologies, testing and certification, and so on. In detail, the services offered include the following aspects :

⇨ *Demonstration of New Technologies*
The operability, competitiveness or specific application of new technologies are demonstrated to back up the information and consultation offered. Different media methods may be used for this purpose.

⇨ *Information about New Technologies*
First of all, general information about how the new technology functions and its productivity. In addition, general information about aspects of application such as general prerequisites of implementation, organisation or qualification for using the technology.

⇨ *Advice about New Technologies*
Individual consultation is also offered alongside general information. This may relate to company-specific technical aspects as well as questions of utilisation (e.g. introduction strategies, training,..).

The services offered are generally neutral with regard to technology suppliers, are presented without sales intention and are aimed at public or private enterprises (i.e. private households are not included as a target group). Based on this definition, a TDAC has to be distinguished from institutions with similar aims and services such as :

⇨ *Technology Centres / Science Parks* : These institutions provide young companies developing new technology products and processes with a fully developed infrastructure as well as services and advice. In contrast to a TDAC, this is only offered to companies based within a technology centre.

⇨ *Technology Transfer Centres* : There are many different terms for this kind of institution such as technology transfer, technology advice, innovation advice or interface centre. Their common characteristic is that they all attempt to promote the transfer of information, knowledge and resources from Technological Resources Centres to companies. In contrast to a TDAC, the technology transfer centre does not necessarily have to be connected with the demonstration of systems or processes.

⇨ *Exhibition / Demonstration Centres of Technology Suppliers* : In contrast to a TDAC, these centres present manufacturer-related offers which aim to sell new technologies.

⇨ *Consumer Advice Centres (e.g. local utilities, energy suppliers)* : In contrast to TDACs, the services offered are aimed primarily at private households.

1. INTRODUCTION

➔ **Objectives of the European Study**

For Public authorities concerned by Technology Transfer policies, one of the crucial and current questions is the following : ***How to enlarge the innovation fabric and how to reach traditional SMEs ?***

This study evolved from the hypothesis that demonstration activities could be an adequate solution to facilitate the diffusion of technologies towards enterprises who, up until now, have not been aware of the existence, or the benefits, of such technologies. In this context, four main objectives formed the structure of the analysis :

⇨ *Characterise Technology Demonstration and Application Centres (TDACs) in the European Union* : Identifying technological and sectorial fields, status, regional distribution, activities, client base, finance structure, difficulties encountered and major trends.

⇨ *Compare TDACs with other types of Demonstration Tools, especially from the SME's point of view* : such as Company Visiting schemes, demonstration investment programmes, supplier commercial activities,..

⇨ *Compare existing public policies towards demonstrations.*

⇨ *From the lessons learned, identify some key areas for the Commission's policies (DG XIII).*

This study will also contribute to the share of experience / best practices between policy makers and TDAC managers at the European level.

1.1. Information Sources

The initial information on the Italian TDACs came from several different sources :
⇨ the AIRI (Associazione Italiana per la Ricerca Industriale),
⇨ the Ministry of Industry,
⇨ the Ministry of Research,
⇨ a directory of European Research and Technological Organisations (RTOs), from which the Italian centres were identified.

➔ **The TDAC Survey**

From the AIRI directory, a list of centres was preselected and submitted to the contact at the AIRI. Their agreement and opinion was asked for on the chosen centres.

In 60 % of the cases, some form of telephone contact took place with the centres after the questionnaires had been sent in order to find out what the centres understood by the term "demonstration activities", as the aim of the questionnaire was to characterise and highlight only the centres' demonstration activities. As expected, it was not very easy to make the questionnaires and the study understood because the term "demonstration" activities is not a term which is known or recognised.

TDAC INTERVIEW GUIDELINES

Objective	Topics / Questions
History	● Historic development of the demonstration activities - origin ? - evolution of client needs and anticipation of future client needs ? - investment strategy ?
Presentation of Demonstration Activities	● How important are demonstration activities compared to other services offered by your centre ? Brief description of the other services ● Description of the technology demonstrated. Why is a demonstration stage necessary for this technology? ● What is your definition of a demonstration activity?
Role in Innovation Process	● Role of TDAC in the dynamics of innovation, diffusion and technology transfer at sector and regional level ● Client base targeted ? Original expectations of the client ? ● Do you know of any other forms of demonstration ? ● Synthesis of the added value of a TDAC
Performance of Demonstration Activities	● Are the demands and the specific needs of the target groups (SMEs) met ? ● How successful has the TDAC been in providing innovation services ? ● Major bottlenecks ? What are the solutions envisaged ?
Management of Demonstration Activities	● Presentation of the different stages ● Key success factors ● Is this activity recognised by the institutions which finance you ? ● Any particular difficulties in obtaining financing for investment ? ● Methods to anticipate the future needs in terms of demonstration activities ? ● Methods used to attract potential clients ?
Public Policies	● Your evaluation of the position of TDACs in National technology transfer plans, ● Recommendations that can be given to regional, national and European policy makers ? ● Participation in any national / European TDAC network / Association ?

In total, 18 questionnaires were sent out of which 11 centres replied and 9 were then analysed.

➔ The TDAC Interviews

The data from the returned questionnaires were entered into a database, along with the data from the other countries being analysed, and from this a typology of the TDACs was produced. Once all of the TDACs had been slotted into the typology, it was decided to visit some of the centres in order to carry out more in-depth face-to-face interviews to be able to get a better understanding of the centre and its demonstration activities.

3 TDACs were visited in Italy : Centro Ceramico (Bologna), Centro Sviluppo Materiali (Rome), DEMO Center (Modena).

The interviews with the centres were carried out using the guidelines shown in the table opposite.

➔ The Policy-Maker Interviews

Similarly, the interviews with the Italian policy makers were carried out along the guidelines shown in the table over the page.

1.2 Content of the report

Having identified in the first section the methodology followed in this survey and any difficulties encountered, the second section will briefly cover the Technology Transfer activities in Italy. The third section provides mainly a quantitative presentation of the main results of the questionnaire survey.

The fourth section looks at the results from the interviews : a qualitative presentation and discussion of the field interviews will be given, focusing on the aspects of demonstration activities and using a detailed example of one centre complemented by the input from other interviews.

The fifth and final section contains the conclusions based on the survey.

POLICY MAKER INTERVIEW GUIDELINES

Objective	Topics / Questions
Role of TDAC	• Role of TDACs in public technology and innovation support programmes at sector and regional level, • Rationale for the existence of TDACs
Performance of TDAC	• Success of TDAC in supporting SMEs, • Are there technologies or applications which can be better diffused via TDACs ? • Effectiveness of TDAC activities, • Methodology and criteria used for the assessment of TDAC activities.
Public Policies	• Position of TDAC in National technology transfer systems / programmes, • Other related activities or measures in the area of technology transfer and innovation strategies promoted by the government, • Role of public authorities / sponsors (funding, strategies on technologies, application fields, target groups),, • Links with European policies (implications)..

2. TECHNOLOGY TRANSFER STRUCTURE IN ITALY

A national study carried out in 1988 identified 75 centres in Italy which provide technological services to firms. These centres' main activities include **supporting the modernisation processes of SMEs and providing services in order to stimulate structural modifications in the production process to improve the level of competition**.

The centres can be classified according to their main activity :

⇨ *Diffusion of Technological Innovation*
Diffusing knowledge in order to support the technical development of local firms by removing limitations on the transfer of innovation technologies from production centres to all current and potential users. This group includes Regional Agencies, Technology Info-Centres and Research Consortia.

⇨ *Relations among Firms*
Supporting efforts to reorganise industrial districts; building or rebuilding the network of relations with the aim of ensuring co-operation between all participants in the organisation of production. These centres usually provide specific services to firms belonging to the same industrial sector and try to launch some industrial networks (notion of clusters).

⇨ *External Economies*
Increasing the efficiency of an area by building a favourable environment for the creation of new economic activities. This group includes Business Innovation Centres (BICs), Science Parks and Research Areas.

These technology centres are supported by numerous national initiatives and institutions. Globally, however, public policy in support of technological innovation does not have a long tradition in Italy and in fact, the arrival of public policy supporting high technology sectors coincided with the emergence of industrial and scientific lobbies in advanced sectors.

National Initiatives

Public policy supporting innovation is implemented in Italy principally via three different initiatives :

⇨ *National Research Council Finalised Programmes (FPs)* - These were launched in 1975 and originally intended to **guide basic research results from the universities and research organisations to industry**. With regards to the sectors affected by the FPs, the financing distribution during the period 1976-1990 has favoured advanced technologies but also has included an educational component (fellowship grants).

⇨ *National Research Programmes of the Ministry for University and Scientific-Technological Research (MURST NRPs)* - These were designed to stimulate co-operation in R&D in high-risk projects and are defined in a top-down approach by MURST. The current objective is to **activate broad technology transfer, promoting transversal research programmes with commercial spin-offs in different sectors**.

⇨ *Applied Research Fund (ARF)* - This fund is managed by IMI, (Industrial Credit Institute), under the guidance of MURST. Up until now, the support has been highly concentrated in the oligopolistic core (FIAT, Olivetti, IRI,..).The purpose is that the fund acts as an **incentive for industrial innovation by promoting autonomous applied research programmes in industrial firms**. The aim is to acquire advanced knowledge and methodologies of product and process development, as well as to create new research centres. The main sectors to benefit from these funds are the electronics, pharmaceutical and mechanical sectors. Although, the fund was modified in 1982 to include an increased contribution towards SMEs, SMEs have received a very limited share of the total funds; much less, in fact, than the minimum share of 20% allocated to them within the ARF.

In addition to these initiatives, several other laws have been introduced within the Italian technology transfer structure, one of which is the *Law n.317*. Within the framework of this law, a "facilitation" system has been introduced specifically for SMEs and the Craft industry, thus compensating the disadvantages of other laws and initiatives for small enterprises.

The objective of this law is the **diffusion of technological innovation** - especially within SMEs, providing facilities and new procedures. The law identifies specific types of innovation expenditure to be subsidised, that can also be extended to include the purchase of services necessary for the development of production and marketing support. Facilities are also provided for internal research development.

Institutions

Various national and regional institutions also exist in Italy which carry out the abovementioned initiatives. In particular, the following institutions play an important role in technological development activities:

⇨ *MURST* - Responsible for promoting university education and scientific research and guiding and co-ordinating universities and research bodies.
⇨ *Universities*

⇨ *National Research Council (CNR)* - This is the major public body and is responsible for the Finalised Programmes and Strategic Programmes, education and training.

⇨ *ENEA (New Technology and Environmental Agency)* - Established in 1982 after the reorganisation of CNEN (Italian Atomic Energy Commission), the objectives of ENEA are to **promote, implement and co-ordinate research and consulting activities and technology transfer** in the fields of energy, environment and technological innovation.

⇨ Out of the 6 Italian Research and Technological Organisations (RTOs) identified in the survey, 3 declare to have some form of demonstration activities. The other TDACs identified are either private initiatives or initiatives launched by the regional policy makers.

3. SURVEY RESULTS

3.1 Introduction

The body of this section is based on the country particularities that have been identified from the results of the Italian survey, compared to the overall results of the European countries analysed. For more detailed information on the overall results, please consult the synthesis of the study.

➔ The list of Italian TDACs

The table on the following page lists the 9 TDAC centres that were analysed in the study and gives their address and area of activity.

➔ Map of Italy showing the locations of the Italian TDACs identified in the Study

List of the Italian TDACs analysed

➢**DEMO CENTER**
⇨41100 MODENA
⇨ Electronics, Comm. & Info. Technologies
⇨ Manufacturing technologies

➢**CENTRO INNOVAZIONE LECCO**
⇨ 22053 LECCO
⇨ Plasma fusion
⇨ Laser welding
⇨Simulation of manufacturing processes
⇨Robotics

CENTRO CERAMICO (CC)
⇨ 40138 BOLOGNA
⇨ Energy saving technologies (ceramic industry)
⇨ New production technologies (ceramic industry)

➢**INSTITUTO PER LE RICHERCHE DI TECHNOLOGICA MECCANICA E PER L'AUTOMAZIONZ (RTM)**
⇨ 10080 VICCI CANAVESE
⇨ Applications of laser technology
⇨ Development of special process systems
⇨ Development of special software packages (not specifically laser)

➢**CSELT**
⇨ 10148 TURIN
⇨ Infrastructures and services for telecomms.
⇨ Electronics and optical components
⇨ VLSI - TLC

➢**CISE**
⇨ 20090 SEGRATE
⇨ Laser processing

➢**CATAS**
⇨ 33048 SAN GIOVANNI AL NATISONE (UD)
⇨All technologies involving wood and furniture

➢**DIESEL RICERCHE**
⇨ 34018 SAN DORLIGO DELLA VALLE
⇨ Harmful emissions reduction technologies
⇨ Energy recovery (from industrial and domestic waste)
⇨ Advanced technologies for diesel engines

➢**CENTRO SVILUPPO MATERIALLI (CSM)**
⇨ 10747 ROME
⇨ Continuous steel making process
⇨ Continuous dry coating of steel sheets

➔ The Organisation, Status and Size of Italian TDACs

Almost all of the centres who replied to this question declared to be an independent unit.

- 4 of the 6 centres who replied declared themselves to be a private or semi-public research institute and 2 are private companies, which is quite rare in the Southern European countries.

- Although 2 out of 8 of the centres are very big organisations with more than 250 employees, 4 out of 8 are still fairly small only employing between 5 and 15 full time staff.

3.2. Activities of Italian TDACs

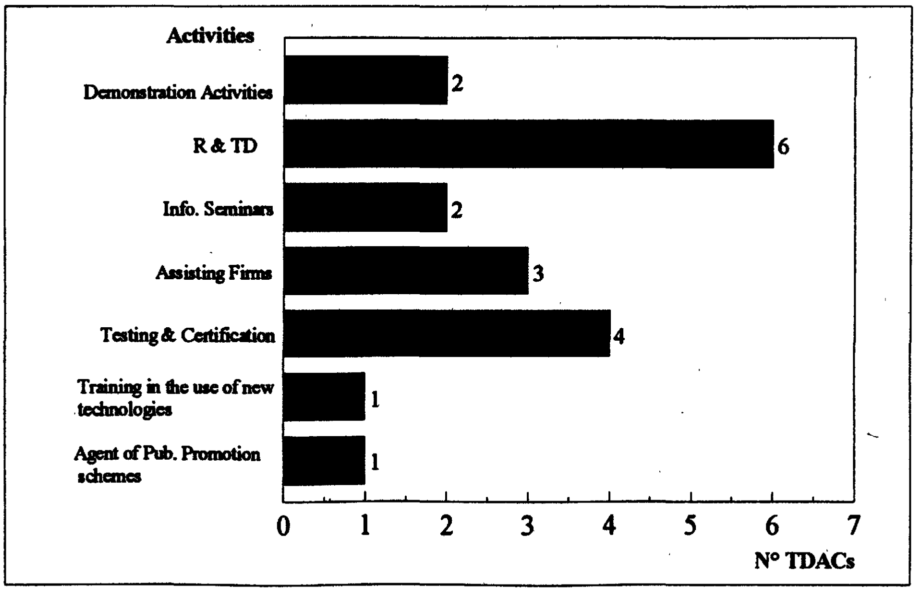
➔ R&D is the primary activity

The centres carry out numerous activities other than the demonstration of advanced technologies and in fact, this activity in only considered to be "very important" by 2 out of 9 centres, which is much lower than the E.U. average of 42 %.

From the analysis of the centres, it can be said that globally, **Research and Technological Development plays a much more important role (in 6 out of 9 centres) within the Italian TDACs than the demonstration of advanced technologies.**

Testing and certification is also seen as a "very important" activity by 4 of the centres.

Activities mentioned as "very important" by Italian TDACs



Definition of the TDAC Typologies

Two main elements have been used to typify TDACs within the European Union :

1) The importance of the demonstration activity for the centre, which differentiates 3 classes :

- **Non TDAC** (15% of the first European sample) - where the demonstration activity is not important. These centres have been kept out of the analysis.

- **Weak definition TDAC** (18% of the first European sample) - where the demonstration activity is not one of the most important activities of the centre.

- **TDAC** (77% of the first European sample) - where the demonstration activity is strategic for the centre (one of the most important areas of activity for them).

2) The nature of the major associated activities within TDACs, excluding Non TDACs and Weak definition TDACs. From this, three new classes emerge:

- **Pure Demonstration Centres** (4% of European TDACs) - where demonstration is the only activity of the centre.

- **Integration Centres** (35% of European TDACs) - these centres are oriented towards helping the SME integrate new technologies (technical assistance, testing, training,..).

- **Development Centres** (57% of European TDACs) - these centres are oriented towards developing / adapting a new technology for the particularities of a particular industrial sector (R&D in particular)..

Typology of Italian TDACs

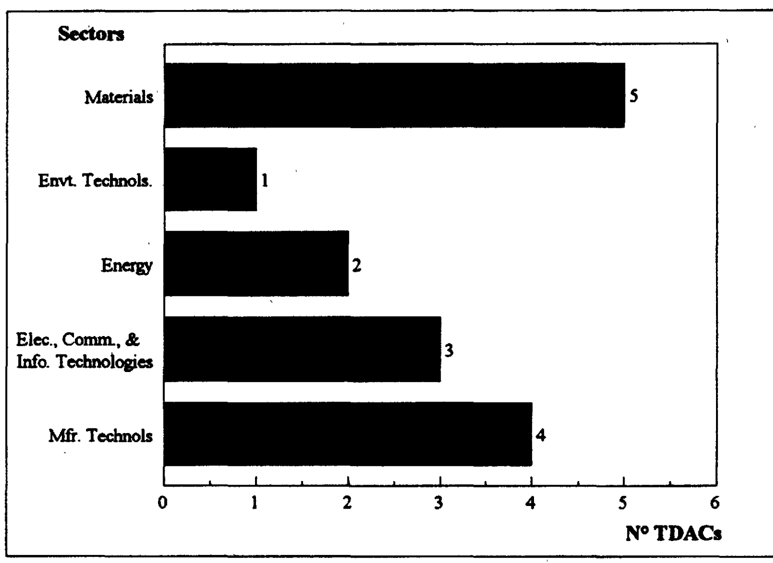
Weak Definition Centres	**TDACs**		
	Pure Demo.	**Integration Centre**	**Development Centre**
CATAS		Demo-Center	Centro Sviluppo Materiali
		Cento Innovazione Lecco	RTM
			CISE
			CSELT
			Centro Ceramico
			Diesel Ricerche

➔ Sectors and Technological Fields : Materials and Manufacturing Technologies

5 out of 9 Italian TDACs consider the technological field of Materials to be a "very important" sector in which to offer their services. Manufacturing technologies is another sector thought of as very important (by 4 out of 9 centres).

Compared to the EU average, the Electronics, Communications and Information Technologies sector is a sector served more by the Italian TDACs than by their European counterparts (1/3 of the centres classed it as "very important").

Sectors and Technological Fields



➔ Typologies : most of Italian TDACs are development oriented and sector oriented

- The table opposite describes the various typologies that were identified in the study.

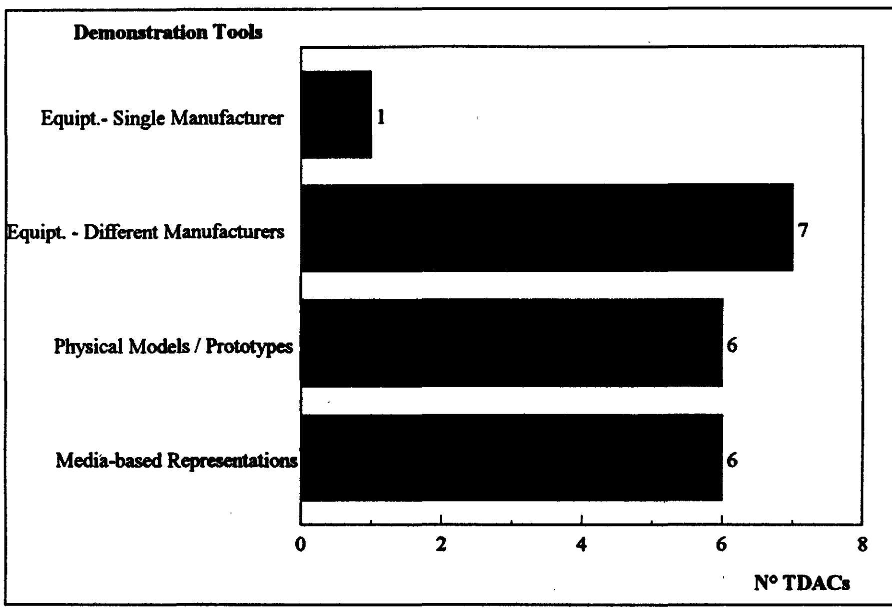
  Looking at the typology based on the associated activities, 2 out of 9 Italian TDACs are classed as "Integration" centres, focusing on training and consulting, but the majority, 6 centres, are "Development" oriented centres reflecting the importance attributed by the centres to R&D and Testing and Certification.

- **6 out of the 9 centres work with a specific sector such as the ceramic industry (Centro Ceramico) and the steel industry (Centro Sviluppo Materials).** 2 centres focused on a specific technology such as the laser and one centre described itself as multi - oriented, not focusing on any particular area.

➔ Methods of Demonstration : media-based representation and physical models

In order to demonstrate these advanced technologies, 6 out of the 9 centres analysed declare to do so either via the use of physical models/prototypes of new technical systems (which is a much larger proportion than the average E.U. TDAC) and/or by media-based representations. They do also however follow the E.U. average in that 7 out of 9 Italian TDACs use the most commonly used tool of demonstrating via systems from different manufacturers.

Tools used to Demonstrate Advanced Technologies



➔ Diffusion / Promotion channels : Mailings and conferences

In Italy, 5 of the TDACs systematically promote their TDAC services. In order to promote them, like the German, the Spanish and the French, **4 out of 6 Italian TDACs regularly use the channel of mailings. The same number of centres also regularly participate at conferences and fairs in order to promote their services**. Any form of media or publications in journals is not a channel regularly used by the Italian centres. In fact, not one Italian TDAC regularly advertises in relevant media and only 1 regularly places publications in relevant journals.

3.3. Finance Structure : the predominence of public financing within the TDAC budget

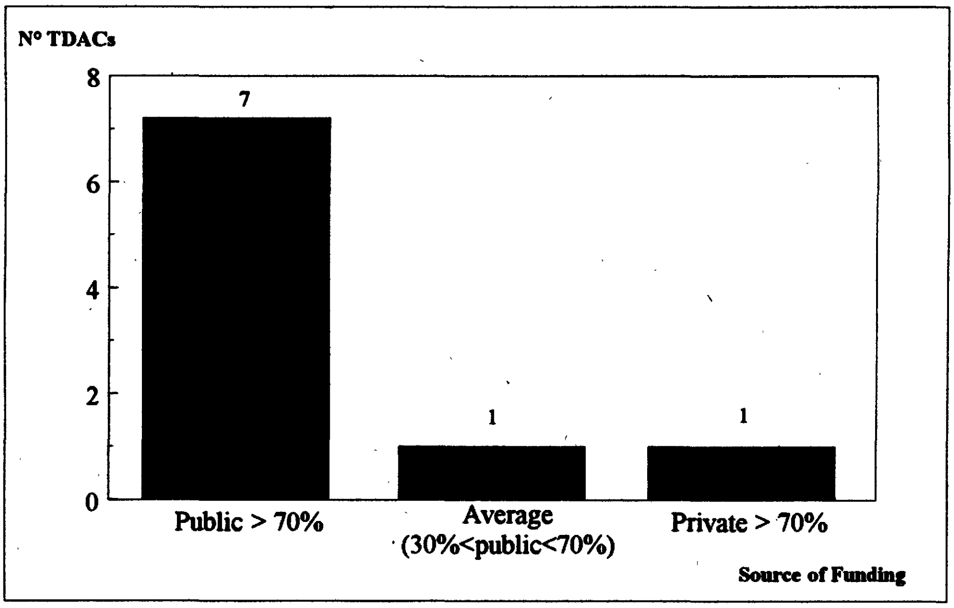
➔ Initial Investment

In Italy, the TDAC centres declared that the initial investment in their centre was financed more or less equally by several different sources. National and regional public funding played the same role funding 3 out of 8 centres and suppliers also funded this number of centres. Notably different from the E.U. average however, is that 37 % (again 3 out of 8) of centres were funded by their users compared to an E.U. average of 20 % and 5 out of 8 centres stated that they funded themselves (which is again superior to the E.U. average).

➔ Budget Sources

The current financing structure of TDACs in Italy is fairly different to elsewhere in Europe. Despite the fact that for 63 % (5 out of 8) of the centres, the initial investment in the centre was funded by self-financing, **7 out of 9 of Italian TDACs claim that they are funded more than 70 % by public funds**. Only 1 centre claims to be funded more than 70 % by private funds.

Budget Sources of Italian TDACs



3.4. Client base : 1/3 of Italian TDACs have an international client-base of more than 20%

For 2/3 of the Italian centres, over 60 % of their clients are small enterprises (less than 50 employees). In addition, 4 out of the 9 centres said that over 60 % of their clients were of a local/regional origin.

With regards to international clients, there is quite a difference compared to the EU average. 33% of Italian TDACs have an international client base of more than 20%, compared to the EU average of 20%.

3.5. Conclusion

From the quantitative information given in the survey, the following points stand out as being fairly specific to the Italian TDACs :

- ⇨ The demonstration of technologies are only considered as "very important" by 2 centres.
- ⇨ The majority of Italian TDACs are "Development oriented" centres.
- ⇨ 6 out of 9 centres work with specific sectors (sector oriented).
- ⇨ Self-financing contributed to the initial investment in 5 out of 8 centres.
- ⇨ 7 out of 9 centres are funded more than 70 % by public funds.
- ⇨ Small enterprises represent over 60% of the client base for 2/3 of Italian TDACs
- ⇨ 1/3 of Italian centres have more than 20% of their client base represented by international clients.

DEMO CENTER

Status :	Independent Unit (Regional Development organisation)
Annual turnover :	400,000 Ecus (1993)
Initial Investment :	Regional Public funding and Suppliers
Budget sources :	Public project funding (90%) and fees for services (10%)
Principal activities :	Demonstration of advanced technologies
Technological domains :	Electronics, Communication and Information technologies, Manufacturing technologies.
Demonstration method :	Physical models or prototypes of technical systems and media based representations. Systematic promotion of TDAC services through mailings and personal visits
Total number of staff :	8 (5 technical, 2 administrative, 1 management)
Client base :	Total clients : 50 80% have less than 50 employees Local / regional origin (90%)

4. INTERVIEW RESULTS

4.1. A case study of the "Demo Center"

The Demo Center is the initiative of two regional institutions and two industrial associations from the industrial basin of Modena.

➔ The Centre's Mission

"To develop and diffuse Communication and Information technologies within local SMEs."

• ***The Demo Centre sees itself as an intermediary in the expressing and revealing of needs phase***

By showing the opportunities represented by these new Communication and Information technologies, the centre arouses needs within the SMEs that cannot be met by the commercial activities of their equipment suppliers. Furthermore, because they are perceived as a neutral intermediary, the Demo - Center is good at accompanying the enterprises throughout the phases of their projects involving technlogical change.

➔ The principal activities of the Demo - Center

⇨ Making enterprises aware of CAD/CAM technologies/software to aid production, rapid prototyping,..

⇨ Demonstrations through "industrial platforms" which permit real technological simulations

⇨ Assistance with the choice of equipment suppliers

⇨ Training of personnel.

Different to certain other European TDACs however, the Demo - Center does not wish to be involved in the industrialisation of the technology (e.g., no technical assistance at the launch of the technology/equipment).

With regards to the assistance that the centre offers in the selection of an equipment supplier, the Demo - Center prefers to work in conjunction with the enterprise to establish an objective list of selection criteria which is specifically adapted to the case of the particular enterprise. According to the manager of the Demo - Center however, the choice of the technology/equipment supplier must be made by the enterprise itself and be an autonomous choice.

• ***Different from other TDACs encountered, the Demo - Center does not have at its disposal its own demonstration equipment.***

The equipment demonstrated in the centre is loaned by the equipment supplier but who can then also use the centre for his own commercial demonstrations and the training of his clients or even employees. In this way, the pre-industrial production lines/platforms are loaned by different suppliers and in general, change two or three times per year. The computer equipment is also loaned by the suppliers with whom, subsequently, the Demo - Center maintains a privileged, yet independent, relationship.

• ***The Demo - Center places great emphasis on optimising production within SMEs through its training and advice activities.***

The training sessions are organsied to take place either at the Demo-Center or directly in the enterprise itself.

4.2. Lessons from the TDAC Interviews

The two other structures that were visited (Centro Ceramico and Centro Sviluppo Materiali) both also integrate demonstration activities into their centres' activities. However, as their principal activity remains collective research and they act as an RTO, demonstration activities remain fairly limited.

Originally their activities would have revolved primarily around traditional technology transfer activities and research, however recently, the centres have developed some activities of demonstration although always on the model of the following :

- ⇨ Detection of new needs, such as demonstrating specialised software to help production and new processes for shared applications,
- ⇨ Research and Development,
- ⇨ Development and realisation of industrial prototypes,
- ⇨ Association with a partner for the commercialisation of the technology/equipment, including commercial demonstrations.

The Centro Sviluppo Materiali has developed, for example, a software to detect defects which is adapted to the iron and steel industry/metal transforming industry. Certain members of the centre financed the research, but the promotion and diffusion of the system should concern all of the sector.

When asked what their plans over the next three years would include, all of the centres analysed in the study categorically agreed that they would develop their marketing activities. However, only a few (4 centres) said that they would increase the proportion of activities devoted to demonstration, the range of demonstration facilities used or the number of technologies demonstrated. As for the numbers of technological fields served, 2/3 of the centres stated that these would not change.

4.3. What do enterprises think of Demonstration Activities ?

In several of the cases, the enterprises had already had some form of contact with the technology transfer structure before they were made aware of the demonstration activities and the associated benefits.

The advantages offered by subscribing to the TDACs (according to the enterprises) are numerous and include :

- ⇨ "the centre revealed needs unexpressed until now, and stimulated a feeling of curiosity",
- ⇨ "helping to break down the reticence of management and employees",
- ⇨ "the enterprises work directly with the Demo - Center who trains and stimulates the engineers",
- ⇨ "the centre is a rapid and inexpensive means of carrying out Technological Monitoring and experimenting with new technologies".

CENTRO SVILUPPO MATERIALI SpA	
Status :	Part of a larger organisation (semi-public institute)
Year of creation :	1958 (Demonstration activities began in 1985)
Initial Investment :	National Public funds and self financing
Budget sources :	Public core funding (20%), fees for services (15%) and membership fees / donations (65%)
Principal activities :	R&D, testing & certification
Technological domains :	Materials - continuous steel-making processes, continuous dry coating of steel sheets, ...
Demonstration method :	Physical models / prototypes of new technology systems. No systematic promotion of TDAC services
Total number of staff :	420 (350 technical, 50 administrative, 20 others)

CERAMIC CENTER	
Status :	Independent Unit (Semi-public research institute))
Annual turnover :	1.4 Million Ecus (1993)
Initial Investment :	European Public funding, suppliers, users and self financing
Budget sources :	Public core and project funding (15%) and fees for services (85%)
Principal activities :	Demonstration of advanced technologies
Technological domains :	Manufacturing technologies (energy saving technologies and new technologies for the ceramic industry), Materials, Energy
Demonstration method :	Systems from different manufacturers No systematic promotion of TDAC although does participate in conferences and fairs.
Total number of staff :	34 (29 technical, 5 administrative)
Client base :	Total clients : 650 80 % have more than 10 employees Ceramics sector Local/regional origin (68 %)

4.4. Role of the Policy Makers

Two initiatives have been identified among the Italian Policy Makers.

➔ Technology Transfer Department of ENEA (Ministry of Industry)

Originally the principal activity of this department revolved around nuclear research. Today, however, the department has developed and reorganised itself around 3 principal poles :

- ⇨ Energy
- ⇨ Environment
- ⇨ Technological Innovation for enterprises

The first two poles are activities where no demonstration takes place but **the third pole is in fact a policy which is based upon demonstration. Within this pole, there are four areas of expertise :**

- ⇨ **ceramics / new materials,**
- ⇨ **laser, electron beam,**
- ⇨ **CAD-CAM,**
- ⇨ **simulation software.**

The ENEA intervenes in a financial and co-operative role concerning technological demonstrations. The generic process followed is outlined below :

- ⇨ *Phase 1 :* ENEA analyses the needs of the Industrial Basin (these are always specialised in Italy).

- ⇨ *Phase 2 :* Identification of a new need where ENEA (through its R&D department) could help.

- ⇨ *Phase 3 :* In order to launch a technological demonstration project, ENEA seeks to establish a collaborative venture with one, or many, private partners. Subsequently, its first task consists of identifying these private partners with whom the financial and research elements of the project will be shared.
  During the launch of Technological Demonstration projects, ENEA undertakes the financial and administrative engineering of the project (management of administrative dossiers, etc.).

- ⇨ *Phase 4 :* Once the project has been put into motion, ENEA participates in R&D activities in collaboration with its partners.

- ⇨ *Phase 5 :* Diffusion and demonstration of the new product/technology.

  If the development project leads to a new product, the commercialisation of it is undertaken by a commercial partner (either the partner from phase 3 or a new one) who will then also take charge of the technological demonstration.

An example of this is a software package developed for the tile industry which enables end-users to perform design simulation. The software package was subsequently commercialised by a software specialist company.

For the development of a new technology/equipment, generally **ENEA introduces a technological demonstration pole :**

- the new equipment is installed by one of the initial industrial partners on their premises,
- the industrial partner will guarantee a technological demonstration service for other interested enterprises. The visits and the demonstrations are financed by ENEA.

One example is the technological demonstration pole CAFE (specialising in demonstration systems for electronic beam technology) which was installed by the private partner BELLELLI.

ENEA played an equally active role as Bellelli during the phases 2, 3 and 4 and also subsidised Bellelli in the 5th phase, enabling it to perform technological demonstrations for every client/company that showed an interest in the technology.

➔Technology Transfer Department (Ministry of Research)

Different to the Ministry of Industry's Technology Transfer Department, the department within the Ministry of Research is not oriented towards demonstration. Their involvement in demonstration activities only goes as far as participating in the carrying out of a feasibility study for an investment project for a new technology. The project is proposed by the enterprise (bottom-up approach) and includes :

- technical feasibility study,
- economical opportunity study.

These are carried out in collaboration with a technological transfer structure.

In order to evaluate the feasibility, the process could include a stage of technological demonstration which takes place on the equipment within a technology transfer structure. The Department will finance a maximum of 50 % of the global expenses if the technological transfer partner is one of the structures which benefits from a previous agreement made with the Ministry of Research.

This initial assistance could be followed either by investment aid from the MICA - Ministry of Industry, or research subsidies granted by the Research Applied Action programme at the Ministry of Research.

Furthermore in the future, the Ministry of Research would like to develop a specific action/policy in technological demonstration. Its reason is that although large enterprises are in fact targeted and are aware of the new procedures which already exist, a large number of smaller enterprises still exist who are not autonomous enough to even be aware of new procedures/technologies.

The Ministry of Research wishes to use its structure of agreed centres to undertake these demonstration activities. It also adds that the universities could be involved, although more on the side of technico-economical evaluations.

5. CONCLUSION

⇨ Italian TDACs are more supported by their national public authorities than their counterparts in other European countries (for example, the Ministry of Industry plays a major role through the ENEA). In addition, the public authorities are eager to launch themselves further into these activities.

⇨ TDACs appear to be an efficient tool to reach SMEs in Italy : small enterprises represent over 60% of the client base for ¾ of Italian TDACs.

⇨ Due to the fact that demonstration activities are recognised by public authorities and public financiers, Italian TDACs do not suffer from the same problems as other European TDACs with regards to the financing of their activities. Over 2/3 of Italian centres are financed principally by public funds.

⇨ In general, demonstration activities of advanced technologies are well appreciated by enterprises/clients and the associated benefits are quickly recognised for their true added value. Their role in stimulating the curiosity of clients with regards to new technologies, as well as providing the opportunity for enterprises to experiment with them, is seen as a major attraction for the services they offer.

⇨ Over the next three years, all of the centres wish to develop their marketing activities.

⇨ In Italy, there are two principal types of TDACs which have been identified:

- One where **a close partnership is formed between a centre (originally Research and Development oriented) and an innovative company**. The partnership leads to the development of new technologies/equipment and subsequently the launch of technological demonstrations towards other less innovative SMEs.

- One where **a close partnership is formed between the equipment suppliers and the centre**. This type of close partnership can be illustrated by the Demo-Center as even though this centre does not have its own equipment to demonstrate, it is capable of mobilising the equipment suppliers into using their equipment for demonstration activities.

Technology Demonstration and Application Centres in the Netherlands

Country Report in the Framework of the SPRINT EIMS Project 94/71

TNO Centre for Technology and Policy Studies

Apeldoorn, The Netherlands

Imke Limpens
Wieger van Dalen

June 1995

CONTENTS *PAGE*

EXECUTIVE SUMMARY

In the European Union little is known about the organisation of technology demonstration activities. Even in a small country like the Netherlands the population of organisations involved in demonstration activities shows a large variety. They all offer business services that concentrate on the technical aspects in a relatively late phase of the innovation process.

The tendency of the government to reduce its spending made the parent organisations of technology demonstration and application centres (TDACs) search for alternative sources of income and demonstration of advanced technology seemed to be one of the services that could generate the necessary funds. It is the availability knowledge that enables these organisations to get involved in demonstration activities.

Three different groups of TDACs exist in the Netherlands:

- Centres that provide services for a certain sector, e.g. agriculture;
- Centres making use of a certain theme, e.g. sustainable building, housing and living in the future;
- Centres demonstrating a certain technology, e.g. solar technology or information technology.

The services a TDAC offers are mostly oriented towards a combination of technologies thus making the services offered suitable for a certain economic sector or a certain application. New materials, environmental technology and energy technology are often combined in activities related to housing and construction (theme-oriented TDACs), while agriculture is closely related to environmental technologies. Almost all TDACs organize information seminars and workshops for technology transfer purposes, making the demonstration activities accessible for a broad range of customers.Usually TDACs are involved in the objective comparison of equipment made by different manufacturers.

Due to the limited amount of information we received on the TDAC client base, only few conclusions can be drawn. Our first impression is that public demonstration meetings are well visited by firms, but that there has not been much growth in the number of clients during the last three years. Though firms are the most important clients of almost all TDACs, public clients (e.g government departments) are important as well. They even represent a growing market segment for TDACs.

Half of the TDACs in the Netherlands is unable to survive without public core funding. Because of the decrease in this source of income alternative means are sought. Many TDACs start to charge their customers for their services and initiate private projects.

It is interesting to compare the major strengths and bottlenecks mentioned above to the actions that TDACs are going to take to improve their functioning. To be able to finance equipment and personnel, the technology oriented TDACs developed an overall action plan to increase income: almost all possibilities to extend the range of activities are mentioned. This group is the most ambitious group of TDACs in the Netherlands. The sector-oriented TDACs have less far reaching plans, but focus mainly on the development of marketing activities and the increase of the client base. In this way they hope to create a financial buffer to be able to cope with the problematic economic situation of the sectors they serve and with the decreasing possibility to use national government subsidies.

Based on a wide experience in technology demonstration projects, policy makers explained that the following practical considerations are important when thinking about how to use demonstration activities most effectively for technology transfer purposes:

- technology demonstration activities are a suitable instrument for technology transfer purposes in a relatively late phase of the innovation process. They inform technology followers about new technological developments;
- be aware of a science-fiction effect which makes the new technology demonstrated not easily adopted.

The following table gives an overview of the main strengths, weaknesses, opportunities and threats of TDACs in the Netherlands.

Strengths	Weaknesses
Well qualified staff	Lack of focus in marketing strategy
Mix of demonstration and other services. e.g. short-term consultancy, research etc.	Marginal management information systems
Opportunities	**Threats**
International funding	Decreasing public funding
Geographical diversification	Lack of input for strategy development and marketing
Collective funding of demonstration activities by firms in a certain sector or by a cluster of companies	
Extension of cooperative relationships with other elements of the National System of Innovation	
Delivery of integrated services: technical innovation support plus management support	

1. *INTRODUCTION*

Many economists stress the crucial role of adoption of new technologies to reinforce the competitive position of firms. The professional demonstration of advanced technologies might be a suitable instrument to make firms aware of the possibilities new technologies offer. To know about the existence of certain equipment, of production methods etc. might be the first step to the actual adoption of a new technology.

In the European Union little is known about the organisation of technology demonstration activities. Who is involved? Are there many different technology demonstration and application centres (TDACs)? Are they independent organisations, or units of a parent organisation? What do they demonstrate and how? How does the future look for these centres?

With the results of this survey the European Commission tries to find effective ways to support firms in regions that have less developed economies. And again: to know about TDACs might be the first step to develop a suitable instrument to support firms in less prosperous regions.

The survey that has been done in the Netherlands is part of a much larger research project. The German research institute Fraunhofer - ISI coordinated this project and gathered information about TDACs from all member states in the European Union.

The TNO Centre for Technology Policy is known for its knowledge about the economic dynamics of industrial sectors. Core business is the analysis of sectoral competitive advantage, which includes the support an industrial sector receives from for example the knowledge infrastructure, educational organisations and professional organisations. This knowledge, and the fact that TNO itself is part of the technology transfer infrastructure and knows its competitors/colleagues, allowed us to make an initial list of Dutch TDACs based on the expertise of our own specialists. The initial list was completed by suggestions made by respondents when returning the questionnaire. Eventually eleven out of seventeen TDACs completed the questionnaire. The six questionnaires that were not completed contained two TDACs and four organisations that did not match the definition of a TDAC at all.

2. *TECHNOLOGY DEMONSTRATION ACTIVITIES IN THE NETHERLANDS*

Attending live demonstrations of new techniques and equipment is an entertaining way to be introduced in the world of high-tech products. The first thing that comes to mind when thinking about meetings for demonstration purposes is activities related to demonstration of consumer products. But this is not what we are looking for in this survey. Instead we try to find out what organisations are involved in professional demonstration of advanced technologies for firms in manufacturing, services and agriculture. The main purpose of demonstration activities should be an objective presentation of different solutions to a certain bottleneck, which enables the entrepreneur to be introduced to the technology and to compare the products of different suppliers.

The first impression is that there is no such thing as a well organized infrastructure for demonstration activities in the Netherlands. Despite the fact that the instrument as such is accepted and used, it does not belong to the core business of the organisations involved. Demonstration activities are often a neglected end product of a research project or alternatively seen as "cash-cows" for knowledge centres. In both cases they do not belong to what is seen as the main aim of the organisations in our survey. The tendency of the government to reduce its spending made knowledge centres search for alternative sources of income. Demonstration of advanced technology seemed to be one of the services that could generate the necessary funds. It is the availability of knowledge that enables these organisations to get involved in demonstration activities.

The government

As a general comment one can argue that there is little if any coordination on demonstration activities between the various organisations involved. This is to a certain extent a surprise, because the government provides funds in almost all the cases. The extent to which the government is involved ranges from organisations being a government department to firms receiving a small contribution as a start-up premium. On the other hand: the reason for the lack of coordination becomes clear when taking a closer look. There are at least three different government departments that support these activities and there are many more different themes around which the activities take place. Technology policy is an important instrument to foster demonstration activities.

In the first phase of the development of a modern technology policy (until 1980), the Ministry of Economic Affairs focused on the development of knowledge. In the second phase, in the first half of the eighties, attention diverted towards the diffusion of knowledge. At this time the demonstration of new technology came into the picture. Nowadays the main technology policy instrument in the Netherlands is the PBTS-programme (Programmatic Business Technology Stimulation). Part of the funds is used to foster demonstration activities. Firms that participate in the programme are obliged to show their research results to other firms and intermediary organisations. Nowadays one might say that policy makers have a more balanced view on the function of demonstration activities in the process of techno-economic development. We will pay special attention to the unique situation of the agricultural sector as concerns technology demonstration activities.

In the Netherlands the greater part of the Dutch technology policy is taken care of by the Ministry of Economic Affairs. However, the Ministry of Agriculture, Nature management and Fisheries plays a role as well in the field of innovation and science policy while concentrating on the agricultural sector. Recently, the Ministry of Agriculture, Nature management and Fisheries introduced a policy scheme disposing 5 mln ECU for 'demonstration- and awareness projects in sustainable agriculture methods'. The Dutch Extension Service (DLV) is an important actor in implementing agricultural technology policy. Since 1880 the DLV provides for techno-economic advice for individual farmers. Part of this advice may be a demonstration of a new machine or a new technique. The DLV has a rich experience in with demonstrations of this kind.

Towards a TDAC classification in the Netherlands
Even in a small country like the Netherlands the organisations involved in demonstration activities show a wide variety: private firms, government departments, research and technology organisations, consultants and technology brokers. When trying to characterize Technology Demonstration and Application Centres (TDACs), the way one clusters them determines to a large extent the outcome. The classification that is made in the following paragraph enables the reader to get acquainted to TDACs in the Netherlands.

One third of the Dutch Technology Demonstration and Application Centres (TDACs) has an agricultural orientation. They are part of the sophisticated and technologically advanced agricultural cluster in the Netherlands. The centres are all specialized in a certain subsector, like horticulture, dairy farming or pig- and poultry farming. Due to the recent privatization of the Dutch Agricultural Extension Service (which used to be a department of the Ministry of Agriculture, Nature Management and Fishery), the centres are even more inclined to find alternative sources of income. Short-term consulting and to some extent demonstration of advanced technology generates new private income, though the centres mention that they have been demonstrating new technology since 1880.

Another important part of the Dutch TDACs is predominantly related to building and housing. One particular organisation has concentrated on buildings that show possibilities for future living and working conditions. At the moment the House of the Future and the Office of the Future are already in place. For the future the privately funded foundation is building a Hotel of the Future and a School of the Future. The Office of the Future consists of an intelligent building containing equipment for video-conferencing, individual climate control systems, special lighting systems etc. Many different manufacturers contributed to the Office of the future, thus creating a demonstration centre where similar equipment (e.g. climate control systems) made by several different manufacturers can be compared when functioning in a real situation.

The House of the Future is a museum of which the building was a real challenge. Many different building contractors, installation experts, architects and other firms involved cooperated with interest groups for disabled people, for elderly, for housewives etc. to create a useful house of the future. Though the house is a museum open for the general public nowadays, businessmen come to pay a visit as well. They are interested in for example the application of new construction techniques: application of solar energy, insulation techniques, new materials etc.

A third group of TDACs in the Netherlands is specialized in technology-related matters, like a research institute involved in solar energy and an organisation that is responsible for the implementation of government schemes to reduce the expenditure of energy. They are not the only ones that are interested in energy-related issues, though. From the survey it becomes clear that in the Netherlands almost all demonstration centres are involved in energy saving technology. The same goes for environmental technologies.

Summarizing there are three different groups of TDACs in the Netherlands:

- Centres that provide services for a certain sector, e.g. agriculture;
- Centres making use of a certain theme, e.g. sustainable building, housing and living in the future;
- Centres demonstrating a certain technology, e.g. solar technology or information technology.

3. *SURVEY RESULTS: FACTS AND FIGURES*

It is far from easy to find common characteristics between organisations that differ to such a large extent as TDACs in the Netherlands do. Nevertheless three different types of organisations could be identified, according to the customer orientation they have.

The services a TDAC offers are mostly oriented towards a combination of technologies thus making the services offered suitable for a certain economic sector or a certain application. In agriculture for example all technologies related to dairy farming are demonstrated by one TDAC. Another interesting example is a TDAC that has expertise in the field of information technology but offers specialized services for different economic sectors. The survey shows that the TDACs are very much oriented towards technical aspects of the innovation process. Little attention is paid to important innovation-related tasks like management of the process of change in the firm or raising funds.

Table 1 shows the combinations TDACs make in demonstrating several technologies. In agriculture and construction the demonstration activities assist firms in creating a more sustainable production system, which is an issue that is strongly promoted by the Dutch government. The technology-oriented TDACs are much more specialized in the range of technologies they demonstrate, which is of course a natural consequence of their business orientation.

Table 1: Technologies demonstrated by TDACs in he Netherlands

Technology	Identification number of TDAC										
	404	408	405	406	407	402	403	401	409	410	411
Electronics, communication and information technologies	X		X		X	X			X		
Manufacturing technologies	X		X		X		X				
Materials	X	X	X			X	X				
Environmental technologies	X	X	X			X	X	X	X	X	X
Energy	X	X	X	X		X	X		X	X	X
Agricultural technology								X	X	X	X
Chemicals and pharmaceuticals									X		
Type of TDAC	Theme-oriented TDACs: e.g. sustainable building			Technology-oriented TDACs: (e.g. solar energy)		Sector oriented TDACs (e.g. paper industry)		Sector-oriented TDACs (agriculture)			

Table 2: Main activities of TDACs in the Netherlands

Activity	Identification number TDACs										
	404	405	408	406	407	402	403	401	409	410	411
Demonstration of advanced technologies	X	X	X	X	X	X	X		X	X	X
Research and technological development		X		X			X				
Information seminars and workshops	X	X		X	X	X		X			X
Short term consulting								X	X	X	X
Assisting firms with innovation		X		X			X		X		
Testing and certification				X				X			
Training in the use of technologies				X	X	X		X			
Agent of public promotion schemes	X	X	X		X	X		X	X	X	
Other activities					X			X			X
Type of TDAC	Theme-oriented TDACs: e.g. sustainable building			Technology-oriented TDACs: e.g. solar energy		Sector oriented TDACs (e.g. paper industry)		Sector-oriented TDACs (agriculture)			

Table 2 shows the range of services TDACs offer. One TDAC does not consider demonstration activities to be important, but all the other organisations regularly demonstrate advanced technologies. Most of the theme-oriented TDACs offer a limited range of services, for example the promotion public schemes and the organisation of information seminars and workshop for technology transfer purposes. One of the organisations considers the promotion of public schemes as its core business. The technology-oriented TDACs have a much broader range of services. Besides demonstration they are involved in training in the use of technologies, in the organisation of seminars and workshops and many other services. The sector-oriented TDACs offer an intermediate amount of services. The agricultural TDACs concentrate on short-term consultancy for farmers. A considerable number of this group of TDACs is an agent for public promotion schemes.

R&D-organisations exploiting a TDAC usually provide firms with intensive guidance in the innovation process. Sectoral TDACs on the other hand mainly concentrate on a less intensive way of assisting firms, namely through short-term consultancy. Finally, agents that promote public schemes mainly offer general information services for firms. Almost all TDACs organize information seminars and workshops for technology transfer purposes, making the demonstration activities accessible for a broad range of customers.

Many TDACs are involved in the objective comparison of equipment made by different manufacturers. New methods like media-based presentations are quite popular among agricultural TDACs in the Netherlands, while the use of physical models is limited. Apparently the presentation and comparison of ever changing equipment requires a flexible approach towards the demonstration methods. Probably the need to reach farmers at distant locations contributes to the use of portable demonstration systems. The sector-oriented TDACs all mentioned that a personal visit to clients is an important way to show the possibilities of equipment from different manufacturers. This group of TDACs uses a relatively wide range of different techniques to demonstrate advanced technologies. In the other groups a clear choice is made for one particular approach towards the demonstration activity, usually the comparison of systems and equipment form different manufacturers. Table 3 gives an overview of TDAC demonstration techniques in the Netherlands.

Table 3: Demonstration techniques of TDACs in the Netherlands

Demonstration techniques	Identification number TDAC										
	404	405	408	406	407	402	403	401	409	410	411
Via systems/equipment from a single manufacturer											
Via systems/equipment from multiple manufacturers	X	X	X	X		X	X				
Via physical models of technical systems						X	X				
Via media-based representations				X	X	X			X	X	X
Other								X	X		X
Type of TDAC	Theme-oriented TDACs: e.g. sustainable building			Technology-oriented TDACs: e.g. solar energy		Sector oriented TDACs (e.g. paper industry)		Sector-oriented TDACs (agriculture)			

Clients

The fact that more intensive ways of supporting firms in the innovation process are not widely spread among TDACs explains partly why TDACs do not have a clear picture on their client base. Only one third of all respondents in the Netherlands was able to mention the number of clients a year, and even then rough approximations were given. Due to the limited amount of information we received on the TDAC client base, only few conclusions can be drawn. Our impression is that public demonstration meetings are well visited by firms, but that there has not been much growth in the number of clients during the last three years. Though firms are the most important clients of almost all TDACs, public clients (e.g government departments) are important as well. They even represent a growing market segment for TDACs.

Technology and theme-oriented TDACs all promote their activities systematically. There are two (agricultural) TDACs that rely on less intensive marketing efforts. As can be seen from table 4, little use is made of advertisements in relevant media, as opposed to the widely spread use of publications. A reason for this might be that TDACs have knowledge-based parent organisations that are used to exploit the opportunities that publication of technical papers and articles offer. On the other hand, the academic way of promoting and selling expertise is not completely copied, since only a minority of the TDACs gives presentations and lectures during conferences. Direct mailing is in fact the most popular way of reaching customers. There is some contradiction between this systematic way of promoting services and the lack of information that TDACs seem to have on their client base. There might be a danger that TDACs do not reach specific target groups efficiently, because of a rather diffuse way of marketing.

Table 4: Promotional activities TDACs, the Netherlands

Activity	Identification number TDACs										
	404	405	408	406	407	402	403	401	409	410	411
Publications in relevant journals	R	R	O	R	R	R	Not yet		R		O
Advertisements in relevant media	S	O	O	R		O			R		Not yet
Participation in fairs, conferences	O	R	O	R	R	O			R		O
Direct mailing of specific information	R	R	O	R	R	R	R		R		O
Other			O		R	O	O				
Type of TDAC	Theme-oriented TDACs			Technology-oriented TDACs		Sector-oriented TDACs		Sector-oriented TDACs (agriculture)			

R = regularly, O = occasionally, S = seldom.

Staff

We expected to find that the demonstration of advanced technologies requires little staff, but the survey shows that the average size of a TDAC in the Netherlands amounts to more than 60 people. The agricultural TDACs are mainly responsible for this considerable average size. The recently privatized Agricultural Extension Service, including its TDACs, employs more than 650 people of which 520 are agricultural experts providing short term consultancy for farmers. Leaving the professional network of agricultural advisers out, the average size amounts to about 15 people. Only part of these people is involved in demonstration activities, since it is not the core business of most organisations.

Initial investors

Until now the European Union hardly invests in the foundation of TDACs in the Netherlands. For the majority of the TDACs the national government is the main initial investor, though the organization and initialization usually is in private hands. Sector-oriented TDACs often use their own funds as well to finance the start-up. Collective contributions from members enable the sectoral TDACs to build up a certain private capital. The theme-oriented TDACs rely on the contributions from suppliers to finance the initialization. The House of the Future and the Office of the Future are both show-rooms full of equipment and systems from many different suppliers, which makes it attractive for firms to contribute to these projects. From table 5 we can conclude that in general TDACs mobilize a limited amount of different investors to finance the start-up. Usually public funding is combined with only one source of private income, for instance with contributions from suppliers or users.

Table 5: Initial investors TDACs, the Netherlands

Investors	Identification number TDACs										
	404	405	408	406	407	402	403	401	409	410	411
Public funding (regional)			X						X		X
Public funding (national)		X	X	X	X		X	X	X		X
Public funding (European)				X			X				
Suppliers	X										
Users		X	X			X	X		X		
Self-financing	X			X		X			X	X	X
Other					X						
Types of TDACs	Theme-oriented TDACs: e.g. sustainable building			Technology-oriented TDACs: e.g. solar energy		Sector oriented TDACs (e.g. paper industry)		Sector-oriented TDACs (agriculture)			

TDAC funding

Table 6 shows that half of the TDACs in the Netherlands is unable to survive without public core funding. Because of the decrease in this source of income alternative means are sought. Many TDACs start to charge their customers for their services and initiate private projects. Until now in only two cases membership fees and donations are the main source of income. The government is not involved in the continuous funding of these organisations, though it was involved in the initial start-up phase. Table 6 gives an overview of the division of total income between various sources per group of TDACs. The sector-oriented TDACs receive about one-fifth of their income from fees for services. The rest of the income comes from the government of from multi-client research projects. The other TDACs are less market-oriented: the technology-related demonstration centres rely for all their income on public core and public project funding. The other TDACs did not give any detailed information about funding mechanisms, which made valid conclusions difficult to define.

Table 7 provides information about changes in fund raising mechanisms that have taken place in the last three years. The agricultural TDACs raised more money from fees for services and from public project funding, while public core funding decreased rapidly. In general the TDACs gave relatively little information about this issue, that is why only rough conclusions can be drawn. The theme oriented TDACs did not see their budget change, while one of the technology-oriented TDACs noticed a slight increase in public core funding.

Table 6: Funding of TDACs in the Netherlands: share in total income

Sources of income	Identification number TDACs										
	404	405	408	406	407	402	403	401	409	410	411
Public core funding	-	0	100	30	100	0	15	90	65	80	75
Public project funding	-	0	0	70	0	0	5	5	10	5	5
Fees for services (incl. private projects)	-	0	0	0	0	20	10	5	25	15	20
Membership fees/donations	-	97	0	0	0	80	0	0	0	0	0
Other	-	3	0	0	0	0	70	0	0	0	0
Types of TDACs	Theme-oriented TDACs: e.g. sustainable building			Technology-oriented TDACs: e.g. solar energy		Sector oriented TDACs (e.g. paper industry)		Sector-oriented TDACs (agriculture)			

Table 7: Changes in funding of TDACs in the Netherlands

Changes in funding	Identification number TDACs										
	404	405	408	406	407	402	403	401	409	410	411
Public core funding			C	C	+	C	C	-	-	-	-
Public project funding				C			+	+	+	C	C
Fees for services (incl. private projects)						C	+	+	+	+	+
Membership fees/donations		C				C					
Other		C					+				
Types of TDACs	Theme-oriented TDACs: e.g. sustainable building			Technology-oriented TDACs: e.g. solar energy		Sector oriented TDACs (e.g. paper industry)		Sector-oriented TDACs (agriculture)			

- = decrease, + = increase, C = Constant

4. *INTERVIEW RESULTS: TDAC STRATEGIC POSITIONING*

Evolution and role of TDACs
Technology demonstration activities have been set up only recently. In 1987 the first real TDACs appeared in the Netherlands. Three TDACs mentioned that their actions were meant to be temporarily. The other TDACs are all developing plans to operate more professionally in the near future. Technology transfer activities are completely integrated in Dutch technology policy. They are regarded as an appropriate instrument for diffusing new technology in the first stages of the S-shaped innovation curve, especially at the point just before the industrial sector as a whole adopts a new technology. The combination of research and demonstration activities in technology policy instruments contributes to the development of a dynamic process in which technology transfer activities lead to new ideas and new collaborative research projects that provide in turn new input for demonstration activities.

Performance and management
None of the TDACs in the Netherlands structurally evaluates demonstration activities. Sometimes the input is measured, like the number of visitors to a demonstration activities or the budget needed to organize the meeting. Two TDACs mentioned that there are plans to do a survey among the visitors to check if the meetings are effective and if there are possibilities for creating new markets for demonstration activities. An objective assessment of the output or effectiveness of demonstration activities is difficult, because of the complexity of the process of technology transfer. When asking Dutch TDACs about their overall performance, they indicated that there are as many major bottlenecks as there are major strengths in managing their business.

Bottlenecks
Theme-oriented TDACs think that there are only a few problems, mainly related to economic developments in sectors served and in changes in government regulations. The agricultural TDACs felt a considerable pressure as well from the less prosperous situation the agricultural sector is in at the moment. Technology-oriented TDACs feel relatively uncomfortable about problems related to financing personnel and equipment. Some agricultural TDACs mention the same bottleneck. It is the agricultural TDACs that feel many major bottlenecks in various fields. Attracting new clients is one of them, environmental pressures that limit the financial room for manoeuvre of the farmers they serve is another. Table 8 gives a complete overview of the major bottlenecks that TDACs face in the Netherlands.

Strengths
The technology-oriented TDACs present themselves as strong players in the field by mentioning many major strengths in all fields. Between the non-agricultural sector-oriented TDACs large differences exist: while one TDAC mentions 7 different strengths, the other TDAC is unable to find any major strength. Between the agricultural TDACs consensus exists about their strengths: they all indicate strategy development as a very positive aspect of their business. The development of complementary services is considered to be at a good level as well. Table 9 shows the issues to be considered as a major strength.

Table 10 shows the plans that TDACs have developed for the next three years. One of the theme-oriented TDACs will be gone within one year. A follow-up in a different set-up is likely to be realized. It is interesting to compare the major strengths and bottlenecks mentioned above to the actions that TDACs are going to take to improve their functioning. To be able to finance equipment and personnel, the technology oriented TDACs developed an overall action plan to increase income: almost all possibilities to extend the range of activities are mentioned. This group is the most ambitious selection of TDACs in the Netherlands. The sector-oriented TDACs have less plans, but focus mainly on the development of marketing activities and the increase of their client base. In this way they hope to create a financial buffer to be able to cope with the problematic economic situation of the sectors they serve and with the decreasing possibility to use government subsidies.

Table 8: Major TDAC bottlenecks, the Netherlands

Major bottleneck	404	405	408	406	407	402	403	401	409	410	411
Recruitment of qualified staff									X		
Financing personnel				X				X		X	X
Financing equipment and facilities				X					X	X	X
Development of complementary services							X				
Strategy development											
Assessment of demand										X	X
Attracting new clients									X	X	X
Development of cooperative relationships											
The pace of technological change						X					
Competitive pressure from other TDACs											
Economic developments in sectors served			X				X	X	X	X	X
Changes in government/EU regulations	X							X		X	X
Environmental pressures							X		X	X	X
Types of TDACs	Theme-oriented TDACs: e.g. sustainable building			Technology-oriented TDACs: e.g. solar energy		Sector oriented TDACs (e.g. paper industry)		Sector-oriented TDACs (agriculture)			

Table 9: Major strengths TDACs, the Netherlands

Major strength	404	405	408	406	407	402	403	401	409	410	411
Recruitment of qualified staff					X		X			X	X
Financing personnel					X						
Financing equipment and facilities					X		X				
Development of complementary services									X	X	X
Strategy development		X		X	X			X	X	X	X
Assessment of demand				X	X		X		X		
Attracting new clients					X		X				
Development of cooperative relationships					X		X				
The pace of technological change	X	X		X	X		X				
Competitive pressure from other TDACs											
Economic developments in sectors served			X								
Changes in government/EU regulations								X	X		
Environmental pressures				X			X	X			
Types of TDACs	Theme-oriented TDACs: e.g. sustainable building			Technology-oriented TDACs: e.g. solar energy		Sector oriented TDACs (e.g. paper industry)		Sector-oriented TDACs (agriculture)			

Table 10: Plans for the next three years

Plans for the next three years	404	405	408	406	407	402	403	401	409	410	411
Operating capital	C	C	-	+	0	C	+	C	C	+	+
Staff size	C	C	-	+	+	C	+	-	C	-	-
Turnover	C	C	-	+	+	C	+	C	+	+	+
Proportion of activities devoted to demon-	C	+	-	+	+	+	+	C	+	C	C
Range of demonstration facilities	+	+	-	+	+	+	+	C	C	C	C
Number of technologies demonstrated	+	+	-	+	+	+	C	C	C	C	C
Size of client base	C	+	-	+	+	C	+	C	+	+	+
Number of sectors served	C	+	-	C	+	C	C	-	C	C	C-
Development of marketing activities	C	C	-	C	0	C	+	+	+	+	+
Use of government programmes/subsidies	C	C	-	+	0	-	-	C	-	-	-
Use of EU programmes/subsidies	C	C	-	+	+	-	-	+	+	+	+
Alternative means of demonstrating	+	+	-	C	+	+	+	0	0	+	+
Types of TDACs	Theme-oriented			Technology oriented		Sector - oriented		Sector-oriented TDACs (agriculture)			

Implications for clients

In the Netherlands two types of TDAC clients exist: visitors of demonstration activities (usually firms) and organisations that hire a TDAC to organize activities on their behalf (e.g. government departments). For firms demonstration activities provide an answer to technological questions that have been defined clearly. The instrument is less suitable for more complex innovation processes. Because of the easy accessibility of demonstration activities for clients, they mainly serve as an information desk for technology followers.

5. *CONCLUSIONS AND RECOMMENDATIONS*

The innovation process as such is a full cycle of activities ranging from discovering an interesting opportunity to raising funds to making a prototype and organizing the market launch of a new product. The technology demonstration and application centres (TDACs) in the Netherlands offer business services that concentrate on technical aspects in a relatively late phase of the innovation process.

The three types of TDACs that have been found in the Netherlands (theme-oriented, technology-oriented and sector-oriented TDACs) all have their own characteristics. The theme-oriented TDACs provide services for the general public as well as for professionals. In this respect the group is unique within the total TDAC population. Another unique characteristic is the fact that their activities are concerned with the demonstration of complete systems that function in reality, e.g. the demonstration of climate control systems made by different manufacturers in one and the same building.

The technology-related TDACs consider their demonstration activities as an important product, but the activity is not a part of their core business. For TDACs that are related to research institutes, the demonstration activity is either a neglected end product of a research product or alternatively seen as a "cash-cow". In both cases it is not related to what is considered to be the main aim of the organisation.

In the Netherlands most of the expertise in the field of technology demonstration activities can be found in the agricultural sector. The following paragraph shows best practice concerning demonstration activities in the Netherlands, and provides several recommendations how to foster professionalism in demonstrating new technology.

Best practice

The Dutch Extension Service (DLV) employs about 600 people. In an independent section, DLV Agriconsult BV, the international consulting activities are concentrated. In the Netherlands the DLV provides for individual business advice for farmers. This service makes 70 - 80% of total turnover. A maximum 10% of their activities relates to the organization of equipment and technology demonstrations. The DLV might initiate demonstration activities itself (especially in the case of demonstration of ready made machines), but it is possible as well that the extension service is hired by executors of technology subsidy schemes for organizing a demonstration. Environmentally sound agricultural practices is a popular issue in this respect. The subsidy scheme provides for a part of the implementation and, in return, the farm acts as a demonstration centre. The extension service has no demonstration facility of its own, which is a strategic choice. The idea behind this is that demonstration activities must be organized at the production place in the sector at hand and not in a separate demonstration centre, to create an effective technology transfer mechanism. It is important to realize that real-life situations are convincing people more easily than demonstrations with a high degree of science-fiction.

The most important role of demonstration is at the end of a technology development trajectory. When technological possibilities have become clear and a technology is maturing, demonstration activities become an interesting technology transfer instrument. Ideally, it is the last persuading argument for entrepreneurs to adopt a technology.

This conclusion is supported by the executors of an IT-subsidy scheme, SENTER. This organization implements technology policy instruments among which a scheme for IT in industries and services. Kernel of their job is the production and transfer of ready-to-use IT-knowledge. Demonstrations play a minor role in their activities. Information technology is a technology of which the applications are not easily demonstrated. Usually the organisational changes that accompany the introduction if IT are much more important for the success of the innovation. For physically discernable technologies demonstrations are more suitable for persuading technology followers to adopt a new technology.

The government is often involved in funding demonstration activities. Modern technology policy focuses on diffusion of new technology. The combination of research and demonstration activities in technology policy instruments contributes to the emergence of a dynamic process in which technology transfer activities lead to new ideas and new collaborative research projects that provide in turn new input for demonstration activities. Demonstrations are regarded by policy makers as a suitable instrument to inform technology followers about new technological developments. They are less suitable for complex transactions that require intense communication and commitment between the parties involved. In order to prevent the activities from becoming science-fiction exercises, the meetings should be organized at the workfloor and show real-life situations at a representative firm. In this case people can identify themselves best, enabling the demonstration activities to provide real answers to clearly defined technological questions.

Table 11 gives a short overview of the main strengths, weaknesses, opportunities, and threats of technology demonstration and application centres in the Netherlands. This table does not reflect the opinions of the TDACs, but an overall evaluation of the research results.

Table 11: SWOT-matrix TDACs, the Netherlands

Strengths	Weaknesses
Well qualified staff	Lack of focus in marketing strategy
Mix of demonstration and other servi-ces. e.g. short-term consultancy, research etc.	Marginal management information systems
Opportunities	**Threats**
International funding	Decreasing public funding
Geographical diversification	Lack of input for strategy development and marketing
Collective funding of demonstration activities by firms in a certain sector or by a cluster of companies	
Extension of cooperative relationships with other elements of the National System of Innovation	
Delivery of integrated services: techni-cal innovation support plus manage-ment support	

Technology Demonstration and Application Centres in Portugal

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DEFINITION AND DIFFERENCES OF TDACs
Compared to Related Institutions

A « Technology Demonstration and Application Centre » (TDAC) is understood as an institution which mainly offers public or private enterprises demonstrations of new technologies and distribute these services in a systematic marketing approach. In addition to that, it can offer further services like information about and advice or training on new technologies, testing and certification and so on. In detail, the services offered include the following aspects :

⇨*Demonstration of New Technologies*
The operability, competitiveness or specific application of new technologies are demonstrated to back up the information and consultation offered. Different media methods may be used for this purpose.

⇨*Information about New Technologies*
First of all, general information about how the new technology functions and its productivity. In addition, general information about aspects of application such as general prerequisites of implementation, organisation or qualification preconditions for using the technology.

⇨*Advice about New Technologies*
Individual consultation is also offered alongside general information. This may relate to company-specific technical aspects as well as questions of utilisation (e.g. introduction strategies, training,..).

The services offered are generally neutral with regard to technology suppliers, are presented without sales intention and are aimed at public or private enterprises (i.e. private households are not included as a target group). Based on this definition, a TDAC has to be distinguished from institutions with similar aims and services such as :

⇨*Technology Centres / Science Parks* : These institutions provide young companies which develop new technology products and processes with a fully developed infrastructure as well as services and advice. In contrast to TDAC, this is only offered to companies based within a technology centre.

⇨*Technology Transfer Centres* : There are many different terms for this kind of institution such as technology transfer, technology advice, innovation advice or interface centre. Their common characteristic is that they all attempt to promote the transfer of information, knowledge and resources from Technological Resources Centres to companies. In contrast to a TDAC, the technology transfer centre does not necessarily have to be connected with the demonstration of systems or processes.

⇨*Exhibition / Demonstration Centres of Technology Suppliers* : In contrast to a TDAC; these centres present manufacturer-related offers which aim to sell new technologies.

⇨*Consumer Advice Centres (e.g. local utilities, energy suppliers)* : In contrast to TDACs the services offered are aimed primarily at private households.

1. INTRODUCTION

➔ Objectives of the European Study

For Public authorities concerned by Technology Transfer policies, one of the crucial and current questions is the following : ***How to enlarge the innovation fabric and how to reach traditional SMEs ?***

This study evolved from the hypothesis that demonstration activities could be an adequate solution to facilitate the diffusion of technologies towards enterprises who, up until now, have not been aware of the existence, or the benefits, of such technologies. In this context, four main objectives formed the structure of the analysis :

⇨*Characterise Technology Demonstration and Application Centres (TDACs) in the European Union* : Identifying technological and sectorial fields, status, regional distribution, activities, client base, finance structure, difficulties encountered and major trends.

⇨*Compare TDACs, with other types of Demonstration Tools, especially from the SME's point of view* : such as Company Visiting schemes, demonstration investment programmes, supplier commercial activities,..

⇨*Compare existing public policies towards demonstrations.*

⇨*From the lessons learned, identify some key areas for the Commission's policies (DG XIII).*

This study will also contribute to the share of experience / best practices between policy makers and TDAC managers at the European level.

1.1. Information Sources

The principal information on the Portuguese TDACs came from interviews that were conducted with the Ministry of Industry and Energy (MIE).

➔ The TDAC Survey

Initially, the MIE supplied information on other similar / related initiatives which enabled the study to incorporate current activities in the domain of innovation and the promotion of technology transfer.

A further interview was then held with the GEP (Gabinete de Estudos e Planeamento - Department of Studies and Planning) of the MIE who identified previous surveys and subsequent conclusions.

TDAC INTERVIEW GUIDELINES

Objective	Topics / Questions
History	● Historic development of the demonstration activities - origin ? - evolution of client needs and anticipation of future client needs ? - investment strategy ?
Presentation of Demonstration Activities	● How important are demonstration activities compared to other services offered by your centre ? Brief description of the other services ● Description of the technology demonstrated. Why is a demonstration stage necessary for this technology? ● What is your definition of a demonstration activity?
Role in Innovation Process	● Role of TDAC in the dynamics of innovation, diffusion and technology transfer at sector and regional level ● Client base targeted ? Original expectations of the client ? ● Do you know of any other forms of demonstration ? ● Synthesis of the added value of a TDAC
Performance of Demonstration Activities	● Are the demands and the specific needs of the target groups (SMEs) met ? ● How successful has the TDAC been in providing innovation services ? ● Major bottlenecks ? What are the solutions envisaged ?
Management of Demonstration Activities	● Presentation of the different stages ● Key success factors ● Is this activity recognised by the institutions which finance you ? ● Any particular difficulties in obtaining financing for investment ? ● Methods to anticipate the future needs in terms of demonstration activities ? ● Methods used to attract potential clients ?
Public Policies	● Your evaluation of the position of TDACs in National technology transfer plans, ● Recommendations that can be given to regional, national and European policy makers ? ● Participation in any national / European TDAC network / Association ?

In collaboration with the MIE and GEP, a definitive list of Portuguese TDACs was decided upon and 20 questionnaires were subsequently sent out. The fact that numerous telephone calls were made to the centres to ensure that everything was understood, meant that a 90 % success return rate was achieved.

In total, 20 questionnaires were sent out of which 18 centres replied and 16 were then analysed.

➔ The TDAC Interviews

The data from the returned questionnaires were entered into a database, along with the data from the other countries being analysed, and from this a typology of the TDACs was produced. Once all of the TDACs has been slotted into the typology, it was decided to visit some of the centres in order to carry out more in-depth face-to-face interviews to be able to get a better understanding of the centre and its demonstration activities.

5 TDACs were visited in Portugal : IEP (Instituto Electrotecnico Portugues), CETO (Centro de Ciencias e Tecnologias Opticas), IDITE (Instituto de Desenvolvimento e Inovacao Tecnologica do Minho), INEGI (Instituto de Engenheria Mecanica e Gestao Industrial) and ISQ (Instituto de Soldadura e Qualidado).

The interviews with the centres were carried out using the guidelines shown in the table opposite.

➔ The Policy Maker Interviews

Similarly, the interviews with the Portuguese policy makers were carried out along the guidelines shown in the table over the page. An overview of Government policies was given (namely PEDIP I and PEDIP II - Programma Especifico para Desenvolvimento da Industria Portuguesa) and documents supplied. The activities and policies on public funding were examined and related to the rate of activities of those funded TDACs.

1.2 Content of the report

Having identified in the first section the methodology followed in this survey and the various difficulties encountered, the second section will briefly cover the Technology Transfer activities in Portugal. The third section provides mainly a quantitative presentation of the main results of the questionnaire survey.

The fourth section looks at the results from the interviews : a qualitative presentation and discussion of the field interviews will be given, focusing on the aspects of demonstration activities and using a detailed example of one centre complemented by the input from other interviews.

The fifth and final section contains the conclusions based on the survey.

POLICY MAKER INTERVIEW GUIDELINES

Objective	Topics / Questions
Role of TDAC	• Role of TDACs in public technology and innovation support programmes at sector and regional level, • Rationale for the existence of TDACs
Performance of TDAC	• Success of TDAC in supporting SMEs, • Are there technologies or applications which can be better diffused via TDACs ? • Effectiveness of TDAC activities, • Methodology and criteria used for the assessment of TDAC activities.
Public Policies	• Position of TDAC in National technology transfer systems / programmes, • Other related activities or measures in the area of technology transfer and innovation strategies promoted by the government, • Role of public authorities / sponsors (funding, strategies on technologies, application fields, target groups),, • Links with European policies (implications)..

2. TECHNOLOGY TRANSFER ACTIVITIES IN PORTUGAL

The first TDAC-type centres that were set up in Portugal were done so by a team of professors in the mid 1980s. The purpose of the centres was to act as a form of consultancy for industry. After the introduction of the PEDIP I programme around 1990 however, infrastructures were set up in order to transform these small groups into technological centres.

At their creation about 5 years ago, the centres were oriented towards assisting firms with the conception, development and implementation of technical solutions. One year later, they started to orientate their activities towards research and technological development, and testing and certification. 1992-1993 saw the real development of demonstration activities.

The current technological infrastructure can be classed into two groups :

- Technological Centres, which demonstrate and work with lower grades of technology,
- Institutes for New Technologies, which base their activities around high-technology.

These two groups reach different client bases.

In Portugal, SMEs are not renowned for being innovative, and they face any changes if and when they happen. As such, communicating and having any form of relation in the technological field with SMEs is a difficult task, and subsequently a gap exists between them and the Universities - Science and Technology infrastructure.

The introduction therefore, of Technological Centres, which base their activities on known technologies - which are very much applied and adapted to the needs of the enterprises - has provided an effective way of disseminating the technologies and know-how at the SME level. Identifying the centres as being a solution to their problems, an initial trust was established between the SMEs and these centres. In this way, there is a willing market for the centres' services and few financial problems for them.

For the Technological Institutes however, the situation is very different. Based on high technology and upgraded demonstration units, the centres' activities are more suited to research projects than SMEs' problems. As such, communication with SMEs is difficult and the institutes are forced to seek another market. Currently, the Technological Institutes' research oriented projects are very often linked to foreign industry via large Community projects.

This technology transfer infrastructure in Portugal has in fact experienced a sizeable increase recently, mainly supported by the PEDIP and CIENCIA programmes of the Ministry of Industry and Energy (MIE) and the Ministry of Planning which were launched 5 years ago. Almost 90 % of TDACs have thus been established during the last 5 years and the others are linked in general to the early phases of industrial development.

Even if the Portuguese technology transfer structure is relatively adequate to promote industrial innovation for the actual pattern of industrialisation, it is, in general, underused. Furthermore, it appears that industry needs to be helped in finding new clusters of higher productivity and international market penetration and therefore, new needs for TDACs will begin to emerge.

List of the Portuguese TDACs analysed

➤AQUACENTRO
⇨4880 V.DO CONDE
⇨Waste water technologies and treatment

➤INESC
⇨4000 PORTO
⇨Business communications

➤IEP
⇨4450 MATOSINHOS
⇨Fibre optics, electromagnetic compatibility, safety in electrical equipment

➤CETO
⇨4000 PORTO
⇨Optical metrology, optical advance components manufacturing, optical fibre and component setting

➤IDITE
⇨4700 BRAGA
⇨Metal and metallurgic

➤CENTIFME
⇨2431 MARINHA GRANDE
⇨C.I.M. in Mouldmaking, tools and plastics industries

➤INEGI
⇨4000 PORTO
⇨Energy, manufacturing technologies, electronics and information technologies

➤ISQ
⇨1500 LISBOA
⇨Welding, robotics, cutting, surface treatment, marking and drilling

➤CNE
⇨1900 LISBOA
⇨

➤CITEVE
⇨4760 VILA NOVA DE FAMALICAO
⇨Textiles and Clothing

➤CCP-CIM
⇨4000 PORTO
⇨C.I.M., Industrial communications

➤APATD
⇨1200 LISBOA
⇨Image database

➤AIBILI
⇨3000 COIMBRA
⇨Health technologies : spectral analysis, fluorescence measurement, biomaterials for human implantation

➤CINTEC
⇨Software and management tools for Quality Control

➤CTCV
⇨3000 COIMBRA
⇨Advanced powder technologies

➤CTIMM
⇨4100 PORTO
⇨Wood and furniture technologies : CAD/CAM and CNC Systems-furniture finished techniques

3. SURVEY RESULTS

3.1. Introduction

The body of this section is based on the country particularities that have been identified from the results of the Portuguese survey, compared to the overall results of the European countries analysed. For more detailed information on the overall results, please consult the synthesis of the study.

➔ The list of Portuguese TDACs

The table opposite lists the 16 TDAC centres that were analysed in the study and gives their address and area of activity.

➔ The Organisation, Status and Size of Portuguese TDACs

Nearly all the centres who replied to this question declared to be an independent unit.

- 10 of 12 centres who replied declare themselves to be a private or semi-public research institute,
- 12 centres out of 15 employ more than 10 full time staff; 3 centres in fact employ over 100 staff.

3.2. Activities of Portuguese TDACs

There is a large range of sectors of activity which are covered by the centres including, micro-electronics, energy, communications, design, biotechnology,... and similarly the technologies which are demonstrated are equally numerous : wood processing, shoes technologies, textiles technology, CAD-CAM, laser technologies, automation and robotics,...

➔ R&D, Testing and Certification, Assisting Firms

The centres carry out numerous activities other than the demonstration of advanced technologies although this activity is considered to be "very important" by half of the centres.

From the survey results, it can be said that in general, Portuguese TDACs place much more importance on R&D, on their role in assisting firms with the conception, development and implementation of technological solutions and on Testing & Certification. In the field of Testing & Certification, the Portuguese results are vastly superior to the EU average of 28 %.

Definition of the TDAC Typologies

Two main elements have been used to typify TDACs within the European Union :

1) The importance of the demonstration activity for the centre, which differentiates 3 classes :

- **Non TDAC** (15% of the first European sample) - where the demonstration activity is not important. These centres have been kept out of the analysis.

- **Weak definition TDAC** (18% of the first European sample) - where the demonstration activity is not one of the most important activities of the centre.

- **TDAC** (77% of the first European sample) - where the demonstration activity is strategic for the centre (one of the most important areas of activity for them).

2) The nature of the major associated activities within TDACs, excluding Non TDACs and Weak definition TDACs. From this, three new classes emerge:

- **Pure Demonstration Centres** (4% of European TDACs) - where demonstration is the only activity of the centre.

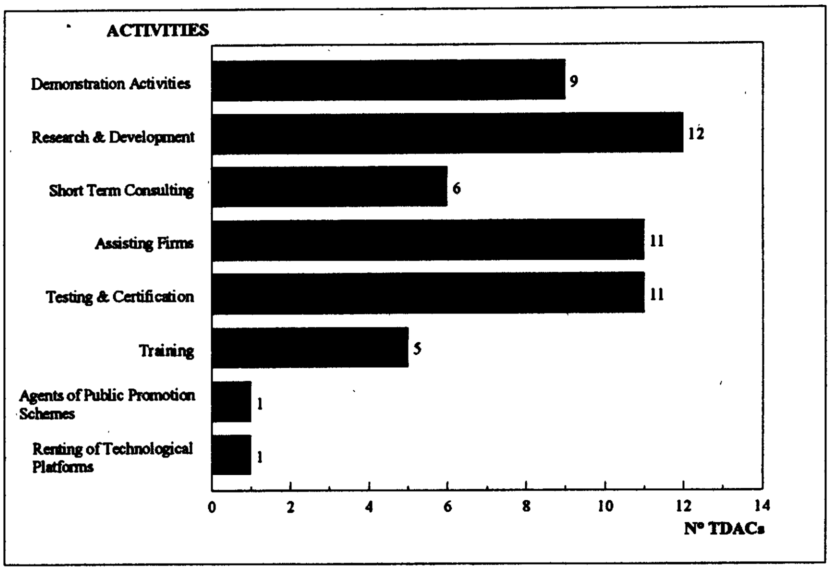
- **Integration Centres** (35% of European TDACs) - these centres are oriented towards helping the SME integrate new technologies (technical assistance, testing, training,..).

- **Development Centres** (57% of European TDACs) - these centres are oriented towards developing / adapting a new technology for the particularities of a particular industrial sector (R&D in particular)..

Typology of Portuguese TDACs

Weak Definition Centres	TDACs		
	Pure Demo.	**Integration Centre**	**Development Centre**
INESC		CITEVE	AQUACENTRO
CENTIFME		CTIMM	IEP
CNE			CETO
CINTEC			IDITE
			INEGI
			CCP-CIM
			APATD
			IBILI
			CTCV
			ISQ

Activities mentioned as "very important" by Portugese TDACs



➔ Sectors and Technological Fields : Electronics, Communication and Information Technologies

Five Portuguese TDACs, who replied to this question, consider the technological field of Electronics, Communication and Information Technologies to be a "very important" sector in which to offer their services. This is quite significantly higher than the EU average. A further 3 also declared manufacturing technologies and materials to be equally important sectors. (These centres tend to be slightly older centres and they are oriented to manufacturing technology as a result of the Portuguese industrialisation phase).

➔ Typologies : Most of Portuguese TDACs are development oriented and sector oriented

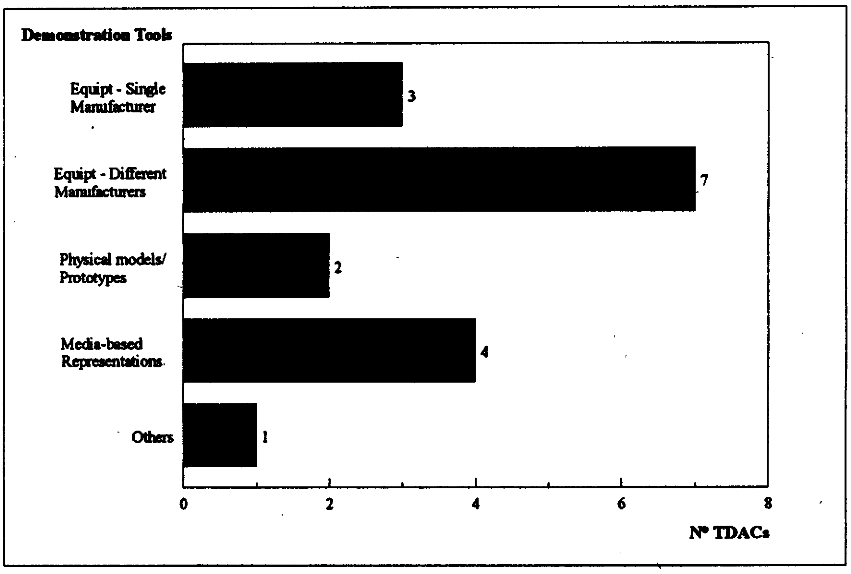
The table opposite describes the various typologies that were identified in the study looking at the typology based on the associated activities. Only 2 out of 15 Portuguese TDACs are classed as "Integration" centres, focusing on training and consulting whereas the majority, 10 centres, are "Development" oriented centres, reflecting the importance attributed by the centres to R&D, Testing and Certification and assisting firms.

Five out of 8 centres work with a specific sector such as the Instituto Electrotécnico Portugués (electronics industry) and the Centro Tecnologico da Ceramica e do Vidro (CTCV) (Ceramics & glass industries). 2 centres focus on either a specific technology, or a specific application, such as waste water treatment (Aquacentro centre). 1 centre described itself as multi-oriented, not focusing on any particular area.

➔ Methods of demonstration : Systems / equipment from different manufacturers

In order to demonstrate these advanced technologies, 7 out of 8 centres declare to do so via the use of systems / equipment from different manufacturers. Lower than the EU average, however, only 2 Portuguese TDACs claim to demonstrate advanced technologies via the use of physical models / prototypes of new technical systems.

Tools used to Demonstrate Advanced Technologies



➔ Diffusion / Promotion channels : Mailings and conferences

In Portugal, 9 out of 16 TDACs systematically promote their TDAC services. In order to promote them, like their German, Spanish, French and Italian counterparts, 6 out of 11 Portuguese TDACs regularly use the channel of mailings, the same number of centres also regularly participate at conferences and fairs in order to promote their services. 4 out of 10 centres regularly places publications in relevant journals but only 1 centre in 12 regularly advertises in relevant media.

3.3. Finance Structure : Predominance of Public Funding

➔ Initial investment

In Portugal, the TDAC centres declared that the initial investment in their centre was financed by three main sources : National public funding (13 centres), European public funding (12 centres) and Self financing (9 centres); all 3 of which are superior to the EU average.

Due to the Portuguese public policy for funding which is very centralised, implying that regional authorities therefore have very scarce financial resources, very few Portuguese TDACs have been financed by regional public funding. Significantly different from the EU average therefore, is that only 1 centre claimed to have been funded in some way by regional public funds. Furthermore not one centre declared having benefited from an initial funding by their suppliers.

➔ Budget sources

The current financing structure of TDACs in Portugal is the same as that in Greece but different to that everywhere else in Europe: every centre analysed in the survey claim that they are funded more than 70 % by public funds.

3.4. Client Base : No Portuguese TDAC has an international client base of over 20%

All TDACs analysed in the survey declared that SMEs represented over 60 % of their client base. Moreover, only 3 centres out of 10 claim that over 60 % of their clients are of a local or regional origin.

Regarding international clients, it can be said that very few Portuguese TDACs have any. Only 4 out of 10 declared to have some international clients, of which 3 have less than 10. This is largely inferior to the EU average.

3.5. Conclusion

From the quantitative information given in the survey, the following points stand out as being fairly specific to the Portuguese TDACs :

- ⇨ The demonstration of advanced technologies are considered "very important" by half of the centres.
- ⇨ The majority of Portuguese TDACs are "Development oriented" centres.
- ⇨ 5 out of 8 centres work with specific sectors (sector oriented).
- ⇨ Nearly all Portuguese TDACs said that National and European funding contributed to their initial investment.
- ⇨ All of the centres are funded more than 70 % by public funds.
- ⇨ Small enterprises represent over 60 % of the client base for all Portuguese TDACs analysed in the survey.
- ⇨ Very few Portuguese TDACs have any international clients.

INEGI - Instituto de Engenheria Mecânica e Gestao Industrial

Status :	Part of a large industrial association
Initial Investment	National and European Public funds and self financing
Budget Sources	Technical Consulting R&D contracts Subsidies to investment Courses and training
Demonstration Methods	Principally via systems / equipment from different manufacturers
Promotion Channels	Although the principal channels of promotion are defined in general by the individual units, there is an overall INEGI policy : - Assorted publicity material - Participation at conferences / fairs - Mailings - Advertisements in relevant media
Technologies used and demonstrated	Engineering and Industrial management Automation, Instrumentation and Control Computer Aided Engineering Mechanical Design and Prototypes Industrial Maintenance Composite Materials New Technologies for Foundry Sheet metal Forming Technologies Energy and Thermal Engineering Structural Integrity
Management	The management structure is simple and versatile. Each unit is responsible for its own management as an independent unit with strategy and guidelines defined internally at the unit level. Within each unit, three hierarchical levels can be defined : Administration, General Management and Division Directors.
Total number of staff	100 (50 scientists / engineers; 50 administration)

4. INTERVIEW RESULTS

4.1. A case study of the INEGI Centre

The INEGI Centre (Instituto de Engenharia Mecânica e Gestao Industrial) was set up by a team of professors from the University of Porto in May 1986 co-jointly with the AIMMM (National Association of Metalomechanic Industry), APGEI (Portuguese Association of Engineering and Industrial Management) and ADEMEC (Old students Mechanical Engineering). It is a Technological Institute but with a particularity of horizontal technology integration and a strong participation of industry bodies in its management board. The main objective was to create an interface between the University and Industry.

The INEGI, as a non-profit Association, has the usual governing bodies : General Assembly, General Direction and the Fiscal council. In 1991, INEGI received investments totalling US$13M financed by the National programme PEDIP II (Programme for Industrial Development of the Ministry of Industry and Energy, within the framework of a European Community programme). This investment was given to create technological infrastructures and acquire equipment for the setting-up of 7 laboratories.

The novelty of INEGI is that it encourages and makes it possible for SMEs to join the centre as subscribing members. This has greatly helped the promotion of industrial innovation as the centre invites SMEs to participate in projects, defining the concepts with them and asking them to co-finance the project.

➔ The Centre's Role

The progress in industrial engineering is a fast, dynamic process and INEGI acts as an Institute for Innovation and Technology Transfer through the development and demonstration of industrial technologies. It does so via several different units / divisions of which some are:

- ⇨ Automation, Instrumentation and Control
- ⇨ Industrial Drawing and Design Division
- ⇨ Industrial Management Division
- ⇨ Centre of Computer Aided Design and Manufacturing
- ⇨ Testing Laboratory,...

Each of these units usually includes :

- ⇨ a demonstration installation,
- ⇨ a simulation / prototype-test sub-unit,
- ⇨ a project development sub-unit.

and they are usually engaged on a myriad of projects with SMEs to demonstrate the application of a certain technology (or technologies) to the production process of developed or new products. One striking example is the NDT (Non-Defective testing) unit that uses advanced optical technologies for design and testing.

➔ The principal activities of the INEGI Centre

Each unit / division carries out the following activities :
- ⇨ Demonstrations through simulation / prototypes of new processes, products or technologies
- ⇨ Continuous training of personnel
- ⇨ Technical support and consulting
- ⇨ Organising company-visits

Often, the centre develops a prototype for a specific project which it then installs in one of the companies involved in the particular project for other interested enterprises to visit. One example includes the demonstration of the different applications of carbon-fibre within different industries, promoting the attributes of a lighter structure. Prototypes were subsequently developed and installed in different industries each demonstrating a different usage.

A second example is provided by a foundry with which the centre developed a new production method for process moulding. Again, company-visits were arranged to the foundry to see the new production method in operation.

- **INEGI's clients**

Five principal sectors of activities form the client base for the centre : Metal working industries, Transportation industries, Chemical and Petrochemical industries, the Cork industry and the Textiles industry.

- **INEGI's performance is monitored closely by the GEP at the MIE**

The Department of Studies and Planning (GEP) at the MIE controls the performance of most TDACs and, in particular, INEGI. More detailed information on this monitoring is given in section 4.4., but in brief, INEGI presents regular reports to the GEP that are used to evaluate its performance.

The following prototype of a Portuguese TDAC based on the survey results, could be as follows:

> An independent semi-public research institution with very strong links to Universities, and with less than 30 employees. Financed by large contributions or national public funding (usually PEDIP programme) and set up within the last five years. It concentrates its activities on demonstrations and directly associated services, using its own equipment supplied from different manufacturers.
> The main technological fields covered are electronics, information sectors, manufacturing, communication technologies, automobile components and natural resources. TDACs are also deeply involved in research and development and assistance to firms through technical solutions.
> The principal channels of promotion are participation at fairs and conferences, and direct mailings targeting essentially SMEs regionally and nationally based.
> The main concern for the TDAC is how to finance the installation of the centre, the operating costs and the required personnel.

4.2. Lessons from the TDAC Interviews

From the numerous centres that were visited, the following lessons can be drawn concerning the evolution of the centres:

⇨ The centres which base their activities around « lower sophisticated » technology (Technological Centres) will not have problems to survive and strengthen. Their previous experiences with SMEs have proved advantageous, especially from the SME's point of view? and a common language has been established.

⇨ The centres which base their activities around highly sophisticated technologies (Technological Institutes) are more likely to be heading towards a cycle of critical periods where they will be forced to make some needed changes (in strategy, market approach, management,..).

⇨ A rapid evolution towards media-based representation/demonstration is likely to occur in light of the emergence of multimedia tools and technologies.

⇨ The main business areas identified are :
- New processing technologies
- New industrial technologies
- Ecotechnologies
- Materials characterisation and development.

⇨ Demonstration activities are carried out in the following targeted industrial sectors :
- Transportation industry
- Cork industry
- Chemical & Petrochemicals
- Metalworking industry
- Energy
- Textile industry;

⇨ It has been noted that any international co-operation is established by the TDACs through their R&D projects which are funded primarily by European programmes. The internationalisation of Portuguese TDACs has therefore started and the establishment of an international network is a strategic move for the TDACs.

One major problem identified by the majority of Portuguese TDACs however, concerns the lack of communication between the partners involved in the project.

Analysing the Portuguese survey results, the issues at stake for the future appear to be:

⇨ Portuguese TDACs in general should change their management approach in line with the demands of the SME market.

⇨ TDACs should seek to promote their image, increasing significantly their visibility and act to. reduce the industrial cultural gap in relation to other European industrial environments.

⇨ TDACs must promote the training of personnel in order to stimulate the technology fabric of the country so that it will be possible to recruit the people needed who have the necessary management and technological skills.

⇨ They must develop strategies which will guarantee the financial resources needed to cover the salaries of the personnel.

⇨ The realisation of joint demonstration projects should be stimulated, involving both the TDAC and SME from particular sectors right from the definition phase of the project.

⇨ The Portuguese TDACs desperately need to be integrated into European networks and support should be provided by the Community to achieve this aim.

4.3. What do Enterprises think of Demonstration Activities ?

The TDAC's clients in general felt that TDACs can help with :

- Technological Development
- Making them aware of new/existing technologies
- Adaptation of production methods and products to new advanced technologies and markets
- Integration of technology
- Technology transfer
- Identifying partners.

A further advantage offered by TDACs involves them accompanying a client/enterprise from the first stages of the conception through to the industrialisation of the final product, process or technology, assisting with and controlling each phase of the development. The sharing of responsibility for a project makes TDACs very attractive partners for the development of specific technologies co-jointly with an SME.

The integration of the new process or technology into an enterprise's regular production process receives, in general, global support from the TDAC that usually includes a free service to facilitate the integration and subsequent adaptations concerning : re-organisation, management, training, continuous technical support,..

4.4. Role of the Policy Makers

In Portugal, the principle Policy Makers are the Ministry of Industry and Energy (MIE), which is associated mainly via the GEP, and the Ministry of Planning, which is mainly associated via the CIENCIA programme. The current public policy programme which covers the TDACs is the PEDIP II programme which came into operation in 1994/1995 in conjunction with the latest Community Structured Framework programme. The PEDIP programme is a specific one to help the development of industry, both in terms of technology and market approach, and the role in fact, of the public policy is to provide stimulating funding.

➔ The Ministry of Industry and Energy (MIE)

The MIE follows two different approaches : one involving direct contact with the TDAC and one involving direct contact with the SME/client.

Regarding the relationship with the SME, support funding from the MIE is given directly to the SME, or their networking bodies (such as professional syndicates or Employers' Unions), who in turn contract the services from the TDACs. For a particular project, usually the SME provides 25% of the costs and 45%-55% is funded externally. 75% of this external funding in general, comes from the FEDER and the rest from the OGE (State budget); there must be a joint contribution.

Regarding the direct contact with the TDACs, the MIE plays a role of observer/evaluator, as was mentioned in the section 4.1. The MIE has established a series of macro-indicators of the evolution and degree of success of the centre :

- Percentage of operating expenses covered by the clients
- Number of industrial clients
- « Recycling » of clients (variations of the client population).

At present, this method is applied to 40 centres and will gradually be extended to cover all of them. This constant observation allows the effects of the public policies to be measured and brings to evidence the necessary additional measures that subsequently need to be taken. The methodology for assessment is a mixture of financing indicators and market interaction indicators. The conclusion from their observations supports the idea that the « old » Technological Centres are well inserted in the technology transfer infrastructure. The « new » centres however, (Technological Institutes), with a profile of higher (or even too high) technology, will have to reorient their activities more in line with the SME's demands.

In light of the active role played by the MIE, it seems fair to say that the public policy makers in Portugal openly recognise demonstration activities as an integral part of the technology transfer infrastructure, and recognise their added-value potential.

5. CONCLUSIONS

⇨ Portuguese TDACs are, in general, fairly well supported by their public authorities. The fact that all of the TDACs analysed declared that over 70% of their budget sources come from public funds supports this notion.

⇨ The Technological Centres have proved to be an efficient tool to reach SMEs in Portugal : small enterprises represent over 60% of the client base for all the TDACs identified in the survey.

⇨ TDACs are believed to play an important role in the demonstration of technologies, mainly due to the current pattern of industrialisation. Demonstration is very important because of the general industrial inexperience with the latest technologies created by this phase of industrialisation.

⇨ In general, demonstration activities of advanced technologies are considered positively by clients/enterprises especially for their support given in making them aware of new/existing technologies, adapting their production methods and products to new advanced technologies and markets and identifying suitable partners for projects.

⇨ Demonstration activities require a fairly important level of financing in both the initial start-up and development phases. In recent years, with the exception of national funding (PEDIP), all of the centres have been self-supported through their contracts with industry and R&D projects. The MIE gives financial support to SMEs to cover expenses for projects where intervention from TDACs might be needed, which is then passed on to the centres under the form of "fees for services".

Technology Demonstration and Application Centres in the United Kingdom

Country Report in the Framework of the SPRINT EIMS Project 94/71

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CONTENTS

Technology Demonstration and Application Centres in the United Kingdom

1. Introduction

Technology demonstration activities occur in the UK, but they have not occupied a central position in the technology and business strategies of the organisations conducting them. Neither have they constituted a central plank of public policies to support innovation. Nevertheless, technology demonstration activities do have a role to play in the processes of technology transfer and diffusion, and the increasing importance these are assuming in the innovation policies of governments around the world merited a review of current technology demonstration practices in the UK.

This review has been conducted as part of a broader review of technology demonstration practices in the European Union (EU). The first step involved the identification of organisations in the UK technology infrastructure likely to be involved in technology demonstration activities. Assistance was sought from the Department of Trade and Industry (DTI), which provided a list of potential Technology Demonstration and Application Centres (TDACs). Eighty potential TDACs were identified.

The next step involved the preparation of a questionnaire designed to collect basic information on the scope and scale of technology demonstration activities in these organisations. The questionnaire was then sent to all potential TDACs in the UK. Forty-seven out of the 80 institutions replied (59% response rate), with 38 confirming that they undertook technology demonstration activities of one sort or another.

To add flesh to the skeletal information provided by the survey of UK TDACs, interviews were conducted with senior personnel in four UK TDACs and with a number of UK policy makers. It was also possible to draw on a parallel study being undertaken by Technopolis for the DTI which involved interviews with a large number of the users of TDAC services.

The results of all these steps are reported in the following sections. Section 2 covers the major points arising from the interviews with policy makers, TDAC managers and SMEs. It provides a broad, qualitative overview of technology demonstration activities in the UK and public support for them. In Section 3, the quantitative results of the questionnaire survey are presented. Finally, in Section 4, the results of the study are summarised.

2. Technology Demonstration Activities in the UK

This Section covers the main points arising out of the interviews with policy makers, TDAC managers and SMEs. It covers the nature of technology demonstration activities in the UK and the policies in place to support them.

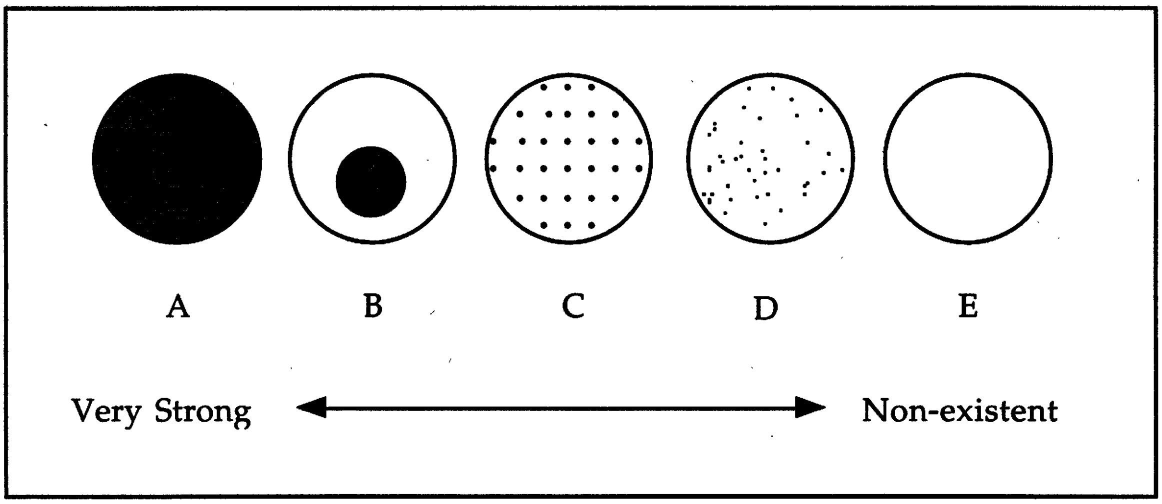
- Technology demonstration activities occur in a number of organisational settings within the UK Technology Infrastructure

- The main organisations in the Technology Infrastructure which conduct technology demonstration activities are Research and Technology Organisations (RTOs). Typically these are sector-based Research Associations set up as research centres and applied problem-solvers for particular industries (e.g. footwear, food processing, welding, printing etc.)

- Exhibit 1 shows figuratively how technology demonstration activities in these organisational settings can be either:

  A - the sole or primary function of the organisation (i.e. the whole organisation can be considered a TDAC)
  B - concentrated in a particular TDAC within the organisation
  C - distributed around the organisation
  D - an infrequent occurrence in the organisation
  E - non-existent

Exhibit 1 Technology Demonstration Activities within an Organisation



- In the UK, there are very few A- and B-type organisations in the Technology Infrastructure, i.e. there are few true TDACs. Technology demonstration is normally an intermittent activity which is distributed around an organisation over space and time (Type C and, more frequently, Type D)

- Technology demonstration is often an unplanned activity which occurs as an afterthought. Typically a research project or a problem-solving task produces an output with diffusion potential which stimulates a modest amount of demonstration activity. The role of technology demonstration in an organisation's overall strategy is rarely considered

- The clients of organisations located in the UK Technology Infrastructure generally turn to them to solve problems (of both a technical and commercial nature); to provide information and give advice on topics such as technology licensing and sources of appropriate technology; and to access services they cannot undertake in-house, e.g. R&D and training. They are not widely or primarily regarded as demonstration centres

- The organisations identified in this study as TDACs (mainly Type C and Type D RTOs) do receive public technology and innovation support from national government sources and from the EU. Much of this support is project based, and although technology demonstration does sometimes occur, it is rarely the main focus of projects

- Support for innovation in the UK is currently geared around:
  - creating a favourable economic climate
  - reducing administrative and regulatory burdens on business
  - providing direct assistance in cases of market failure

- DTI activities therefore cover:
  - working to strengthen partnership between Government and industry
  - fostering the climate for innovation
  - promoting best practice
  - promoting technology transfer via access to know-how and the use of know-how
  - encouraging appropriate technology development

- Historically the largest area of expenditure has been in technology development. Current programmes include grants for SMEs (SMART and SPUR); industry and academic collaborations (LINK); and European collaborations (EUREKA and the the Fourth Framework Programme). Many of the technology demonstration activities which occur within institutions located in the UK technological infrastructure arise as a result of project funding of this nature. In large part they are incidental activities and not the primary focus of the projects

- There has been an increasing shift of emphasis, however, to the promotion of technology transfer (via Business Links; the Teaching Company Scheme; and access to Overseas Technology); and to the promotion of best practice (via the Managing in the '90s Programme, for example)

- There is no formal or direct public support for technology demonstration activities in the TDAC population of the UK

- Consequently there are no public mechanisms in place to assess the scope, scale, nature, efficiency, effectiveness and impact of technology demonstration activities in RTOs and similar organisations. Similarly, at an organisational level, assessment mechanisms are scarce, making aggregation to a national level difficult

- Public support for technology demonstration activities does exist, though the focal points for the activity are private sector firms rather than TDACs within RTOs. The main mechanism is the Inside UK Enterprise Scheme (IUKE) sponsored by the UK Department of Trade and Industry (DTI)

- This scheme provides an opportunity for UK firms to visit leading companies employing best management practices in a wide range of product areas. Visits are designed to give a better understanding of these issues and a forum in which to discuss with senior management the implications of the strategic issues and the advanced technology which help to create business success. Currently there are an average of four visits per year to over 100 companies demonstrating best practice in the fields of:
    - purchase/supply
    - design
    - quality
    - successful product introduction
    - manufacturing improvement
    - total quality
    - cellular manufacturing
    - human resources
    - management of information/CALS

- The IUKE scheme has parallels in Germany and the Basque country, but there are no parallel Commission activities

- In the UK, many of the RTOs which host technology demonstration activities (albeit in a sporadic fashion) have been affected by recent changes in innovation support policies in the UK. In particular, DTI plans to limit R&D support have led many RTOs to look towards the Commission for funding. It has also caused some of them to consider other activities which could generate funds. These include technology transfer and diffusion, and technology demonstration is starting to receive more attention as one possible mechanism to stimulate diffusion in a more coordinated fashion

- A new DTI programme to be launched in 1995 is aimed at RTOs and other potential TDACs. It will provide assistance to organisations in the UK technological infrastructure wishing to develop more focused strategies for serving the needs of SMEs. There will be no overt focus on technology demonstration activities, but organisations will be encouraged to review the role of these in their overall technology and business strategies

- There are also likely to be more public programmes specifically geared to demonstration activities which are likely to attract the TDACs, amongst others. For example, the DTI is currently planning to launch a Multimedia Demonstrator Programme to help diffuse multimedia technologies and applications

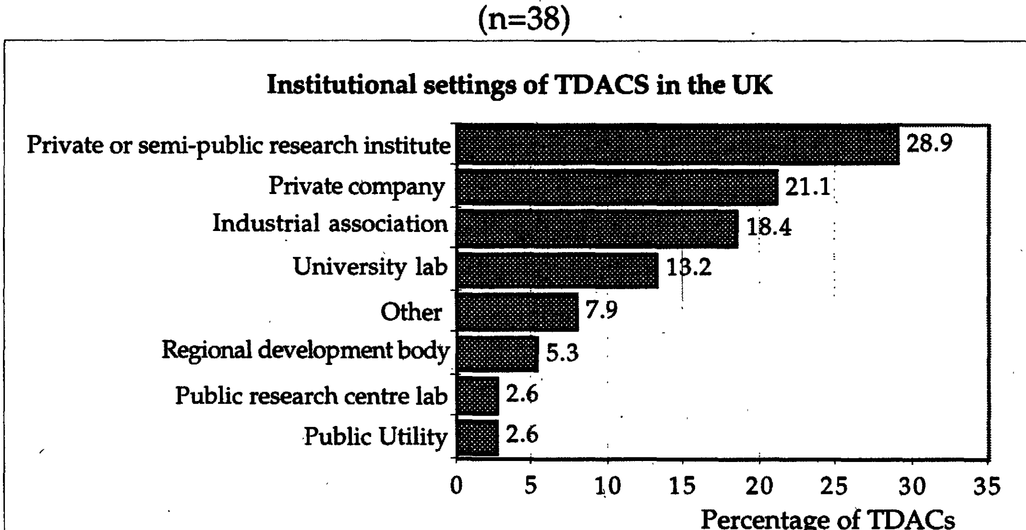
3. Survey Results

The purpose of the survey was to collect basic information on Technology Demonstration and Application Centres (TDACs) in the UK. The questionnaire was designed to gather information in the following main areas:

- Organisation - (status & type of institution, establishment, finance, personnel)
- Services - (main activities, technological fields, promotional activities)
- Client Base - (by type, sector, size)
- Future Developments - (strengths and bottlenecks, future plans)

3.1 Organisation

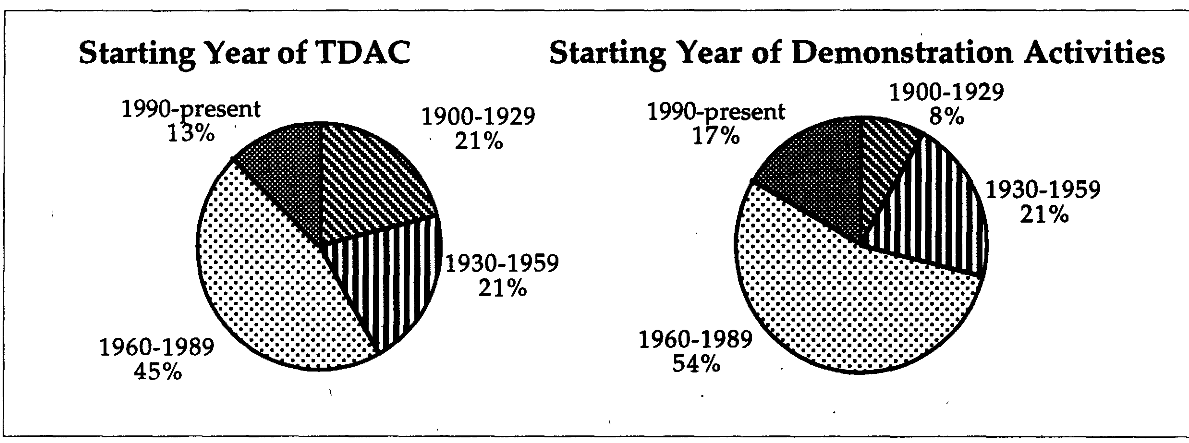
Exhibit 3.1
(n=38)



Of the 38 Technology Demonstration and Application Centres in the UK that responded to the questionnaire, 55% (21) stated that they were an independent body which concentrated on technology related services, including demonstration. The remainder (17) reported themselves to be part of a larger organisation. Exhibit 3.1 shows how the TDACS are split according to type of institutional setting. The TDACs that are independent bodies fall into three main categories; private or semi-public research institutes (9), private companies (5), and industrial associations (5). TDACs forming constituent parts of larger organisations were found in every one of the categories shown below, but were most commonly university labs (5) or units within private companies (3).

The year of establishment of the TDACs in the survey is shown in Exhibit 3.2. Similar numbers of TDACs were established in the first two periods (1900-1929 & 1930-1959), with a significant increase in the period 1960-1989. In the last five years, three new TDACs have been established. As regards demonstration activities, roughly half of the TDACs started demonstrating advanced technologies in the year that they were established. Of those centres not starting demonstrations until later, most did so within a year or two of the centre being established.

Exhibit 3.2
(n=24)



The sources of the TDACs' budgets are shown in Exhibit 3.3. By far the biggest source of income for TDACs in the UK is fees for services, representing over half of all financing. Public project funding and public core funding make up roughly one-third of TDAC finances between them, and membership fees represent most of the remainder. Exhibit 3.3 also shows how the sources of TDAC budgets have changed over the last three years. In half of the TDACs, financing via fees for services had increased over the last three years, whilst public project funding and public core funding decreased in a similar number of centres. Public project funding had increased in 16% of the centres but no centres experienced an increase in public core funding.

The sources of the initial investment in equipment used for demonstration purposes is shown in Exhibit 3.4. Most of the centres reported that demonstration equipment was funded by a variety of sources. National public funding was the most common single source, used for purchasing demonstration equipment in 63% (24) of the centres. Sixty percent of the centres (23) used their own money, whilst suppliers and users contributed in 47% (18) of the centres. Public money from Europe had funded demonstration equipment in 34% (13) of the centres.

Exhibit 3.3
(n=31)

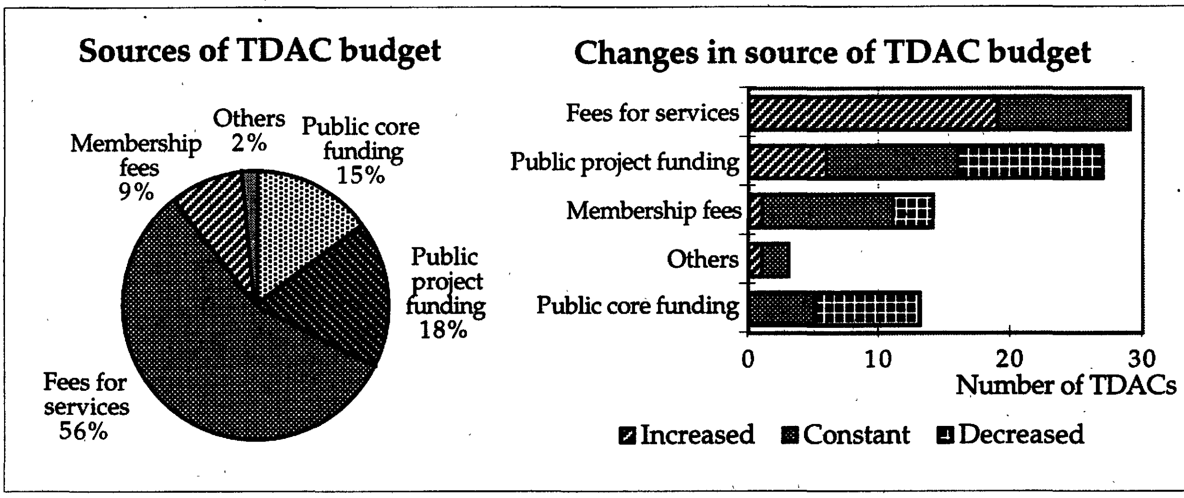
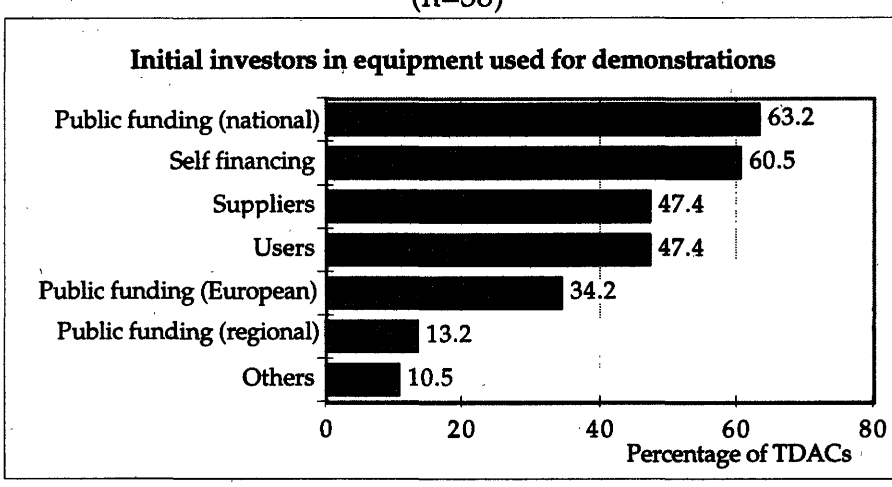


Exhibit 3.4
(n=38)



The average turnover of a TDAC in 1993 was roughly £1.75M. Exhibit 3.5 shows approximate turnovers for 1993 for the 31 centres who responded to this section of the questionnaire. Twenty nine percent (9) of the centres had a turnover of less than £1M in 1993, whilst 19% (6) had a turnover of more than £20M. Exhibit 3.5 also shows how the turnover of the centres has changed in the last three years. Over two-thirds of the centres stated that turnover had increased in the last three years, whilst only five centres (16%) stated that turnover had fallen.

Total numbers of employees in the TDACs are shown in Exhibit 3.6. Of the 36 centres responding, 58% (21) had between 1 and 100 employees, 33% (12) had between 101 and 500 employees, and 8% (3) had more than 500 employees. The average number of staff working in a TDAC was found to be approximately 250. Exhibit 3.6 also shows how these employees are split between technical staff (76%), administrative staff (21%), and others (3%).

Exhibit 3.5
(n=31)

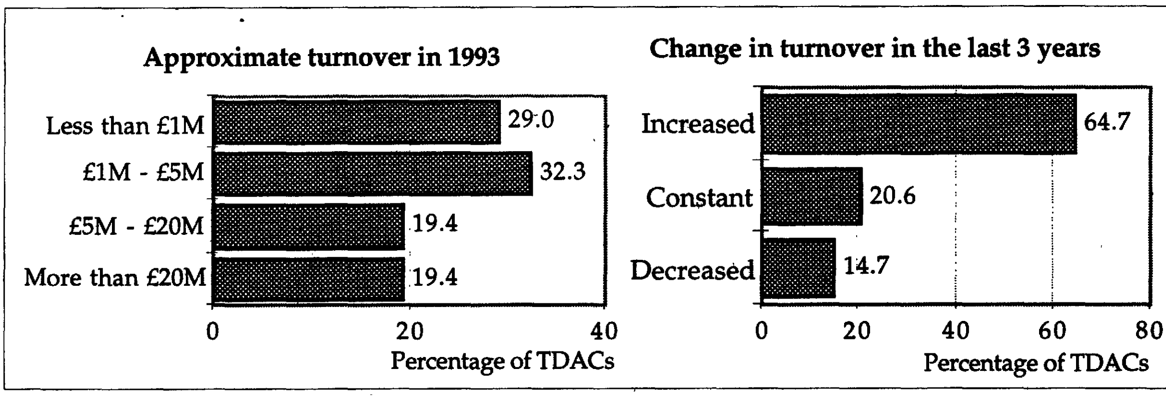
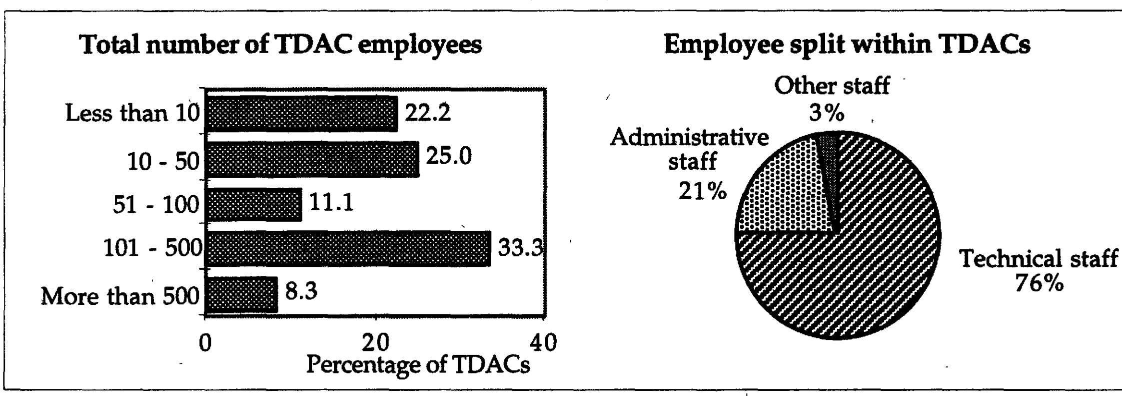


Exhibit 3.6
(n=36)

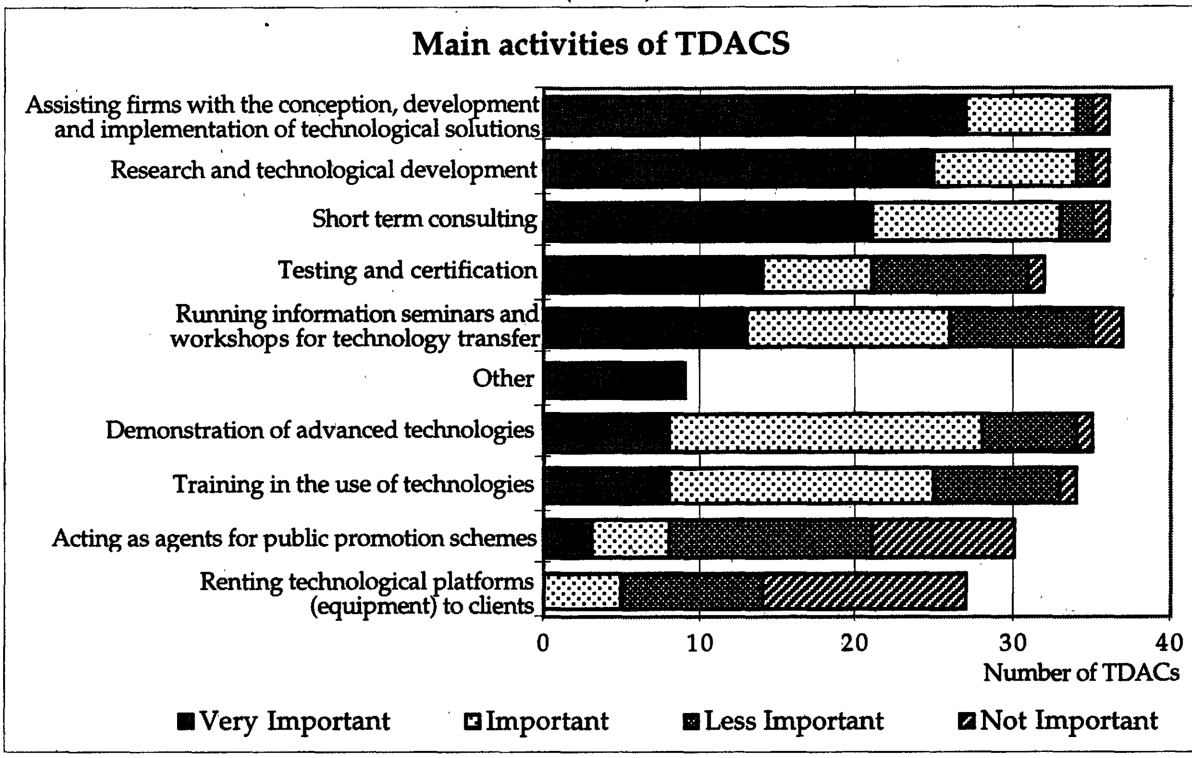


The survey revealed how the total work force had changed over the last three years. The total number of employees had increased over this period in just over one third of the centres, had decreased in just over one third, and had remained unchanged in the remainder. Staff undertaking demonstration activities remained the same in 46% (16) of the centres, increased in 33% (12) of them, and decreased in 22% (8).

3.2 *Services*

The TDACs were asked to indicate the importance of a number of activities on a scale ranging from 'Very Important' to 'Not Important'. The number of centres rating each activity are shown in Exhibit 3.7. It can be seen that assisting their clients with the conception, development and implementation of technological solutions, R & D, and short term consulting are the three activities rated as 'Very Important' by over half of the centres, and rated 'Important' by almost all of them. Testing and certification and running seminars and workshops for technology transfer are either 'Very Important' or 'Important' activities for over half of the centres. Demonstration of, and training in the use of, advanced technologies are important activities in most of the centres, but were rated as 'Very Important' by only 21% (8) of them. Exhibit 3.7 also shows that most

Exhibit 3.7
(n=38)



TDACs act as agents for public promotion schemes, though for the majority this is a minor activity. The TDACs in the survey do not, on the whole, rent technology platforms to their clients.

The four most important activities (in order of importance) of the independent TDACs and those that are units of larger organisations are shown below:

Independent
Research and technological development
Assisting firms with technological solutions
Demonstration of advanced technologies
Short term consulting

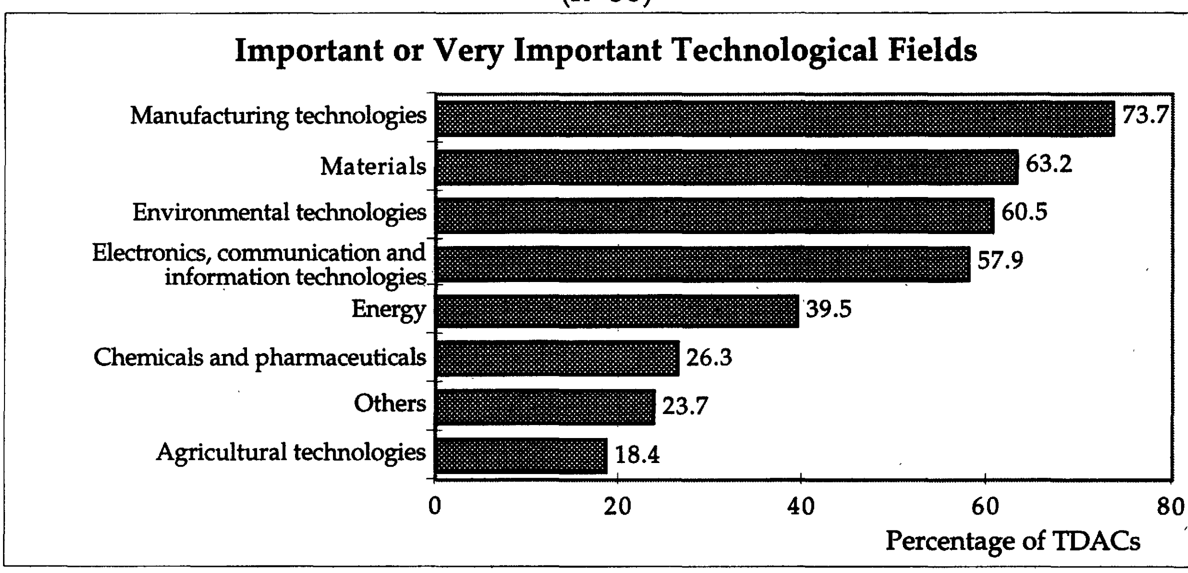
Part of a larger organisation
Short term consulting
Research and technological development
Assisting firms with technological solutions
Running information seminars and workshops for technology transfer

Ninety four percent of the independents regard technology demonstration as at least 'Important' whereas only 62% of the units of larger organisations do so.

The TDACs were also asked to rate the importance of certain technological fields in which demonstration and application services were offered. Exhibit 3.8 shows the percentage of centres rating each field as 'Very Important' or 'Important'.

Almost three quarters of the centres rated manufacturing technologies as a field in which they provide their services. The fields of environmental and materials related technologies were offered by over 60% of the centres, and services in the area of electronics, communication, and information technologies were offered by over half of the centres. Services in the more specific fields of agricultural, chemical & pharmaceutical, and energy related technologies were also offered but only by a minority of the centres.

Exhibit 3.8
(n=38)



The centres were asked to classify themselves according to whether they were technology-centred (i.e. they demonstrated a single technology across multiple application areas and sectors), application-centred (i.e. they demonstrated multiple technologies in a single application area across multiple sectors), sector-centred (i.e. they demonstrated multiple technologies in multiple application areas relevant to only one sector), or other. Exhibit 3.9 shows the percentage of centres in each category, and it can be seen that the UK TDAC scene is dominated by sector-centred institutions. Almost one third of the TDACs, however, felt that they did not fall easily into any of the categories, and rated their centre as 'other'. The majority of these centres stated that they demonstrated multiple technologies in multiple application areas across multiple sectors.

The means by which the TDACs demonstrate advanced technologies are shown in Exhibit 3.10. Roughly two thirds of the centres in the survey demonstrated technologies via systems and equipment from different manufacturers, whilst less than 10% used systems and equipment from only one manufacturer. Again approximately two thirds of the centres used media-based representations e.g. computer models, charts and videos. Just under half of the centres used physical models to demonstrate technologies.

Exhibit 3.9
(n=38)

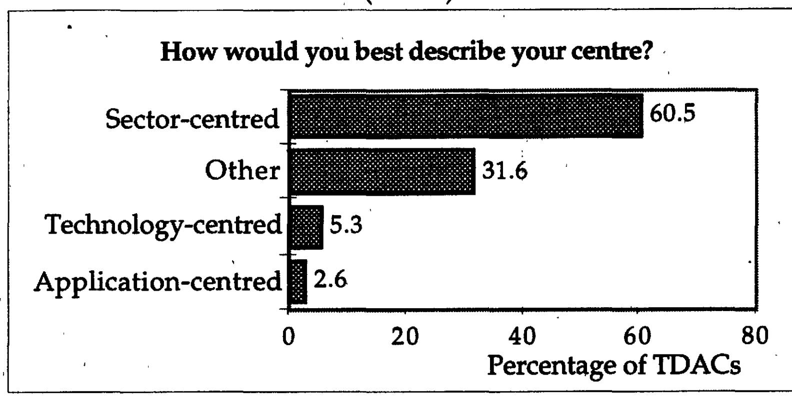
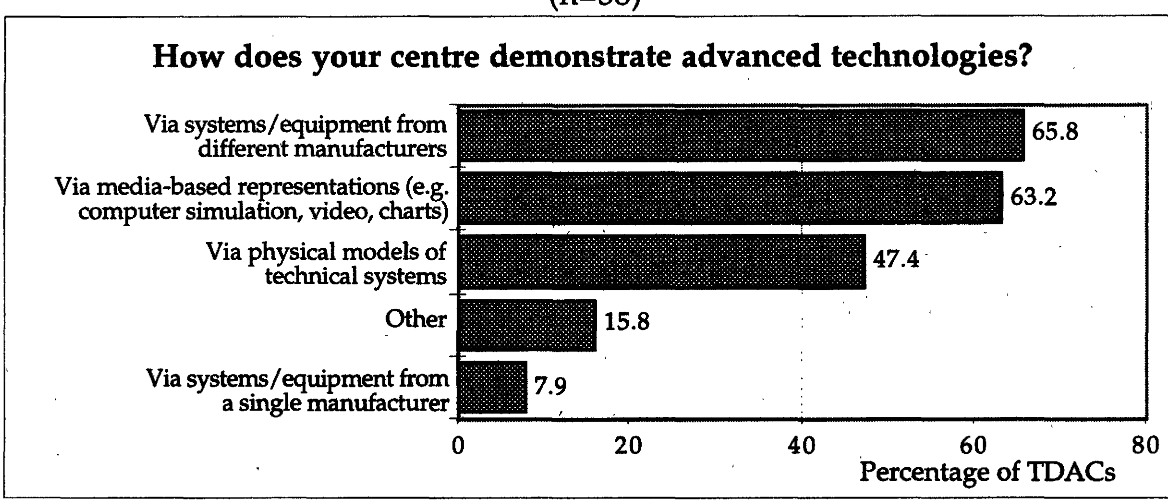


Exhibit 3.10
(n=38)



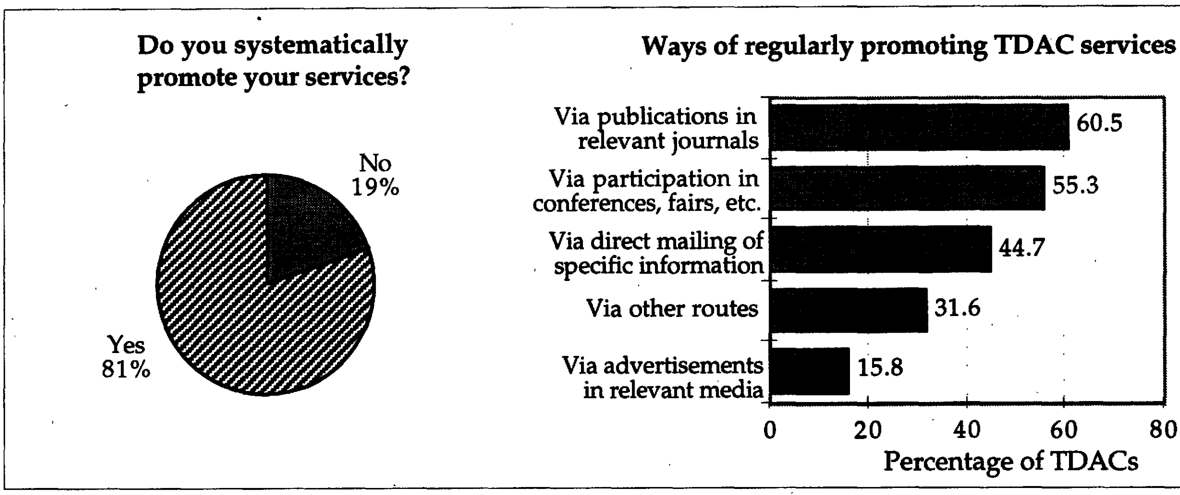
The marketing activities of the TDACs are presented in Exhibit 3.11. It can be seen that over 80% of the centres do promote their services in a systematic fashion. The most popular mechanisms are publications in relevant journals and participation in conferences and fairs, both of which are used by over half of the centres in the survey. Direct mailing of specific information is also commonly used to promote TDAC services, and although advertisements are sometimes placed in the relevant media, their use is much less common.

3.3 *Client Base*

The client base of the TDACs in 1993 was investigated by type, by sector of industry, and by geographical origin.

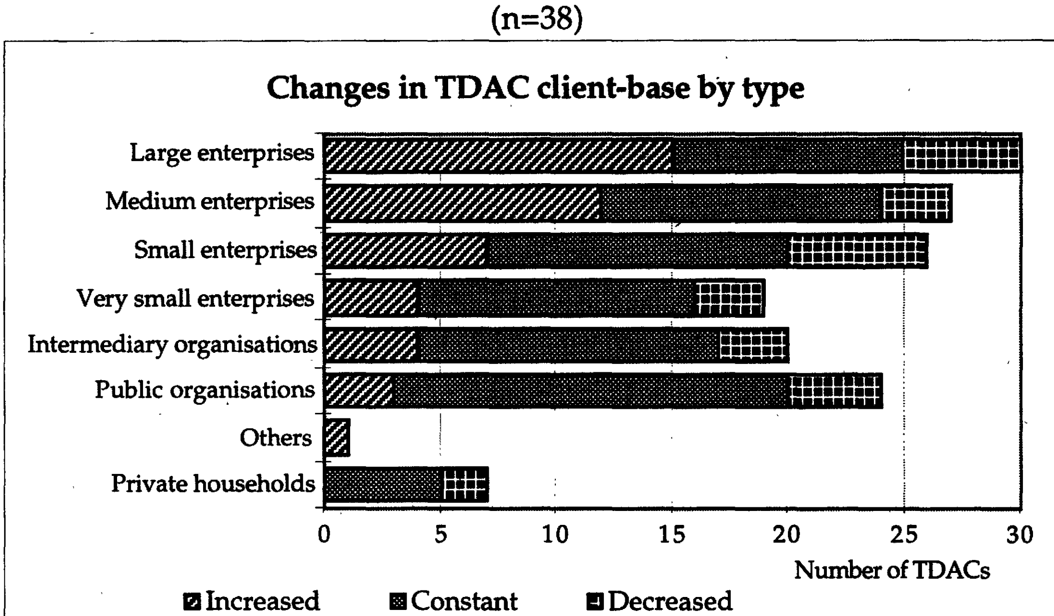
The most common clients of the centres are medium enterprises (50-500 employees), representing 37% of all TDAC clients. Next are large enterprises (more than 500 employees), representing 16% of clients; and small enterprises (less than 50 employees), 12% of clients. The remainder is split between very small enterprises, public organisations, intermediary organisations,

Exhibit 3.11
(n=36)



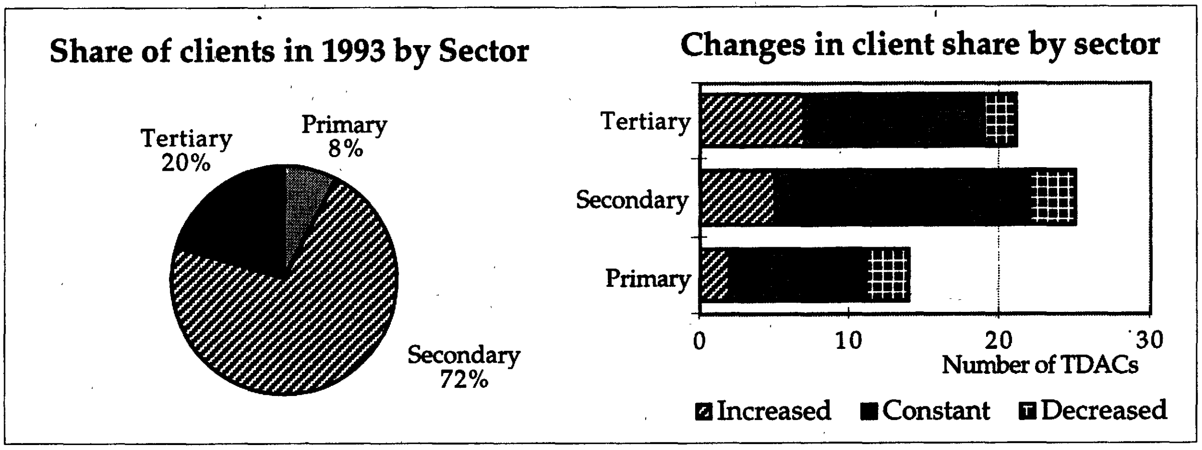
private households, and others. An investigation of how this client base has changed over the last three years reveals that there has been large gains in the number of clients who are large and medium enterprises, whereas other types of client have remained steady overall (see Exhibit 3.12).

Exhibit 3.12
(n=38)



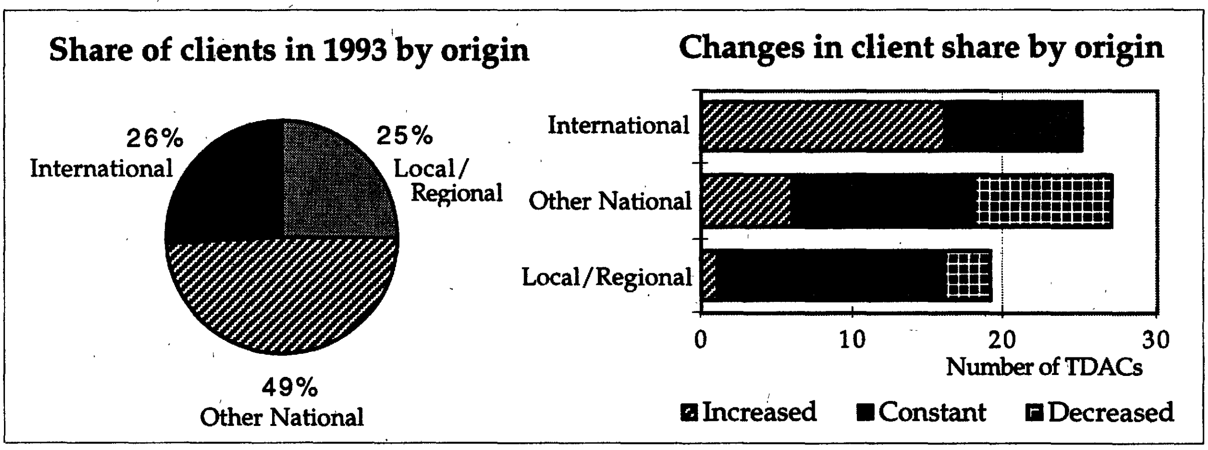
The approximate share of clients by industrial sector, along with changes over the last three years, is shown in Exhibit 3.13. Almost three quarters of TDAC clients are from secondary industries (manufacturing etc.), one fifth are from tertiary industries (services etc.), and the remainder are from the primary industries. Exhibit 3.13 also reveals that TDACs over the past three years have seen more gains than losses in clients from both manufacturing and the service sector, whilst clients have been lost overall from the primary industries.

Exhibit 3.13
(n=38)



The approximate share of clients by geographical origin, along with changes over the last three years, is shown in Exhibit 3.14. One quarter of all TDAC clients are from the centres' local areas or regions, approximately half are other UK clients, and the remaining quarter are international clients. Over the last three years the number of UK clients (both locally and nationally) has decreased in more centres than it has increased. However, this trend is offset by increases in the number of international clients. Almost half of the centres in the survey reported an increase in the numbers of international clients, and none of the centres reported a fall off in numbers from abroad.

Exhibit 3.14
(n=38)



3.4 *Trends and Developments*

The centres were asked about the main factors likely to affect the TDAC in the coming years and to rate each factor according to whether it was perceived as a major or minor potential strength/opportunity or major/minor potential weakness/bottleneck. The percentage of centres rating each factor a major weakness/bottleneck is shown in Exhibit 3.15. Clearly the main bottlenecks facing TDACs in the coming years relate to finance. Almost half of the centres (17) foresee problems with financing demonstration equipment and facilities, and over a quarter (10) are concerned over the financing of personnel. Concerns were also expressed over changes in government/EU regulations (7), the recruitment of qualified staff (6), and economic developments in the sectors served (6).

Exhibit 3.15
(n=38)

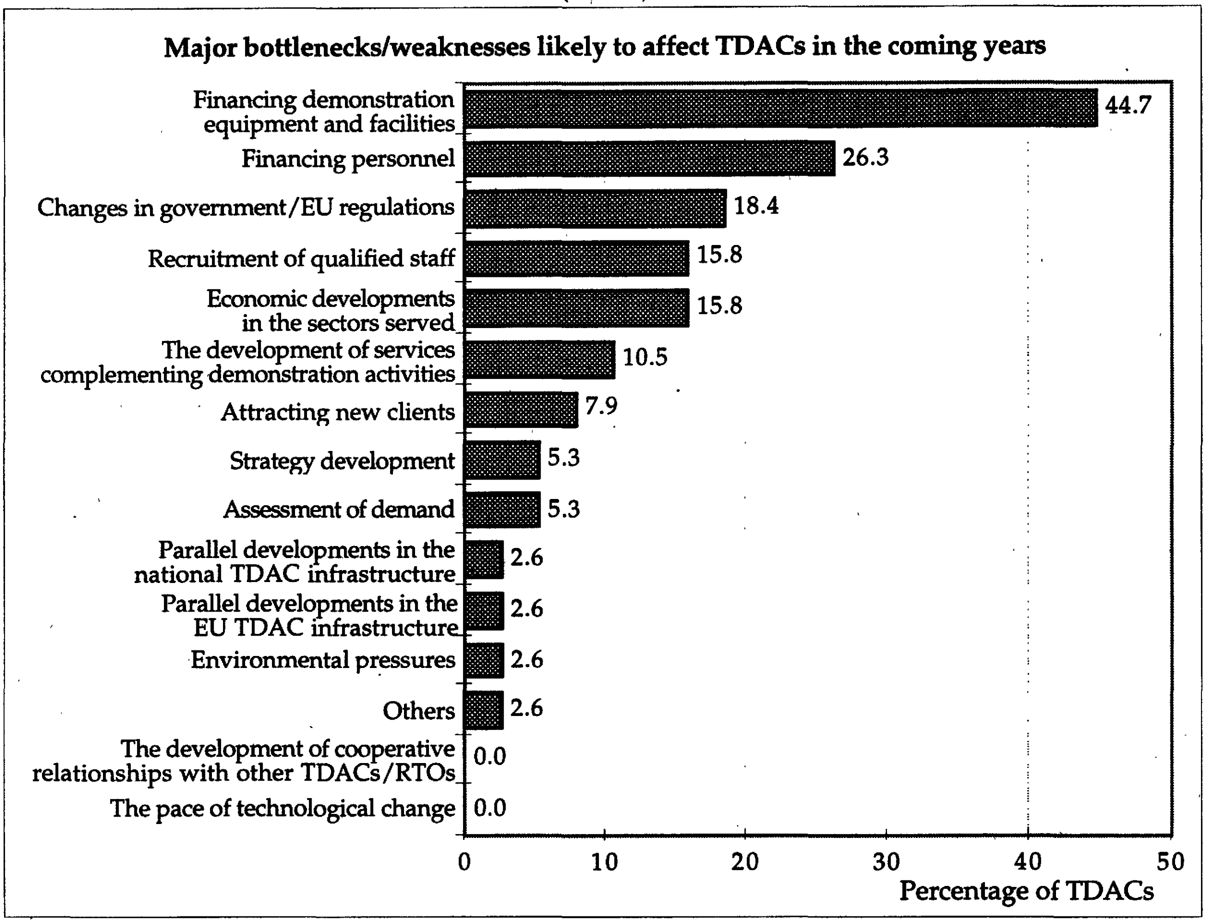
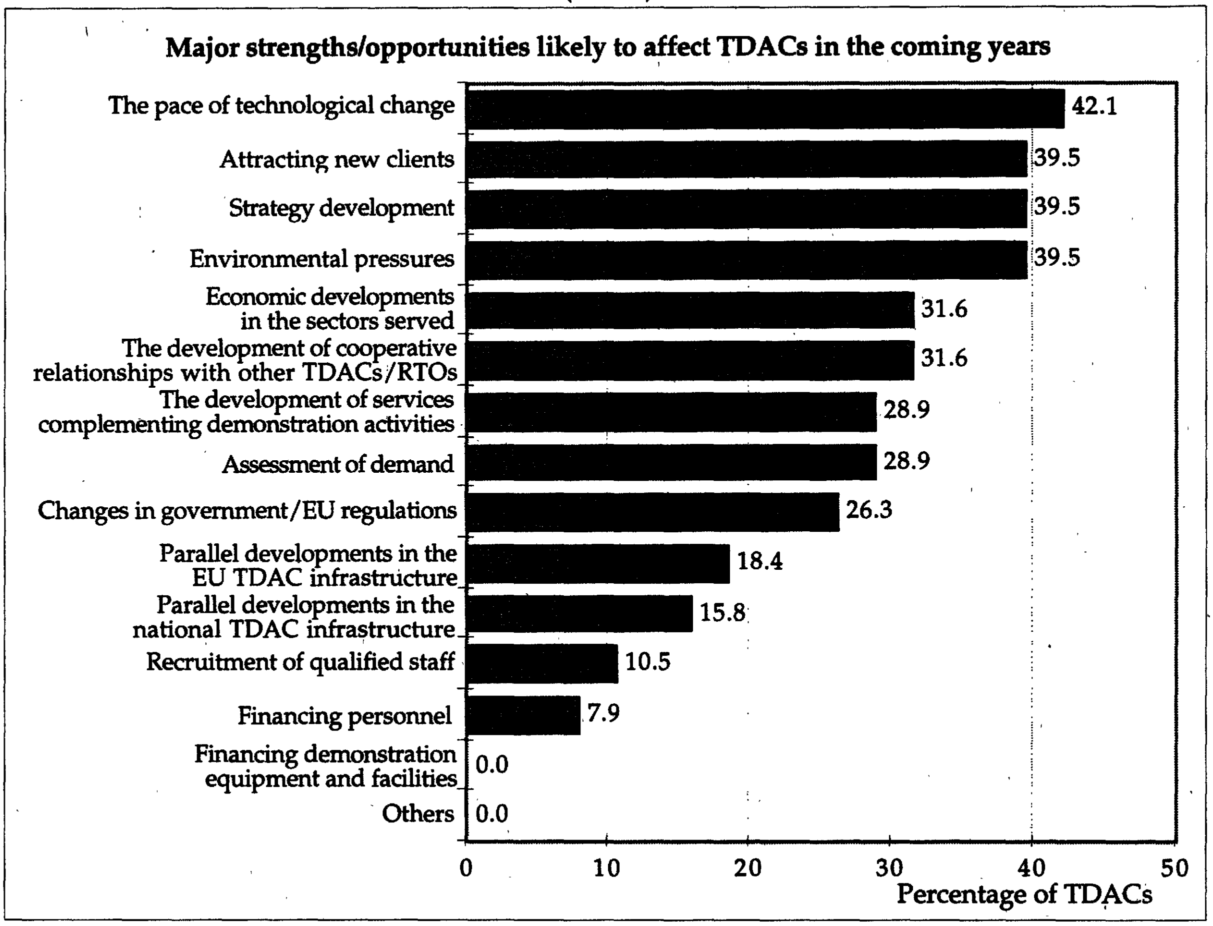


Exhibit 3.16 shows the percentage of TDACs seeing each factor as a potential major strength/opportunity. The main opportunities seen by the centres are the pace of technological change (16), attracting new clients (15), strategy development (15), and environmental pressures (15). Economic developments in the sector served, the development of cooperative relationships with other centres, the development of services complementing demonstration activities, and assessment of demand were also seen as potential opportunities by a significant number of centres.

Exhibits 3.15 and 3.16 show clearly that more TDACs see the factors listed as opportunities than as bottlenecks. The only factors perceived more frequently as bottlenecks than as an opportunities were financing demonstration equipment and facilities, financing personnel, and the recruitment of qualified staff.

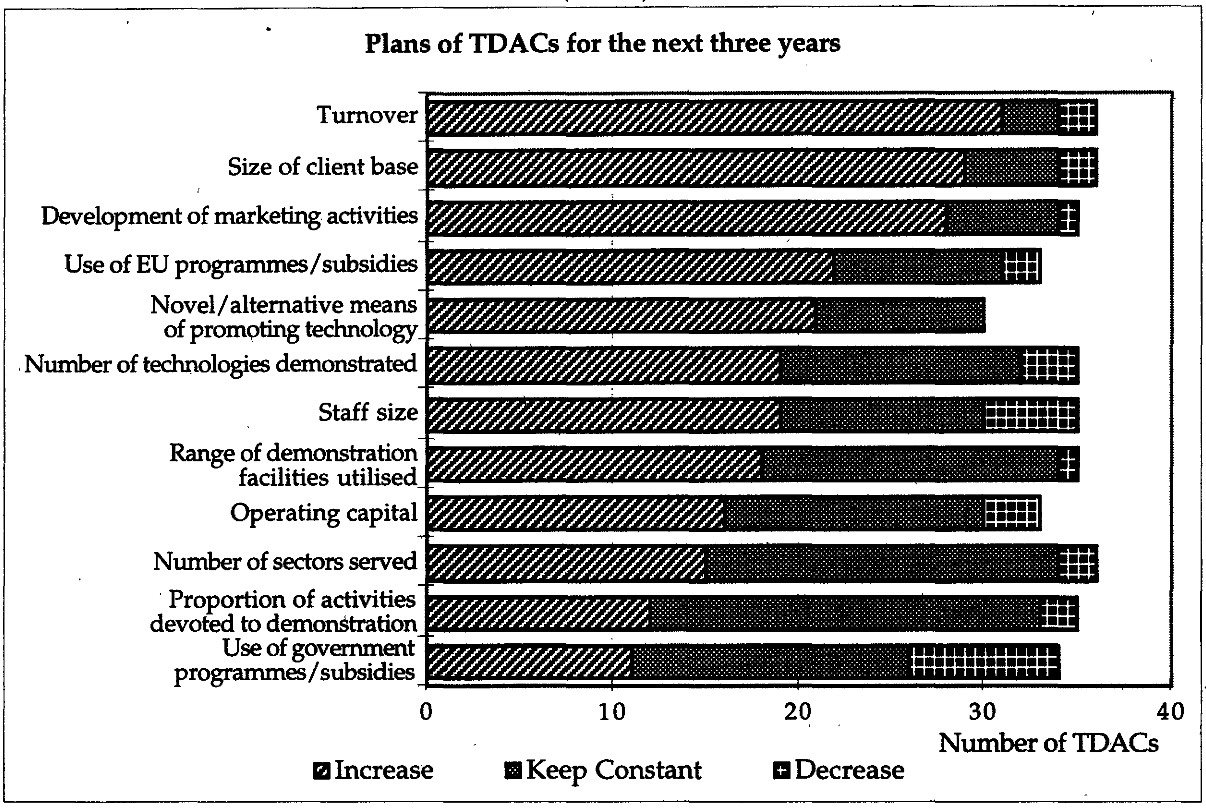
A comparison of perceived future bottlenecks/opportunities between the independent centres and those forming part of a larger organisation revealed very little. The only difference was that the centres that are units of larger organisations see changes in government/EU regulations as an opportunity, whereas the independent TDACs view future changes in this area as a threat.

Exhibit 3.16
(n=38)



Finally, the TDACs were asked about their expectations for the next three years. Exhibit 3.17 shows that the vast majority of centres envisage increases in turnover (31), size of client base (29), and marketing activities (28). Almost two-thirds of the centres plan to increase their use of EU programmes and subsidies, while less than a third foresee an increase in their use of comparable national support schemes. Almost two-thirds of the centres plan to develop new or alternative means of promoting new technology, while roughly half expect to increase the number of technologies demonstrated, the range of demonstration facilities used, staff size, and operating capital. Most TDACs do not envisage changes to the number of sectors served or the proportion of activities devoted to demonstration.

Exhibit 3.17
(n=36)



As regards differences between the independent centres and those that form parts of larger organisations, the most significant difference between the two groups concerns planned decreases. Half of the independent centres who responded to this question expected to decrease their operations in at least one respect, while only a quarter of those centres that form part of a larger organisation had similar plans.

4. Summary

4.1 The Status of TDACs in the UK

- Technology Demonstration and Application Centres (TDACs) in the UK are embedded in a variety of institutional settings, the majority of which are Research and Technology Organisations (RTOs), industrial associations, private companies and university departments. Many are independent bodies focusing on demonstration and technology-related services, but equivalent numbers are component parts of larger institutions.

- The UK TDAC scene is dominated by sector-centred institutions, i.e. centres demonstrating multiple technologies in multiple application areas, all relevant to specific sectors, e.g. food, paint or footwear

4.2 *The Activities of UK TDACs*

- Although technology demonstration activities are important in UK TDACs, they are secondary to primary activities such as R&D, short-term consultancy and assisting firms with the conception, development and implementation of technological solutions. Technology demonstration is a means to an end - a contribution to the central technology problem-solving remit of UK RTOs. Technology demonstration is a way of promoting technology transfer, which in turn is just one of the ways RTOs fulfil their problem-solving solving remits

- Some UK TDACs do act as agents for technology-related public promotion schemes, but for the majority it is a minor activity. UK TDACs do not, on the whole, rent technology platforms to their clients

- Although there are RTOs in the UK which focus on specific technological fields such chemicals and pharmaceuticals, agricultural technologies and energy-related technologies, the majority of the institutions included in the survey offered demonstration and application services in the broad fields of IT, manufacturing, and materials-related technologies. Environment-related technologies were also commonly offered

- Almost all the TDACs in the survey demonstrated systems and equipment from a range of manufacturers. Many used physical models and multi-media based representations, e.g. computer models, charts and videos as tools to demonstrate the relevant technologies

- The vast majority of RTOs do promote TDAC services in a systematic fashion. The most popular mechanisms are publications in journals, participation in conferences and fairs and direct mailing of specific information. Advertisements are used, but their use is not as frequent

4.3 *Finance and Employment*

- On average, just over half of TDAC incomes are derived from fees for services. Roughly one third comes from either public core funding or public project funding, and membership fees/donations make up the remainder

- Public support of TDACs via core and project funding has decreased over the last three years, though reductions have been compensated by increases in revenue generated by fees for services

- The majority of TDACs in the UK have experienced an increase in turnover over the last three years, though staff numbers have remained steady

4.4 *The TDAC Client Base in the UK*

- The TDAC client base in the UK consists mainly of medium-sized enterprises (50-500 employees). Small firms constitute only 12% of the client base. Increases in client numbers have occurred mainly through gains of large or medium enterprises

- Almost three-quarters of the TDAC client base are secondary industries, with tertiary industries comprising one fifth of clients. Client share by sector has seen few net changes over the last three years, with the biggest gains in the tertiary industries

- Approximately one quarter of TDAC clients were local or regional organisations, almost a half were other national organisations, and the remainder of clients were international organisations

4.5 *The Future for UK TDACs*

- Most TDACs are optimistic about the future in terms of growth opportunities. They envisage increases over the next three years in operating capital, staff size, turnover and size of client base

- TDACs are less expansionist in terms of the number of sectors served and the proportion of their activities devoted to demonstration activities, though they do foresee increases in the range of demonstration facilities utilised, the number of technologies demonstrated and the development of marketing activities

- The majority of TDACs foresee an increase in their use of EU programmes and subsidies, while many see no increase in their use of comparable national support schemes

- The major constraint on the growth of technology demonstration activities is lack of finance for equipment and facilities. This is exacerbated by the availability of finance for skilled personnel and problems recruiting appropriate staff

- Changes in the external environment, such as the economic health of the sectors served, changes in government and EU regulations, and infrastructural developments affecting TDACs, offer both opportunities and threats to TDACs. Although many TDACs in the survey did feel threatened by external changes outside of their direct control, just as many saw these changes as opportunities for expansion

- In the main, TDACs see environmental pressures and the pace of technological change as opportunities rather than threats

- The majority of TDACs are confident of their own abilities to assess demand, attract new clients and develop strategies capable of implementing services complementary to demonstration activities

4.6 Technology Demonstration Policies in the UK

- There have been few policies focused on technology demonstration in the UK. Support for R&D projects has often led indirectly to demonstration activities in TDACs, and there are initiatives such as the 'Inside UK Enterprise Scheme' which supports visits by firms to a select group of companies in order to benefit from the *in situ* demonstration of technological best practice, but there have been no policies geared directly towards the support of technology demonstration activities in recognised TDACs

- This situation is unlikely to change radically. There will be more opportunities for TDACs to participate in demonstrator programmes (e.g. the Multimedia Demonstrator Programme) as the emphasis in UK innovation policy continues to shift towards technology transfer and diffusion, and TDACs will be able to exploit another programme designed to help them refocus overall technology and business strategies, but there is little indication that technology demonstration activities in TDACs are likely to occupy centre stage in policy terms

Appendix A

Survey Results - Summary of Main Findings

Organisation	
Status	Both independents & sub-units of larger organisations
Type	Private or semi-public research institutes, private companies, industrial associations, & university labs
Establishment	8 centres (1910-1939), 12 centres (1940-1979), 10 centres (1980-1994)
Funding	Mainly fees for services, some public funding
Investors in equipment	National public funding, self, suppliers, users
Turnover	Ranges from £20,000 - £250M. Average of £1.75M
Personnel	Ranges from 2 - 4,500. Average of 250 employees
Services	
Main activities	Assisting firms with technological solutions,R & D, short term consulting
Technological fields	Manufacturing, materials, environment, electronics, comms & IT
Demonstration methods	Systems from different manufacturers, media, models
Promotional activities	Journal publications, conferences/fairs, direct mailing
Client Base	
Number	Ranges from 5 - 8,500. Average of 850 clients
Type	Medium, large, and small enterprises
Industrial sector	Mainly secondary (manufacturing etc.), some tertiary
Geographical origin	Mainly national, some international and local/regional
Future Developments	
Bottlenecks	Financing demonstration equipment, financing personnel, changes in government/EU regulations
Opportunities	The pace of technological change, attracting new clients, strategy development and environmental pressures
Future plans	Increasing turnover, size of client base, and use of EU programmes. Developing marketing activities

Appendix B

List of UK TDACs

Company	AEA Technology
Address	Building 329, Harwell Laboratory
	Didcott
	Oxon OX11 ORA, UK
Tel	01235 821111 x 2138
Fax	01235 432606

Company	AMTRI Advanced Manufacturing Technology Research Institute
Address	Hully Road
	Macclesfield
	Cheshire SK10 2NE, UK
Tel	01625 425421
Fax	01625 434961

Company	Battelle Institute Ltd
Address	15 Hanover Square
	London
	W1R 9AJ, UK
Tel	0171 493 0184
Fax	0171 629 9705

Company	BCIRA International Centre for Cast Metals Technology
Address	Alvechurch
	Birmingham
	B48 7QB, UK
Tel	01527 66414
Fax	01527 585070

Company	British Technology Group
Address	101 Newington Causeway
	London
	SE1 6BU, UK
Tel	0171 403 6666
Fax	0171 403 7586

Company	British Textile Technology Group (BTTG)
Address	Shirley Towers Didsbury Manchester M20 8RX, UK
Tel	0161 445 8141
Fax	0161 434 9957

Company	Cambridge Consultants Ltd
Address	Science Park Milton Road Cambridge CB4 4DW, UK
Tel	01223 420 024
Fax	01223 423 373

Company	Cambridge Regrigeration Technology
Address	140 Newmarket Road Cambridge CB5 8HE, UK
Tel	01223 65101
Fax	01223 461 522

Company	Campden Food and Drink Association
Address	Chipping Camden Gloucestershire GL55 6LD, UK
Tel	01386 840 319
Fax	01386 841 306

Company	Cornwall Innovation Centre
Address	Rosewarne Tehidy Road, Camborne Cornwall TR14 0AB, UK
Tel	01209 612670
Fax	01209 612671

Company	Cutlery and Allied Trades Research Association (CATRA)
Address	Henry Street
	Sheffield
	S3 7EQ, UK
Tel	01742 769836
Fax	01742 722151

Company	De Montfort University
Address	School of Engineering
	PO Box 143, Leicester
	LE1 9BH, UK
Tel	01533 551551 x 2045
Fax	01533 588052

Company	ERA Technology
Address	Cleeve Road
	Leatherhead
	Surrey KT22 7SA, UK
Tel	01372 374151
Fax	01372 374496

Company	Footwear Technology Centre
Address	SATRA House
	Rockingham Road, Kettering
	Northamptonshire NN16 9JH, UK
Tel	01536 410 000
Fax	01536 410 626

Company	Furniture Industry Research Association (FIRA)
Address	Maxwell Road
	Stevenage
	Hertfordshire SG1 2EW, UK
Tel	01438 313433
Fax	01438 727607

Company	IRD (International Research and Development) Ltd
Address	Fossway Newcastle upon Tyne NE6 2YD, UK
Tel	0191 2650451
Fax	0191 2760177
Company	Leatherhead Food and Research Association
Address	Randalls Road Leatherhead Surrey KT22 7RY, UK
Tel	01372 376761
Fax	01372 386228
Company	Nimtech, The North West Technology Centre
Address	Alexandra House Borough Road, St. Helen's Merseyside WA10 3TN, UK
Tel	01744 453366
Fax	01744 453377
Company	North East Innovation Centre Company Ltd
Address	Saltmeadows Road Gateshead Tyne & Wear NE8 3AH, UK
Tel	0191 4901222
Fax	
Company	North West Regional Electronics Centre
Address	John Moores University 4th Floor, Faculty of Engineering Byrom Street, Liverpool L3 3AF, UK
Tel	0151 2312121
Fax	0151 2981014

Company	Northern Ireland Technology Centre
Address	Faculty of Engineering, The Queen's University of Belfast Ashby Building Belfast BT7 1NN, Northern Ire., UK
Tel	01232 2451332
Fax	01232 0663715

Company	Paint Research Association
Address	8 Waldergrave Road Teddington Middlesex TW11 8LD, UK
Tel	0181 9774427
Fax	0181 9434705

Company	Pera International
Address	Melton Mowbray Leicestershire LE13 OPB, UK
Tel	01664 501501
Fax	01664 501264

Company	PIRA
Address	Randalls Road Leatherhead Surrey KT22 7RU, UK
Tel	01372 376161
Fax	01372 379405

Company	RAPRA Technology Ltd
Address	Shawbury Shrewsbury Shropshire SY4 4NR, UK
Tel	01939 250383
Fax	01939 251118

Company	Ricardo Group plc
Address	Bridge Works
	Shoreham by Sea
	West Sussex BN43 5FG, UK
Tel	01273 455611
Fax	01273 464124
Company	Smith System Engineering Ltd
Address	Surrey Research Park
	Guildford
	Surrey GU2 5YP, UK
Tel	01483 505565
Fax	01483 506976
Company	South West Regional Electronics Centre
Address	School of Electronics, University of Plymouth
	Drake Circus, Plymouth
	Devon PL4 8AA, UK
Tel	01752 232588
Fax	01752 232583
Company	Southern Regional Electronics Centre
Address	Highbury College of Technology
	Cosham, Portsmouth
	PO6 2SA, UK
Tel	01705 383131
Fax	01705 381513
Company	Spring Research and Manufacturers' Association (SRAMA)
Address	Henry Street
	Sheffield
	S3 7EQ, UK
Tel	01742 760771
Fax	01742 726344

Company	TEaM Ltd
Address	2 Whitton Road
	Martin's Heron
	Bracknell, Berkshire RG12 6QZ, UK
Tel	01344 411000
Fax	

Company	The British Leather Confederation (BLC)
Address	Leather Trade House
	Kings Park Road, Moulton Park
	Northampton NN3 1JD, UK
Tel	01604 494131/4
Fax	01604 648220

Company	The Electronics Centre
Address	Dept. of Electronics and IT, University of Glamorgan
	Pontypridd
	Mid Glamorgan CF37 1DL, UK
Tel	01443 480480
Fax	01443 482541

Company	Timber Research and Development Association (TRADA)
Address	Stocking Lane
	Hughenden Valley, High Wycomb
	Buckinghamshire HP14 4ND, UK
Tel	01494 563091
Fax	01494 565487

Company	TWI (The Welding Institute)
Address	Abington Hall
	Abington
	Cambridge CB1 6AL, UK
Tel	01223 891162
Fax	01223 892588

Company	WRc (Water Research Centre)
Address	Frankland Road
	Blagrove, Swindon
	Wiltshire SN5 8YE, UK
Tel	01793 511711
Fax	01793 511712
Company	Yorkshire Electricity Group plc
Address	Wetherby Road
	Scarcroft
	Leeds LS14 3HS, UK
Tel	01532 895130
Fax	
Company	Yorkshire Regional Electronics Centre
Address	School of Engineering, Huddersfield University
	Queensgate
	Huddersfield HD1 3DH, UK
Tel	01484 451883
Fax	01484 422288

Technology Demonstration and Application Centres in the USA and Japan

Country Reports in the Framework of the SPRINT EIMS Project 94/71

School of Public Policy, Georgia Institute of Technology, Atlanta, USA

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Technology Demonstration and Application Centers: Technology Modernization and Extension Programs in the United States[1]

1. INTRODUCTION

In recent years, concern has grown about the technological position and capabilities of small and mid-sized manufacturing enterprises (SMEs) in the United States.[2] American policymakers have been worried about the slowness of their smaller firms in adopting and fully using new manufacturing technologies and techniques and the resulting adverse effects on industrial competitiveness, domestic supply chains, regional economies, and the stability of high-wage manufacturing jobs. To assist US SMEs, a series of technological infrastructural initiatives and programs have been put into place by federal and state governments, academic and industry organizations, and other groups. These efforts include legislation and policies to promote industrial technology transfer, the expansion of industry assistance centers, the stimulation of industrial networking, and support for the conversion of defense suppliers to civilian technologies and markets.

America's new initiatives to bolster its technological infrastructure seek, in broad terms, to promote the "technological modernization" of its SMEs – raising manufacturing capabilities, productivity, and industrial performance in domestic and international markets. Public and private resources are being focused on upgrading technology, quality, manufacturing processes, workforce skills, management systems, marketing approaches, and industrial and regional linkages. These considerations of industrial and technological competitiveness are also coupled with ones related to employment and local economic development, since it is also hoped that modernization programs will maintain, if not expand, employment and wage levels in the small manufacturing sector. This mix of objectives is understandable given the size of America's SME sector, with its more than 400,000 enterprises and 7.6 million jobs (Table I).

After reviewing recent trends in US industry and the SME sector in particular, this report considers the development and current operation of American state and federal technology modernization policies and programs.[3] There is a discussion of the characteristics and services of these US programs and an assessment of their role and effectiveness. The report notes that US policymaking for technological modernization occurs in a federal-state system, where sub-national governmental units often assume leadership, resulting in considerable program diversity and experimentation across the country. While there has been a considerable expansion of federal support for technological modernization in the last few years, recent political changes may lead to some retrenchment in federal support. Federal agencies will probably maintain a role, but the momentum for further policy and program development could shift back to the states.

Table I. Small and Mid-Sized Enterprises, United States, 1990

	Enterprises 1990	Employment 1990
	Thousands	Thousands
Small and Mid-Sized Enterprises	415.4	7,666
of which:		
under 20 employees	324.1	1,800
20-99 employees	74.0	2,853
Large Enterprises	4.2	13,640
Total	419.6	21,306
	Percent	Percent
Small and Mid-Sized Enterprises	99.0	36.0
of which:		
under 20 employees	77.2	8.4
20-99 employees	17.6	13.4
100-499 "	4.2	
Large Enterprises	1.0	64.0
Total	100.0	100.0

Note Small and mid-sized enterprise: United States = less than 500 employees.

Source Small Business Data Base, USEEM file, version 8, 1991, reported in U.S. Small Business Administration, The State of Small Business: A Report to the President, USGPO, Washington, DC, 1992 (Tables A.7 and A.22).

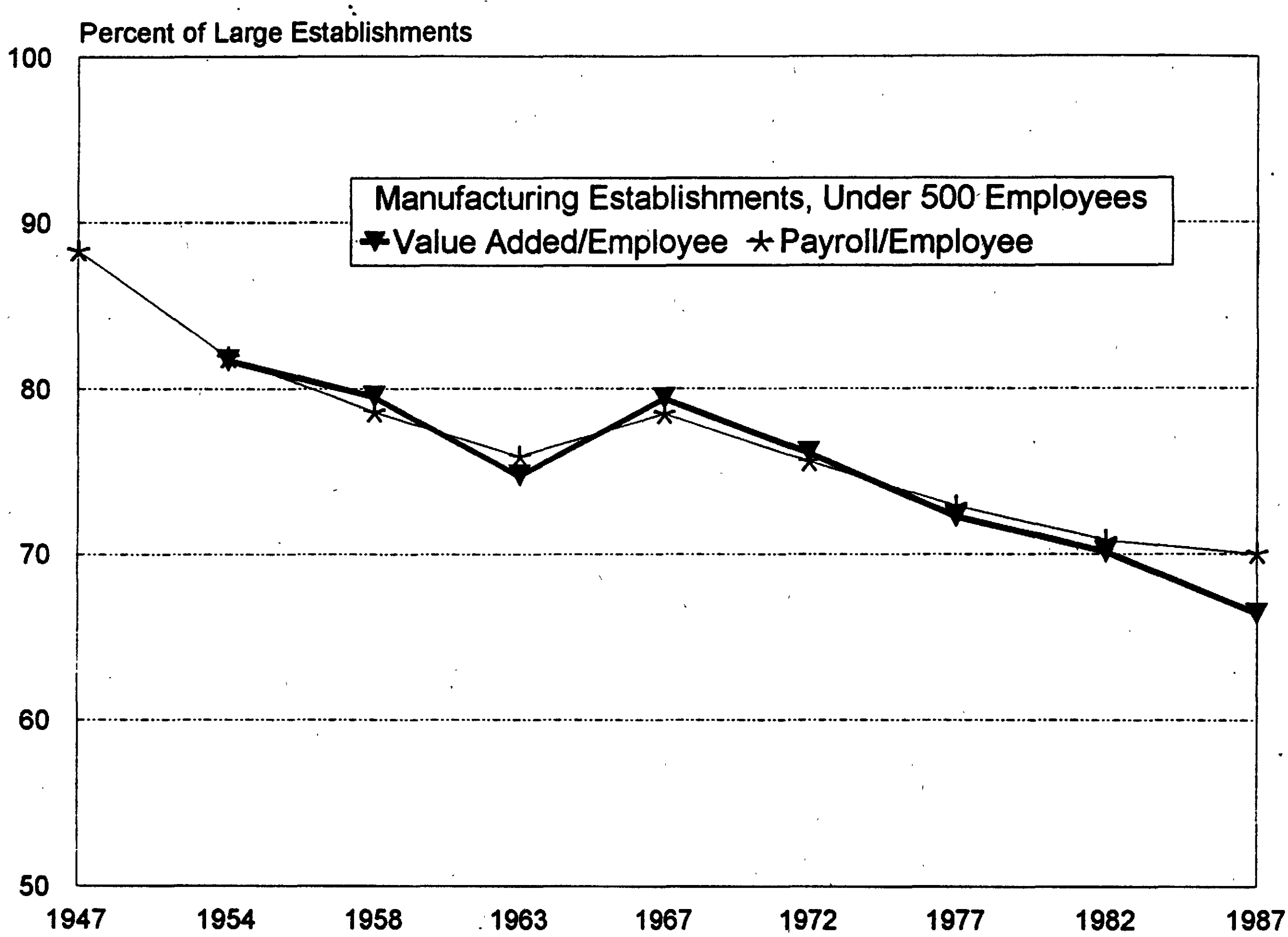
2. CONTEXT AND DYNAMICS OF THE SME SECTOR IN THE UNITED STATES

US technological modernization policies and programs have emerged in recent years against the backdrop of widespread anxiety about the overall performance of American industry and the loss of employment in the manufacturing sector.[4] Between 1979 and 1992, manufacturing productivity growth – averaging 2.4 per cent annually – increased at only two-thirds of the rate in Japan, the yearly merchandise trade deficit expanded to $96 billion, and total manufacturing employment declined by three million jobs.[5] America's poor manufacturing performance has been associated not only with declining employment, but also with a shift in the structure of firms comprising the US industrial base. While many large manufacturing firms have rationalized or closed US production facilities, the number of smaller manufacturers has <u>increased</u>. Manufacturing establishments with fewer than 250 employees rose by 19 percent, from 303,500 in 1980 to 359,900 in 1990. Over the same period, very large (1,000 employee+) establishments fell by almost a quarter, from 2,440 to 1,880.[6]

Different explanations have been put forward for this tilt toward smaller manufacturing units. One interpretation suggests that standardized, large-scale, mass production systems of the post World War II era (sometimes typified by the term "Fordism") are now being edged out by more specialized and flexible forms of manufacturing. In this new phase, competitive advantage is accruing not to the old industrial giants, but to networks of small, innovative, flexible, and specialized production units.[7] These systems of flexible specialization are often associated with geographical concentration and highly collaborative linkages among firms and with business support infrastructures. California's Silicon Valley has been submitted as an example of the leading edge of this new production system although other locations in the US (and Western Europe) have been highlighted too.[8] However, there is another explanation which identifies the cause of the shift toward smaller units not in any intrinsic new advantage to small and mid-sized firms but in the changing strategies of large corporations. Here, the argument is that large firms – responding to global competition – are concentrating on core business elements, using "lean" production techniques. Other operations such as parts production, sub-assembly, transportation, or maintenance are subcontracted out to smaller – and less costly – suppliers.[9] The result – the downsizing of big production units and a growing number of smaller ones – still leaves unscathed the dominance of larger parent corporations.

Significantly, whichever explanation turns out to be more accurate (and it may be that both processes are occurring simultaneously), the prospects for US SMEs are not necessarily favorable. There is little disagreement that, in the past, US manufacturing has emphasized large-batch production, with slow change in product lines, and subordinate supplier relationships. With some exceptions (for example, in very high technology sectors), this approach has promoted a small-firm manufacturing sector that often lacks dynamism and strong internal technological capabilities. Indeed, despite increased employment in small plants and the trend toward smaller manufacturing enterprises, the US still has a lower share of jobs and value-added in enterprises with less than 500 employees than in Japan and some European countries.[10] Moreover, the relative productivity and payroll gap between small manufacturers and large ones in the US has continued to widen (Figure I). Thus, if the balance of industrial advantage is shifting toward

Figure I. Relative Productivity and Wage Levels, US Small Manufacturing Establishments



Source: US Census of Manufacturers.

flexible small-scale units, the US is not especially well placed at present. On the other hand, if large corporations remain dominant and aggressively pursue lean production methods, small US manufacturers will face tremendous pressures both to reduce unit costs and improve other aspects of manufacturing performance. US-based large firms will no doubt continue to seek sources of supply on a global basis, putting US suppliers under the strain of matching foreign competitors or losing business, especially for more routine types of production. Moreover, where larger customers place orders in the US, they will increasingly require contractors to pay greater attention to quality and on-time delivery and, in some cases, take considerable responsibility for design and sub-assembly. As US SMEs face these increasingly demanding commercial markets, many will also need to deal with the loss of business from reduced US military procurement over the coming years.

Many SMEs have responded to these structural changes in manufacturing systems and corporate strategies by "bidding down" wages and working conditions – also known as the "low road" strategy of industrial competitiveness. Among small firms in sectors like apparel, electronics, and metalworking, low-wage employment has proliferated.[11] But there is another approach, which is for smaller manufacturers to upgrade their production systems, improve products, enhance design capabilities, invest in workforce skills, and develop new customers and markets in the US and in foreign countries. This "high road" strategy is more likely to maintain high-wage manufacturing sectors (although the distribution of jobs is sure to change, in favor of "off-the-floor" technical work rather than traditional manual production employment) and strengthen regional and national technological capabilities.

Yet, while numerous US SMEs are already pursuing a "high road" approach, far more are slow to modernize their manufacturing technologies, methods, and relationships. This has been confirmed in several studies conducted over the last few years.[12] For example, US small and mid-sized manufacturers not only lag larger US units in adopting new manufacturing technology, but also trail the technology adoption rates of small and mid-sized firms in Japan and Germany. Moreover, the gap in new technology use between large and small units is wider in the US than in Japan (Table II). Perhaps of even greater concern, small and mid-sized US firms are not only slow to adopt new "hard" manufacturing technologies, but also lag in using "soft" people-based technologies and techniques. Such methods as statistical process control, just-in-time manufacturing, cell-focused manufacturing, or greater attention to manufacturability in design can lead to significant improvements in productivity without large capital expenditures. Similarly, the use of simple cost-estimation spreadsheets and planning techniques can save managers considerable time in bidding for jobs. But smaller firms do not often use these methods and techniques.[13]

In an aggregate sense, US SMEs are thus caught between two competing systems, being neither fully "lean" (particularly compared with Japanese counterparts) nor fully "flexibly-specialized" (outside of Silicon Valley and some other unique cases). Several factors have contributed to this situation. At the firm level, small and mid-sized manufacturers face a series of barriers, including the lack of technical expertise, access to information, issues of finance and cash flow, and limited strategic planning. These barriers are perhaps universal to all SMEs, being

Table II. Use of New Technology in Manufacturing, U.S. and Japan, 1988

Types of New Manufacturing Technology Japanese definition (closest US definition in brackets)	Technology Users By Employment Size				Technology Use Comparative Ratios			
	Japan		US		Large/SME Ratio		Japan/US Ratio	
	SME	Large	SME	Large	Japan	US	SME	Large
	[a]	[b]	[c]	[d]	[e]	[f]	[g]	[h]
	Enterprise Employment		Establishment Employment					
	Under 300	300+	50-499	500+				
	%	%	%	%				
NC/CNC Machine Tools (NC/CNC Machine Tools)	57.4	79.4	39.6	69.8	1.4	1.8	1.4	1.1
Machining Centers (FMS Cells or Systems)	39.4	67.4	9.1	35.9	1.7	3.9	4.3	1.9
Computer-Aided Design (and Computer-Aided Engineering)	39.1	75.2	36.3	82.6	1.9	2.3	1.1	0.9
Automatic Transport Equipment	34.9	68.3			2.0			
(Automated Guided Vehicles)			0.8	13.1		16.4		
Automatic Inspection/Measuring (Automatic Inspection: Final Product)	30.1	66.7	10.5	44.3	2.2	4.2	2.9	1.5
Automatic Warehouse Equipment (Automatic Storage and Retrieval)	22.6	62.2	5.5	43.3	2.8	7.9	4.1	1.4
Handling Robots (Pick and Place Robots)	10.9	44.9	1.9	24.4	4.1	12.8	5.7	1.8
Assembly Robots (Other Robots)	8.3	41.4	3.9	35.0	5.0	9.0	2.1	1.2
Welding/Painting Robots	16.0	42.7			2.7			

Notes Japanese technology definition is given (with closest matching US technology definition in brackets). The comparisons between Japan and the US are approximate since there are differences in technology definitions and employment size categories. Additionally, the Japanese data is enterprise-based, while the US data is establishment based. SME = Small and medium enterprise.

Sources

[a], [b] "Current Survey on the Manufacturing Industries 1988," reported in Ministry of International Trade and Industry, Small and Medium Enterprise Agency, Small Business in Japan 1989: White Paper on Small and Medium Enterprises in Japan, Tokyo, 1988.

[c], [d] U.S Department of Commerce, Bureau of the Census, Manufacturing Technology 1988, Current Industrial Reports SMT(88)-1, Washington, DC, May 1989.

[e] = [b]/[a], [f] = [d]/[c], [g] = [a]/[c], [h] = [b]/[d].

a function of small size. US SMEs may have more difficulties in addressing some of these barriers due to internal differences (eg. fewer engineers in SMEs) and broader US business practices and policies. It has been suggested that the short-term character of supplier-customer links and the weakness of small-firm technology-focused networks puts US small and mid-sized firms at a disadvantage in pursuing modernization when compared with small and mid-sized firms in Japan, Germany, Italy, and other European countries.[14] US smaller firms operating in end-use markets do so in an atmosphere of great uncertainty, generally squeezed for capital for investment, and are typically in a weak position to bargain with their customers and vendors. Trade associations could help, but most American trade associations tend to be reactive, responding to government actions or dealing with business regulation issues. Only a few associations actively focus on helping their member firms improve technology.

The public infrastructure for modernization in the US, including education and training systems, technology transfer programs, and other public services, is also an area of concern. At the local and regional level, where the workings of this infrastructure are most relevant for small firms, many gaps and problems are apparent. For example, universities typically stress research and advanced technology missions, and reward their faculty for excellence in these areas. Technology deployment for small and mid-size firms is generally not high on the university institutional priority agenda. Equally, state and local economic development programs are felt to offer little in the way of appropriate technological expertise and infrequently focus on the needs of existing small and mid-sized manufacturing enterprises: traditionally, most economic development efforts have concentrated on recruiting large firms, aiding new start-up businesses, or building physical infrastructure. Until recently, few states had active modernization programs. The educational system, including vocational education, is frequently criticized for producing neither well-rounded competent students nor well-trained technical specialists. Smaller firms often employ workers who have less education and higher turnover. Such firms generally do not provide formal training and tend not to participate in public training programs, which are frequently not suitable for small firm needs, especially for upgrading existing employees. In a mutually reinforcing downward cycle, the general weakness of training makes many small firms reluctant to invest in training themselves because they fear workers will leave to obtain higher wages elsewhere.[15] Inadequate training means that smaller manufacturers are then unable to develop and retain skilled labor – which constrains their abilities to pursue modernized manufacturing methods and upgrade pay and working conditions.

US policymakers, in designing a series of fresh federal and state initiatives to promote technological modernization, hope to address these barriers and stimulate the upgrading of more SMEs to be competitive in "high road" terms. Yet, success is not guaranteed, even if the new initiatives are well implemented. Much, for example, depends on the stance of larger US firms. If they singularly pursue short-term, low-price relationships with their smaller suppliers, those suppliers will continue to find it difficult to upgrade, resulting in an industrial variation of the "tragedy of the commons" where both large and small firms will be adversely affected in the long run. Equally, if basic regional social structures (such as education and training systems) remain below par, US SMEs will be disadvantaged vis-a-vis their counterparts operating within stronger regional systems elsewhere. If they are to be effective, US SME modernization strategies need to incorporate a two-part strategy involving improvements in broader systems of relationships, such as customer-supplier links and public and private support services, as well as focusing on the upgrading of individual firms.

3. US MODERNIZATION POLICIES

Over the past decade, there has been an expansion of public and public-private technological infrastructural initiatives and programs to help small firms with technological modernization and deployment in the United States. But, until quite recently, most of these modernization activities were initiated at the sub-national level, by state governments, universities, colleges, and other local and non-profit organizations. During this period (covering much of the 1980s) the federal government provided only limited and uncoordinated support for state and local modernization efforts, preferring to focus the bulk of federal technology resources toward basic R&D and defense.

The federal government's technological modernization role began to change with the passage of the 1988 Omnibus Trade and Competitiveness Act. This Act recognized that America had a problem of industrial competitiveness and mandated the National Institute of Standards and Technology (NIST), within the US Department of Commerce, to promote manufacturing technology deployment.[16] NIST started programs to establish regional manufacturing technology centers and promote state technology extension programs, marking a first round (1988-1992) of increased federal support for US modernization efforts.

This first period of federal involvement was motivated largely by the US Congress – under Democratic Party control, but with a bi-partisan consensus – stimulating President Bush's Republican administration into action. In the next and much bigger phase, the impetus came from the executive side. After taking office in 1993, Democratic President Clinton – reinforcing statements he made in the 1992 election campaign -pledged to build a national system of manufacturing centers to help small- and medium-sized manufacturers adopt new technology, production techniques, and business practices.[17] This was one part of the administration's plan to promote US civilian technology and strengthen the country's technological infrastructure.[18] Initially, Clinton proposed 170 US manufacturing centers – which matched the number of equivalent technology centers in Japan.[19] Subsequently, the administration pared back its goal to one of establishing "100 manufacturing centers nationwide by 1997." Nonetheless, this remains a significant commitment and the Clinton administration has overseen a dramatic enlargement of manufacturing technology assistance in the US. NIST's manufacturing extension budget has been greatly increased through the administration's defense conversion initiative (known as the Technology Reinvestment Project, or TRP), supplemented by additional funds to the agency through the regular Department of Commerce appropriation. These resources are being used to expand already existing state programs as well as establish numerous new programs at national and state levels.

However, the expansionary post-1992 stage of federal modernization involvement could end in 1995. The Republican majority that took control of Congress after the Fall 1994 election promises to stymie further efforts to extend the federal role in the technological modernization of industry.[20] A third phase may thus be beginning during which leadership shifts back to the states to continue the development of their own programs, with more limited federal support.[21]

Recent state and federal technological modernization initiatives are described in more detail in the following sections.

3.1. State Industrial Modernization Programs

In America's decentralized governmental framework, states have frequently led the federal government in promoting new developmental and public infrastructural policies.[22] This has been the case for the modernization of industry where several states have run their own programs for many years. For example, in the US South, industrial extension programs were started by North Carolina in 1955 and Georgia in 1960.[23] These efforts – modeled after the long established cooperative extension service in agriculture – used professional engineers, based in regional field offices, to help area industrial development strategies and local firms in resolving technical problems and using technology. In the mid-1960s, state programs such as the Pennsylvania Technical Assistance Program were formulated to diffuse technical information to industry and to solve problems by linking firms with technical specialists.[24] Then, in the late 1970s and throughout the 1980s, new state technological modernization and technology transfer programs were started in Maryland, Massachusetts, Michigan, New York, Ohio, Pennsylvania, Virginia and several other states.

By the beginning of the 1990s, 42 modernization programs in 28 states had been established.[25] While this total included a handful of federally-supported (but state operated) manufacturing technology centers (see next section), these programs were mainly sponsored and funded by the states themselves.[26] There were several reasons for this growth of state interest in modernization. At the broadest level, states were concerned about the real or potential declines of their industrial competitiveness. The modernization of industry was also seen as a new and useful tool for promoting local economic development. In other cases, modernization efforts sought to help small firms hard hit by the restructuring of core basic industries or formed part of targeted strategies to promote the take-up of new technologies.

About one-half of the state modernization programs in place by the early 1990s were administered by educational institutions (usually universities, sometimes community colleges), with the others operated by non-profit institutions, state agencies, or other local organizations. Each program offered its own blend of services ranging from the provision of technical information, seminars and workshops to demonstrations, referrals to qualified technical experts and on-site plant consultations. However, the number of programs with direct and intensive one-on-one field assistance was small. A 1990 NIST study found only 13 state programs using field agents to work on-site with firms to solve technical problems.[27] As recently as 1992, despite some further expansion of state efforts, most programs still had relatively few resources, services were patchily available, and many states had no programs at all. But, by 1994, this situation had changed dramatically, as increased federal resources leveraged additional state funds to significantly expand modernization program activities through a new federal-state partnership.

3.2. NIST, the MTC Program and the Manufacturing Extension Partnership

The recent growth of US modernization activity has been greatly aided by the emergence of NIST as a sponsor and champion. For the first time, a federal-level civilian agency is directly concerned with issues of industrial technology and manufacturing performance. The 1988 Trade Act charged NIST with assisting industry to improve technology development, quality, process modernization, product reliability, manufacturability, functionality, cost effectiveness, and commercialization. The agency was authorized to provide technical assistance to state and local industrial extension programs and serve as a link between these programs and other federal technology services.

While NIST was given a substantial mandate, in the agency's first few years through to 1993 its budget for manufacturing technology programs was quite small – under \$16-17 million (ECU 13-14 million) annually. These funds were mostly used to sponsor a group of regional centers for the transfer of manufacturing technology – to provide information and education for local small and mid-sized firms, demonstrate advanced technology, help firms evaluate their needs and implement new technologies, and support workforce training. By 1992, seven of these Manufacturing Technology Centers (MTCs) had been designated through a competitive award process (in Ohio, New York, South Carolina, Michigan, Kansas, Minnesota and California). The MTC program was initially designed to transfer advanced technologies developed at NIST's Advanced Manufacturing Research Facility in Maryland and at other federal labs. But once established, the centers quickly realized that most small firms did not need such state-of-the-art technologies which, besides being expensive, were often untested. For most smaller firms, it was recognized that the first job was to improve existing operations, using proven, off-the-shelf technologies, and to strengthen quality, inventory control, design, training, and marketing. MTCs have also found that "soft" activities in such areas as training, management guidance, information access, referrals, and networking and association are typically more important than "hard" assistance in helping firms to introduce new machine technologies.

Each MTC has a budget of roughly \$6 million (ECU 4.9 million) a year from federal, state, and industry funds, supplemented by service fee revenues. Under current legislation, federal funding is provided for six years. For the first three years, NIST funds have to be matched equally by state and other sources. The federal share then declines to zero in year six, with the aim that the MTCs would become self-sustaining without direct federal sponsorship. Few now believe this is practical or desirable, and proposals have been made to extend NIST funding to the MTCs beyond the six-year limit (at a level of about one-third of each MTC's budget, with state, private, and other federal sources comprising the balance).[28]

A series of reviews found the original MTCs to be helpful in promoting small firms to modernize and upgrade technology. But these assessments also acknowledged that the small number of MTCs and their limited geographical scope, relatively low level of funding, and separation from other federal and state programs limited the total effectiveness of the effort.[29]

To expand the scale of activity and better tie MTCs with other public technology infrastructures, NIST subsequently established a new effort in 1992, the Manufacturing Extension Partnership (MEP), to coordinate and develop a national network of government, industry, and academic resources engaged in industrial and technological modernization. This network aims to coordinate services, facilities, expertise, and technologies to better assist customer firms. The MEP also seeks to strengthen links other federal agencies and programs, including the Small Business Administration, Labor, Energy and Defense.[30]

3.3. The Technology Reinvestment Program

With funding from the Technology Reinvestment Program (TRP) – using money diverted from the defense budget – NIST has been able to make a considerable down-payment in establishing the Manufacturing Extension Partnership. The TRP combines the missions of maintaining and developing the advanced defense technology base with those of helping the transition of defense suppliers and technologies to civilian markets and stimulating the production of competitive commercial products.[31] This program was conceived in Congress before the Clinton presidency, but it has been embraced by the new administration. Three broad activity areas are defined: technology development, technology deployment, and manufacturing education and training.

Over two fiscal years, beginning in 1993, about $900 million (ECU 732 million) in federal funds was allocated to all TRP activities, with a further $550 million (ECU 447 million) authorized for FY 1995. In FY 1993, as part of its technology deployment effort, TRP allocated $87 million (ECU 71 million) for manufacturing extension and $91 million (ECU 74 million) for defense dual-use extension to assist small businesses, including defense dependent firms, to improve technology and operations. Support was also provided for technology extension enabling and access services, such as training, electronic linkages, and regional networking. By FY 1995, TRP's sub-allocation for these technology deployment activities had ramped down as NIST's own civilian-side budget for manufacturing extension was raised to $90.6 million (ECU 73.7 million). However, in FY 1995 TRP supported several new initiatives that relate to industrial modernization, most noticeably a Regional Technology Alliances program to strengthen geographical clusters of industries and technology centers.[32]

Awards under the TRP program are based on competitive application and generally require applicants to team and to provide their own matching funds, thereby leveraging the federal resources. The overall lead agency is the Defense Department's Advanced Research Projects Agency (ARPA, formerly known as DARPA) but several other line agencies are charged with program execution. NIST has taken the lion's share of responsibility for carrying out the technology deployment and extension enabling thrusts of TRP, merging these into the MEP program.

The TRP program has stimulated a tremendous response, as state and local governments, educational institutions, industry groups, and companies formed alliances and teams to develop proposals and secure matching funds. In 1993 – the program's first year – almost 2,800 TRP proposals were submitted, requesting some $8.4 billion (ECU 6.8 billion). In the technology deployment area, there were 545 proposals, requesting $1.4 billion (ECU 1.1 million) – almost eight times the available funding.[33] Proposals were submitted to expand existing modernization efforts; others sought to establish new programs of service delivery, networking, and enabling assistance. In this process, many new partnership arrangements were established, innovative service approaches devised, and funding commitments secured.

By the end of 1994, more than 45 MTCs or smaller Manufacturing Outreach Centers (MOCs) had been funded through NIST with TRP funds (Map I). In addition, NIST used TRP funds to establish about 25 pilot programs to expand the infrastructure for manufacturing modernization service providers. Some twenty states also received smaller State Technology Extension Program (STEP) awards for program development or demonstration projects. Counting state and private contributions – which match federal funds on a 50:50 basis for new centers and at a higher rate for existing programs, the total investment in US public modernization programs going into 1995 will probably exceed $250 million (ECU 203 million) – a large increase from the position two to three years earlier (Table III). A further round of competitive awards by mid-1995 will bring NIST's portfolio to about 20 MTC-sized programs and 50 smaller MOCs – and take the Clinton administration more than two-thirds of the way toward reaching its 100-center goal.

3.4. Network Groups

In a comparatively recent development, several states and regional organizations have started to promote industrial networks or groupings of manufacturing companies to promote shared approaches to modernization. Networking seeks to aid groups of firms, usually within a proximate geographical area, through information sharing, solving common problems (such as training), and cooperation in design, production and marketing. Additionally, networking, by generating new linkages between firms and new forms of cooperation, requires and generates cultural and systemic changes. Network advocates also point out the leveraging effects of the approach. By stimulating networks, more firms are expected to modernize by themselves, overcoming the scale problem of the limited public resources available to fund costly "one-on-one" methods of technology assistance. It is suggested that public resources will go further by leveraging networks, especially if public efforts focus on developing private network brokers who ultimately see it in their business interest to form and support networks.[34] Practitioners note that networks of like manufacturers tend not to form on their own, but they can be facilitated by the provision of skilled assistance and extensive efforts to build trust and cooperation.[35]

The scale of organized industrial networking in the US has grown rapidly over the past few years. An analysis of 1994 data for 27 states finds around 140 industrial networks involving more than 2,600 firms.[36] Efforts by public agencies, industrial associations and other hub organizations to further promote networking are now found in more than one-half of US states. Nonetheless, there is a degree of skepticism about the networking approach, especially by some of the more established programs in the modernization field. Here, the belief in the value of one-on-one professional field service contact is very strong. It is sometimes felt that there is no substitute for good professional staff people who can interact with firms on a face-to-face basis. However, other practitioners see a potential marriage between networking and individual

Map I. Recent Federal-State Industrial Modernization Projects in the United States

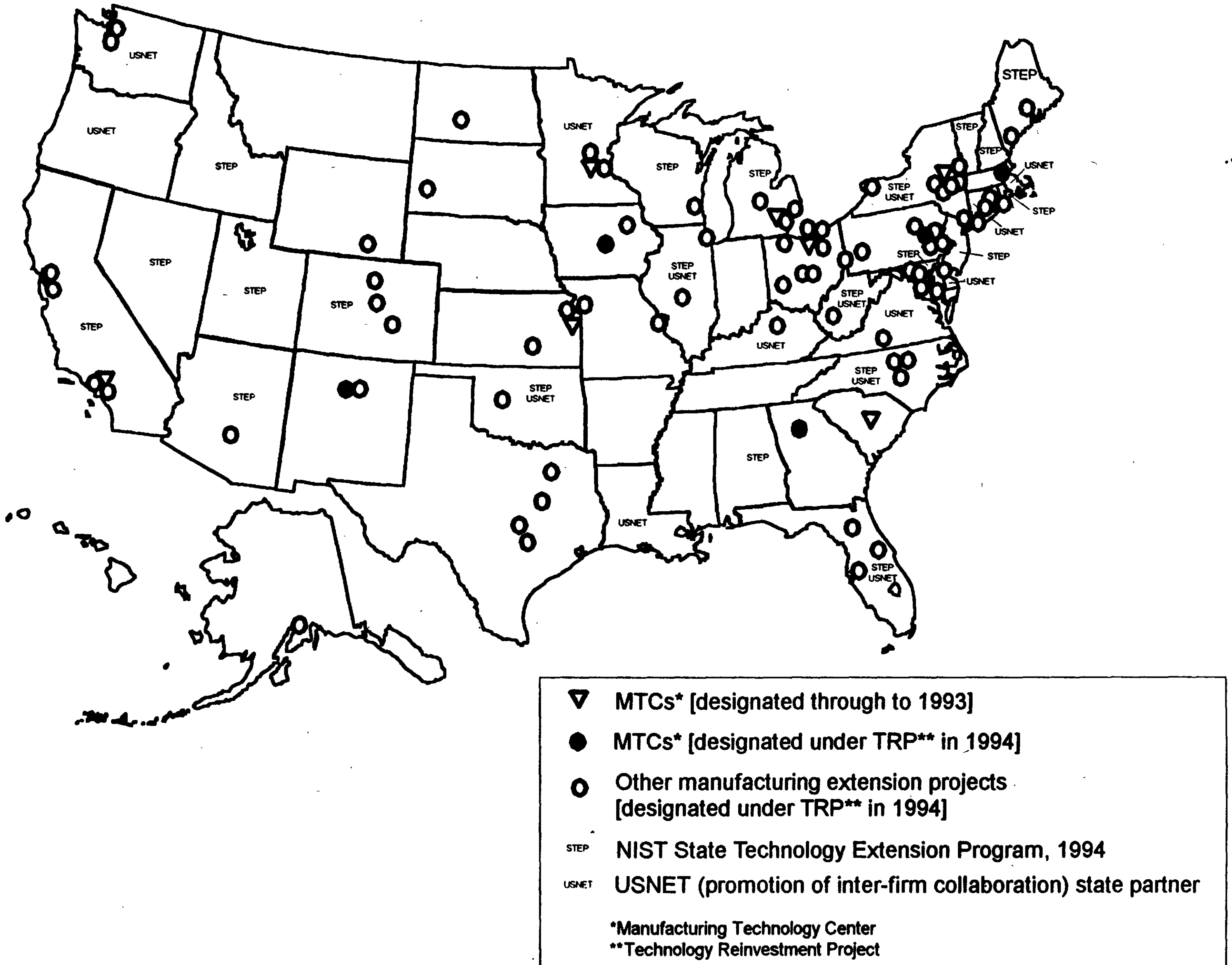


Table III. US Technological Modernization and Industrial Extension Programs Measures of Performance

	Federal and State Programs[1] 1992 Annual Rate **Estimated**	**Manufacturing Extension Partnership**[2] 1995 Annual Rate **Projected**
Centers/Programs	30	70+
Total Funding	$80 million ECU 65 million (Federal: $15.1 million ECU 12.3 million)	$250 million+ ECU 203 million+ (Federal: $90 million+ ECU 73 million+)
National Funding	17%	30-50%
Staffing	N/A	1,500+ (professional and technical staff)
Staff Research Time	almost none	almost none
Technological Assists (annual cases)	Total: 13,500+ Field service: 6,000	Total: 26,000+ Projects: 13,500+[3]
Companies Participating in Training	N/A	4,000 - 6,000
Demonstrations	1,740	increased
Network Groups[4]	50	150-200+

Sources and Notes

1. US federal and state programs, 1992. Author's calculations from surveys of state programs.
2. Author's projections. Funding estimate assumes up to 1:1 state and private to federal match for new MEP programs, with a higher ratio for existing centers. Staffing and service levels scaled up from data from a subset of existing MEP programs. Staffing estimate excludes support staff and is for full-time equivalent personnel.
3. "Projects" includes informal engagements, technical assistance projects, and assessments.
4. Estimate of "network groups" incluses those sponsored by other organizations. Estimate excludes many quality and user groups sponsored by MEP centers.

N/A = Not available. Currency exchange at rate of ECU 1.00 = US$ 1.23.

approaches, through which networks provide a way for business firms and technical assistance providers to interact with one another. Firms may not initially form networks with an explicit and major focus on modernization issues; marketing or shared services are more likely initial aims. But, once the network is up and running, it is possible that modernization issues can become part of the network's agenda, and at that time they may be more effective than traditional modernization programs. One particularly strong argument in favor of networking is that it more readily allows underlying modernization issues of inter-firm relationships and public-private linkages to be addressed. NIST has recognized this and, partly using TRP funds, has provided additional funding to several local and national networking initiatives, including projects such as USNET – a consortium of fifteen states working together to promote inter-firm collaboration.

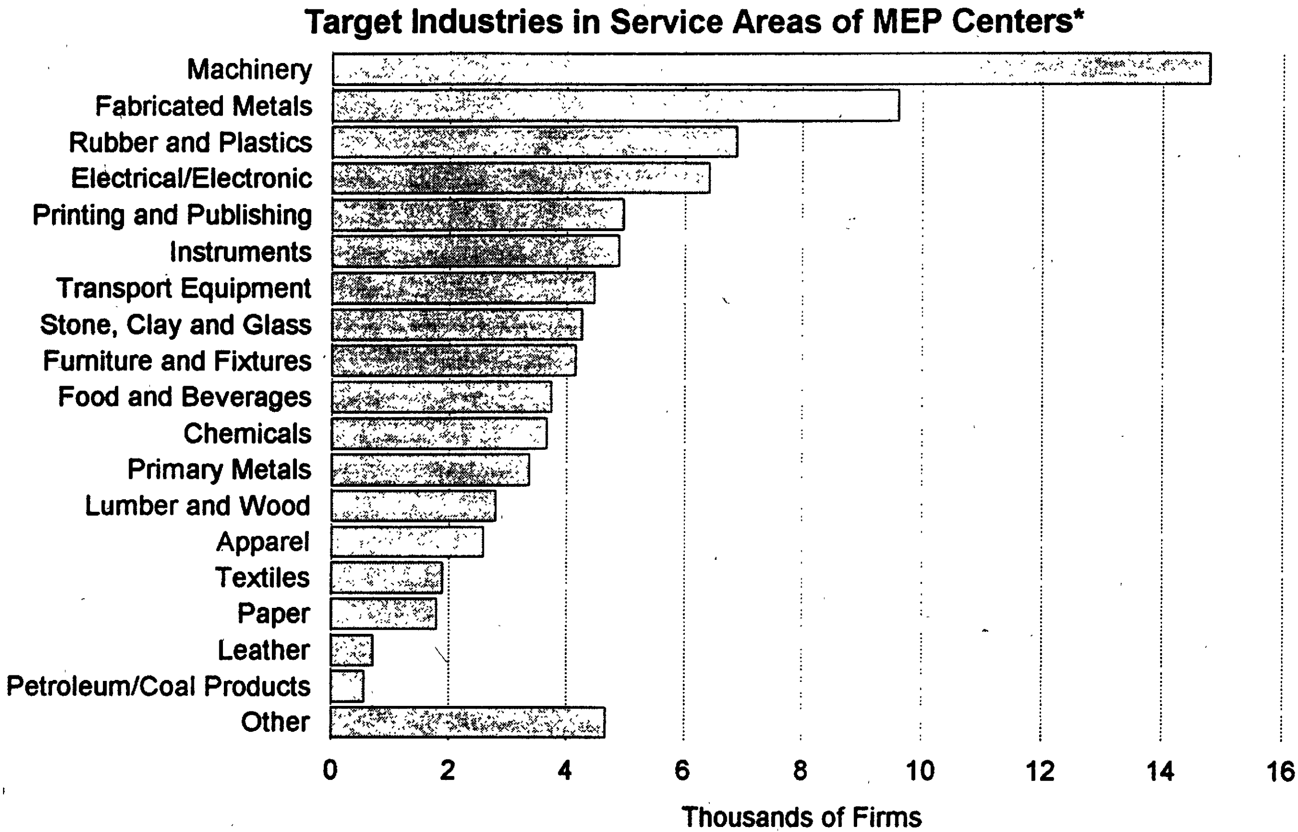
3.5 Modernization Services and Practices

At the start of 1995, about three-quarters of all US manufacturing establishments were in a state with at least one MEP center. The breadth and depth of coverage – which is not yet universal – will grow further throughout 1995 as the number of MEP affiliates expands. So far, the typical MEP center has about 35 professional and technical staff and, each quarter, uses an additional ten consultants. The average number of targeted manufacturers in an MEP's service area is 6,200. But the spread is wide, with smaller MEPs (usually serving dispersed rural areas) targeting 1,300 to 1,500 enterprises and a few larger centers (in urbanized locations) targeting more than 15,000 firms. The list of targeted firms (based on analysis of 14 center reports) is headed by durable goods and discrete parts makers in such industries as machinery, metalworking, rubber and plastics, and electrical and electronic products (Figure II). While there are again variations by center size, on average each MEP center assists about 300 firms a quarter through individual engagements and projects. More than two-thirds of the firms served have fewer than 100 employees (Figure II). Most frequently, assistance is provided in areas of business systems and management, quality, market development, process improvement, and human resources through a combination of initial visits, engagements, assessments, and technical assistance projects (Figure III). The leading categories of MEP service thus mostly emphasize "soft" technologies and techniques, followed by assistance with process, environmental and product technology. There is a lower level of service in "hard" areas of factory automation.

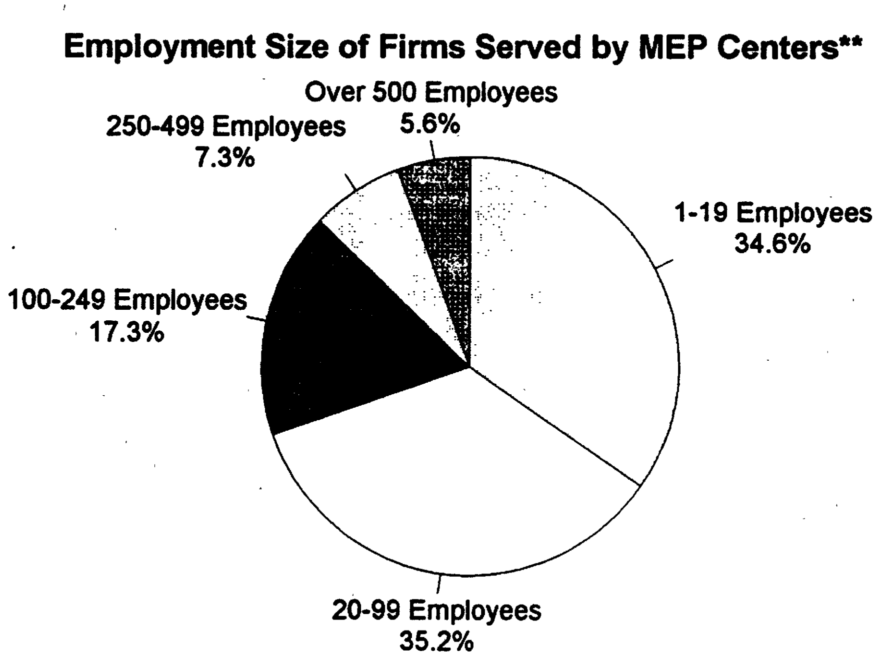
While there are many detailed differences in organizational design and technological expertise among US modernization programs, in a growing number of centers – particularly those affiliated with the MEP program – it is possible to discern a common core of services and practices. Examples from two centers – one in Georgia, the other in Pennsylvania – illustrate this.[37]

The Georgia Manufacturing Extension Alliance (GMEA) is a partnership between the Economic Development Institute (EDI) at Georgia Institute of Technology and three other organizations – the University of Georgia's Small Business Development Centers, the state's Quick Start customized training program, and Georgia Power Company's Technology Applications Center. GMEA aims to offer an integrated delivery system linking technology, management, training, and applications assistance to Georgia manufacturers. A central element of this delivery system is a network of 17 regional field offices staffed by full-time personnel

Figure II. Technological Modernization Activities
Target Industries and Size of Firms Served
US MEP Centers, 1994 Second Quarter



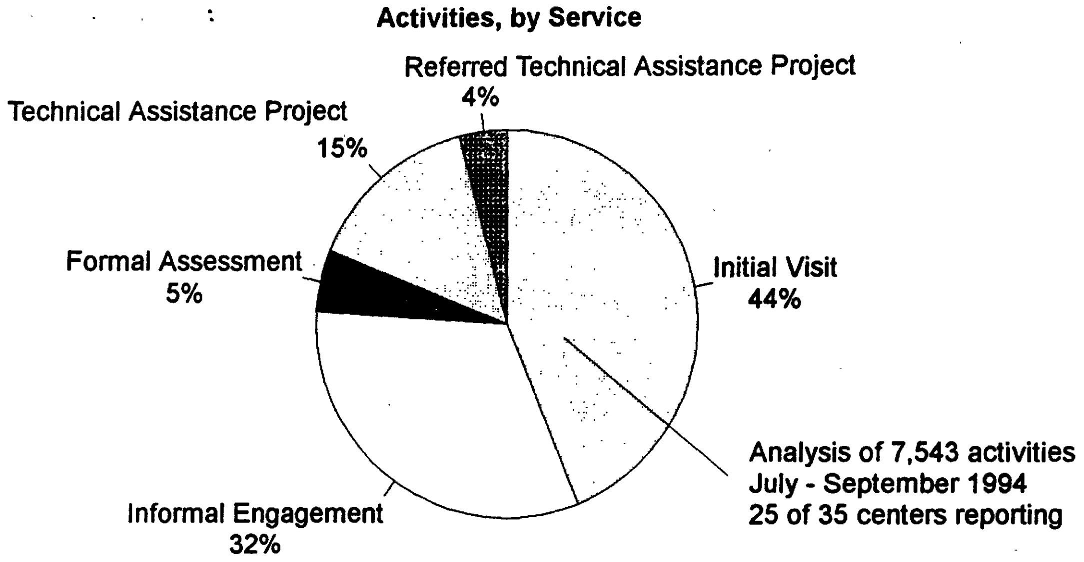
*April - June 1994, 14 centers reporting

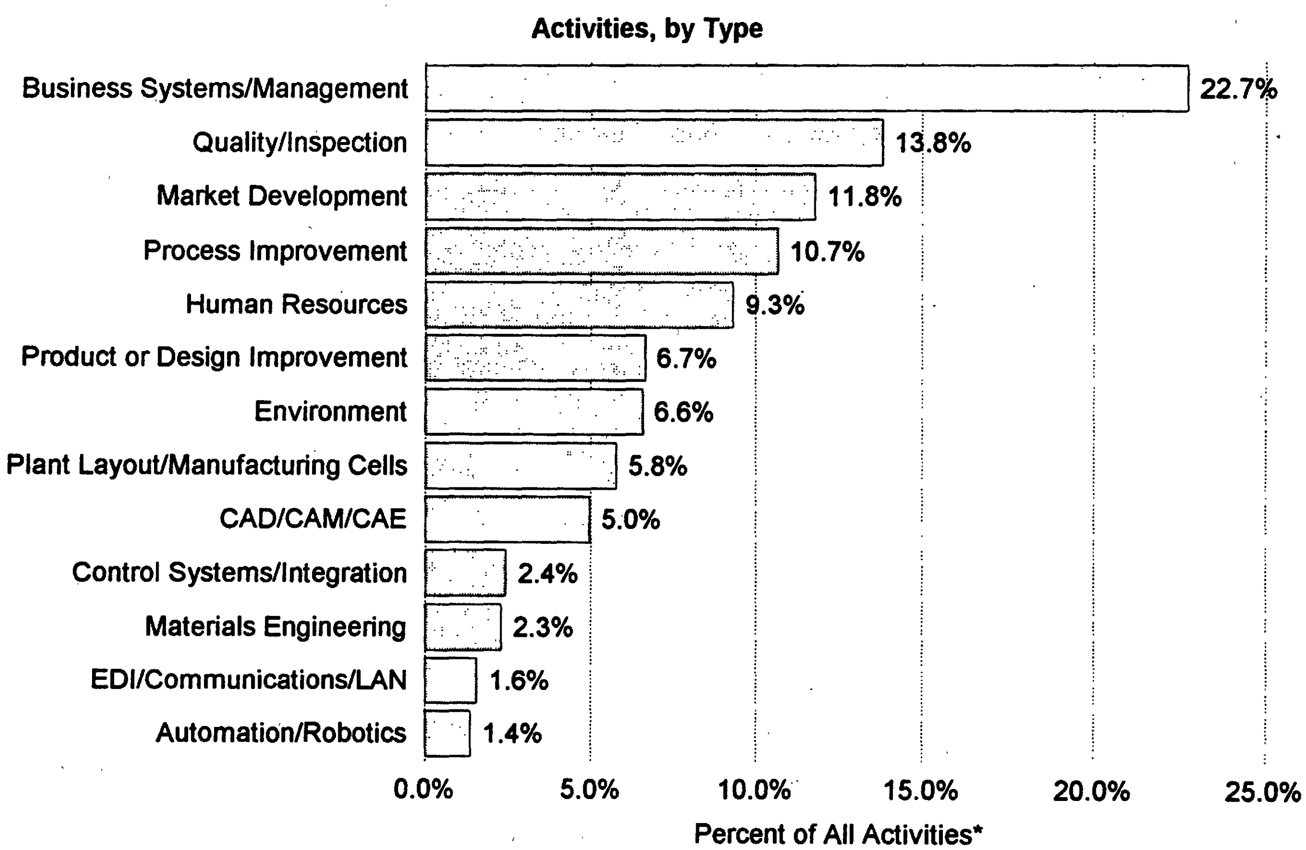


**Analysis of 6,552 activities, April - June 1994, 14 centers reporting

Source: Manufacturing Extension Partnership, National Institute of Standards and Technology

Figure III. Technological Modernization Activities US MEP Centers, 1994 Third Quarter





Analysis of activities, July - September 1994, 25 of 35 centers reporting
* Double counting is allowed

Source: Manufacturing Extension Partnership, National Institute of Standards and Technology with engineering, management and industrial experience. These skilled professionals can provide reliable and timely information to firms, resolve technical problems, and offer guidance to encourage the application of technology and improved business practices. GMEA's services include initial meetings to discuss needs and potential projects with firms, informal engagements through which limited assistance is provided, and in-depth formal assessments leading to specific recommendations. The program then carries out technical assistance projects involving up to five days of staff time to resolve specific problems or transfer new or existing technology. GMEA also makes referrals to external resources (such as private consultants, university faculty, or federal labs), and offers an extensive array of group assistance activities (training, conferences, seminars, user groups, ISO 9000 groups, and demonstrations). GMEA, which receives funding from federal and state sources, provides most of its services without charge to Georgia firms.

The second example – the Manufacturers Resource Center (MRC) in Bethlehem, Pennsylvania – has some differences in organization and funding, although its primary services are similar to those of GMEA. A not-for-profit corporation within Lehigh University, the MRC is one of eight state-sponsored Industrial Resource Centers. The MRC is funded through state and, with a recent TRP award, federal sources but also generates some revenue through cost sharing and private contributions. MRC's industrially-experienced staff conduct needs assessments of area manufacturing companies, identifying important problems or opportunities and providing some technical assistance. Fees range from zero to a little over $2,000 (ECU 1,600) for this initial service. If a firm requires further assistance, the MRC makes a match with qualified outside consultants, sharing the cost of the external help with the firm in most cases. The MRC also offers a range of information seminars and training programs, supports group activities (such as quality forums and ISO 9000 groups), and coordinates with other area economic development and technology organizations.

Although methods of financing and implementation vary, the core services of these two programs include initial assessment, diagnosis, technical assistance, qualified referral, training, information provision, and group services. Similar arrays of services are found in programs throughout the country. The identification and adoption of such "best practice" program management and service approaches has been encouraged by NIST through conferences, training sessions, research projects, and program reviews.[38] Professional associations have also actively assisted the dissemination of best practices. Innovative or successful services and practices developed in one locality are thus quickly recognized and copied by others. For instance, a technique to systematically identify modernization opportunities by comparing a manufacturing customer with similar firms along a series of critical measures was developed by the NIST/Midwest Manufacturing Technology Center in Michigan.[39] This technique – known as performance benchmarking – is now being adopted (with NIST's support) by other MEP centers. Similarly, the promotion of industrial networks – described in the previous section – is now attracting broad interest after trial projects in a handful of locations.

A common set of evaluation measures has been formulated for the MEP centers, developed in a collaborative effort between NIST and a group of the initial centers. Among the measures tracked are service type, service by technological activity and employment size of firm, and anticipated and subsequent benefits in terms of such factors as investment, sales, use of technology, and employment. Although it is still early to fully assess MEP performance based on these measures, the initial indications are positive.[40] Separate evaluation have also been initiated by the General Accounting Office, individual centers, and other researchers.[41]

4. ASSESSMENT OF US APPROACHES

The concept and practice of technological modernization for small firms has advanced rapidly in the United States in recent years. Once practiced almost unnoticed and with meager resources by a handful of states, modernization has now gathered considerable political and business support and seen the development of new federal and state policies and institutions. There is now a wider recognition that to make a real difference, modernization programs need to have sufficient resources, linkages, and local leverage points to work with large numbers of firms. Funding has been enlarged and the number of programs and centers has increased across the country – although by no means is there yet complete coverage. Moreover, understanding has improved about what constitutes good practice in addressing company, industry, and regional deficiencies, needs and opportunities (see Table IV for a summary characterization of the US system).

In general, US modernization programs exhibit a pragmatic approach to technology. Experience has shown that much improvement can be obtained in many small and mid-sized manufacturers by off-the-shelf technologies and better management and training, rather than highly sophisticated and complex new technologies. To an important extent, the emphasis on pragmatic technologies in the US programs is counterbalancing a national research and innovation system that has been highly focused toward advanced technologies (including advanced defense technologies).

A growing number of MEP centers offer a common service core of assessment, assistance, referral, information and training. Yet, as might be expected in a decentralized program, there are still many varieties in approach and organization. Some programs focus on individual one-on-one projects conducted by their own staff, while others give a greater role to consultants to provide assistance after an initial assessment. Several programs are trying go beyond specific problem-solving to stimulate their customers to pursue broader technological upgrade and business development paths. And, while there is a heightened interest in networking and group services, this is implemented in diverse ways in different places. The experimentation has continued even as the national MEP framework has developed, with new efforts (often with MEP support) to develop improved assessment tools, benchmarking measures, and telecommunication techniques.

This said, there are still several important challenges to be addressed in further promoting public-private collaboration for industrial modernization in the United States. While it has been possible to distill a series of common services and best practices for modernization, there is still a tendency at the field level to focus on "fixing" individual problems of firms – for example,

Table IV. Structure and Organization of U.S. Industrial Modernization Programs

	Federal and State Industrial Modernization Programs
Sponsors	States, non-profits, universities & colleges, others
Primary users	Varies, but generally manufacturers with fewer than 500 employees
Services	Technology needs assessment; problem solving; technical advice and guidance; implementation assistance; brokerage and referral; training; information dissemination; demonstration
Coverage and standardization of services	Not all states have programs; service mix varies by state; experimentation in service approach and delivery
Staffing	Flexible, with varied use of core staff and consultants; many staff have engineering and industrial experience, but varies by program
Research links	Few programs have own research, but several are within research institutions; many are linked with local universities; emerging links with federal labs
Service delivery methods	Varies, from informal to formal assessments and written recommendations; up to 5 or more days of service; fee policies vary, from free to cost match to full fees for intensive services
Program evaluation	Varies, but NIST MEP programs use standard performance measures; external reviews by program sponsors, oversight agencies
National role	Federal funding match; competitive selection for federal funds; diffusion of best practices; demonstration projects; coordination and partnership within a decentralized, federal-state system
Program status	Expansion mode, but future federal role and funding uncertain
Key Issues	Long-term stability and role of federal government; disseminating best practices; proving effectiveness; stimulating system changes

correcting a quality problem or recommending a specific technology. While these "project" services are important, the charge of stimulating deeper "systemic" change in firms and in relationships with other firms and public institutions is less attended to, probably because such efforts are complex and it is hard to gauge success. But such changes are possible, as illustrated by an effort in Grand Rapids, Michigan, where a modernization program affiliate has effectively brought together customers and suppliers in the office furniture sector to improve mutual linkages and develop common industry directions.[42] The further promotion of systemic activities will involve broadening program mandates, improved staff training, and changes in evaluation systems (to shift program horizons more toward longer-term objectives). And, while most MEP programs have developed good working relationships with their local industrial organizations, renewed efforts are still needed to increase the commitment of larger customers and major industrial associations to SME technological modernization.

As US programs grow in scale, increased attention is being paid to issues of personnel and staffing. In the US, with its fluid labor market, it is relatively easy to hire competent staff with either general or specific expertise (and also to lose them). While a few US programs use academic faculty, the dominant trend is to hire industrially-experienced engineers, preferably with business management experience or training. Other types of professionals (eg.: in training, general management or marketing) are also used. US program staff need not only to be technically competent, but also able to work with diverse firms, build confidence, enthusiasm, and support among a variety of constituencies, and involve other specialists, faculty, or consultants as necessary to meet particular needs. With the increased scale of US modernization efforts, the number of personnel engaged in the system is growing dramatically, and complementary initiatives are being put into place to provide staff training, tool libraries, shared information resources, and other staff support.

A concern yet to be fully faced is that of geographical and industrial targeting. The highly competitive award processes used both for MTCs and the TRP program risks the danger of key industries or regions being overlooked, perhaps due to a poor proposal submittal or difficulty in obtaining matching funds. Moreover, the case has been made that modernization resources, especially from the federal government, should be focused at selected strategic regional industrial clusters, such as the motor vehicle industry complex in the Midwest.[43] However, while perhaps desirable from a pure industry policy perspective, targeting resources to specific places and industries is difficult in America's federal system, especially since analyses of clusters tend to favor older Northeast and Midwest industrial regions where industries are historically more geographically concentrated. In the South and West, where industries are generally less agglomerated, it is unlikely there would be much support for a targeted approach that left them out.

Many (but not all) US programs actively seek fee income for the services they provide to firms. Program managers pursue fees for service for various reasons (not mutually exclusive). There may be formal requirements to generate fee income (for example, in the original MTC program). With an eye to uncertain funding, managers also prefer to diversify income sources. Additionally, it is often held that generating fee income can be beneficial by giving "market signals" to programs to provide those services most valued by firms (i.e., those services which firms will pay for). From a practical perspective, the "transaction costs" of serving many small firms are high, and sufficient fee income can rarely be generated to cover the full cost of the services provided – leading to a measure of subsidy even when fees are collected. Moreover, most programs seek a balance between fee income and public support. Such a balance is important, because if programs become over-dependent on fees, there is a danger that they will focus too much on short-term individual projects to make "sales" and generate income.[44] This may cause programs to avoid more systematic or strategic efforts where fee income is unlikely but which could have bigger long-term benefits and spillovers (for example, promoting inter-firm collaboration). There is also the possibility that programs will loose objectivity and perceived company trust if they are too aggressive in promoting their own income base (companies often comment that they like modernization programs because they do not "push" any particular technology or service, unlike equipment vendors or private consultants who have a strong motive to promote their own products and interests). Most practitioners, even in programs that generate revenues, agree that modernization needs a stable and sufficient core of public support to avoid such difficulties and fully realize its potential.

Perhaps the greatest challenge confronting US efforts is that of reconciling the "technological cycle" of modernization (requiring a long-term commitment by programs and firms) with the "political cycle" (which operates on the shorter interval of two-to-four years) as well with as the annual "budget cycle". Although the level of public funding has now increased, the issue is whether this effort can be sustained over the long term. Modernization is not a quick-fix jobs program and it fundamentally entails more than the one-time identification and adoption of new technology. Stability and patience are crucial – characteristics that are often difficult for policymakers in America's fluid, decentralized, and often fragmented federal-state political system to maintain. Despite the generally warm receptivity of US policymakers at the state level to the concept of upgrading the SME industrial base, these elected and appointed officials do not always fully understand the combinations of managerial, technological, and system-changing tasks that modernization requires.

Meanwhile, changes in national political leadership are set to renew ideological disputes about the desirability and scale of federal government intervention. These differences may constrain the further development of modernization policies and lead to a retrenchment in federal support. In the first part of 1994, administration officials were confident that the federal government was assuming a long-term responsibility for the technological modernization of industry.[45] However, the subsequent shift in Congressional leadership and the possibly of a presidential changeover after the 1996 election have raised doubts about the federal role. The TRP looks increasingly like it will be a "one-shot" approach – giving a massive but temporary federal boost to public modernization efforts. This was perhaps inevitable as the use of TRP as a funding vehicle for industrial modernization reflected short-term political compromises: first, in eluding budget deficit problems by using defense dollars rather than new civilian-side funds and, second, by cloaking the program with a national defense mission to avoid the appearance of "industrial policy" (still a politically-sensitive concept in the US). These compromises are now becoming unravelled. The proponents of modernization will have to make their case in other ways if federal funding is to be continued for the many local programs spawned by NIST's TRP resources. It may be possible to persuade the new Congressional leadership to re-authorize large-scale civilian funding for NIST's MEP program, on the grounds of program effectiveness, competitiveness, jobs, or state and industry support (rather than "technology policy" per se). But this is not a certain sale.

Even if federal civilian-side funding is secured and NIST is given a budget for modernization commensurate with its charter, the existing level of multi-agency fragmentation within the federal government will still make it hard to achieve coordination and consistency. Besides the Defense Department, many other federal agencies – including Energy, NASA, Agriculture, the federal labs, the Economic Development Administration, and the Small Business Administration – have become involved in modernization and technology deployment initiatives. Similar problems exist at state levels, where inter-agency and inter-institutional competition is a frequent occurrence.

If federal leadership fades, the weight of responsibility for further developing US industrial and technological modernization efforts will shift to the states. Such swings are not unusual in US economic and social policy. There is a strong tradition of state and local autonomy in designing programs to fit particular needs, and this localization is generally a desirable feature of modernization programs. The TRP competition showed that state and local governments and regional business communities are hugely interested in technological modernization and deployment. At the same time, without supplementary federal funding and a national framework to guide program development, distill best practices, and disseminate and transfer those practices around the country, state modernization efforts will certainly be weakened.

NOTES AND REFERENCES

1. A nominal exchange rate of ECU 1.00 = US$ 1.23 is adopted for currency conversions in this paper.

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13. Evidence on the low adoption rates of "soft" technologies and techniques by small and midsized firms is provided in: Industrial Technology Institute (1987), op.cit; and P. Shapira and M. Geiger, Survey of Technology Use in West Virginia Manufacturing, West Virginia University, Regional Research Institute, Research Paper 9001, Morgantown, WV, 1990.

14. For international comparisons, see: R. Dore, Taking Japan Seriously, Stanford University Press, Stanford, CA, 1987; M.H. Best, The New Competition: Institutions of Industrial Restructuring, Polity Press, Cambridge, UK, 1990; F. Pyke, G. Becattini, and W. Sengenberger, Industrial Districts and Inter-Firm Co-operation in Italy, International Labour Organization, International Institute for Labour Studies, Geneva, 1990.

15. US Congress, Office of Technology Assessment, Worker Training: Competing in the New International Economy, OTA-ITE-457, US Government Printing Office, Washington, DC, 1990; National Coalition for Advanced Manufacturing, Preparing Workers for the New Industrial Era: The Need for a Fundamental Shift in Federal Policy Toward Technical Education, NACFAM, Washington, DC, 1993.

16. NIST was previously known as the National Bureau of Standards.

17. W.J. Clinton and A. Gore, Jr., Manufacturing for the 21st Century: Turning Ideas Into Jobs, National Campaign Headquarters, Little Rock, AR, September 8, 1992; W.J. Clinton and A. Gore, Jr., Technology for America's Economic Growth: A New Direction to Build Economic Strength, Executive Office of the President, Washington, DC, February 22, 1993.

18. For a discussion of the shift in US technology policies in the early 1990s and a contrast with the 1980s, see: L. M. Branscomb, "The National Technology Debate," in L.M. Branscomb, ed., Empowering Technology: Implementing a US Strategy, MIT Press, Cambridge, MA, 1993.

19. This was not a coincidence – Clinton's advisers were aware of the operation and scale of the Japan's technological modernization effort.

20. Incoming Republican Congressional leaders have stated that the federal government should focus on basic research and back away from applied technology policies ("New Direction of the House Science Committee," NACFAM Alert, National Coalition for Advanced Manufacturing, Washington, DC, December 15, 1994). Deregulation and a reduction in capital gains and other taxes are preferred ways of stimulating technological innovation, rather than direct government-sponsored support (E. Andrews, "Congress and White House split on high tech," New York Times, January 3, 1995, p. C19). In this context, the Clinton administration will likely lack the Congressional endorsement to fully fund its technology investment plan — which includes increasing NIST's budget to $1.4 billion (ECU 1.1 billion) by 1997 (up from $381 million or ECU 310 million in FY 1993).

21. At the end of 1994, there were Manufacturing Extension Partnership centers in 32 states – 18 with Democratic governors, 13 with Republican governors, and one state with an independent governor (The Role and Importance of the Manufacturing Extension Partnership Centers, The Modernization Forum, Dearborn, MI, December 1994). At the state level, industrial and technology policy is generally seen as an augmentation of the long-accepted states' role in economic and business development. States are likely to continue support a variety of technological modernization efforts, even if federal assistance wanes (although a decrease in federal funds may lead to a decline in cash match by several states).

22. D. Osborne, Laboratories of Democracy, Harvard Business School Press, Boston, MA, 1988; P. K. Eisinger, The Rise of the Entrepreneurial State: State and Local Economic Development Policy in the United States, University of Wisconsin Press, Madison, WI, 1988.

23. R. S. Combes, Origins of Industrial Extension: A Historical Case Study, Masters Thesis, School of Public Policy, Georgia Institute of Technology, Atlanta, GA, 1992.

24. The Pennsylvania program did receive federal sponsorship through the State Technical Services Act of 1965 (Public Law 89-182) but after federal funding was cut in 1969, the Commonwealth of Pennsylvania continued to support the program.

25. National Governors' Association, Promoting Technological Excellence: The Role of State and Federal Extension Activities, National Governors' Association, Washington, DC, 1990; National Governors' Association, Increasing the Competitiveness of America's Manufacturers: A Review of State Industrial Extension Programs, National Governors' Association, Washington, DC, 1991.

26. For its 1991 study, data collected by National Governors Association indicates total spending for surveyed programs at about $79 million (ECU 64 million), including almost $41 million (ECU 33 million) from state and university sources, $20 million (ECU 16 million) from the federal government, and over $15 million (ECU 12 million) from industry and program income. Most of the federal support went to Manufacturing Technology Centers.

27. National Institute of Standards and Technology, Technology-Based Economic Development: A Study of State and Federal Technical Extension Services, Special Publication 786, National Institute of Standards and Technology, US Department of Commerce, Gaithersburg, MD, 1990.

28. Efforts (S-4/HR820) to extend federal funding to MTCs beyond the six year limit did receive considerable support in the 103rd Congress in 1994, although legislation was ultimately not enacted.

29. US General Accounting Office, Technology Transfer: Federal Efforts to Enhance the Competitiveness of Small Manufacturers, GAO/RCED-92-30, Washington, DC, 1991; Manufacturing Technology Centers, Third Year Review Panel, Manufacturing Technology Centers: Broad Programmatic Issues, National Institute of Standards and Technology, US Department of Commerce, Gaithersburg, MD, 1992.

30. For an early exposition of the MEP, see: National Institute of Standards and Technology, Manufacturing Extension Partnership: A National Strategy for Manufacturing Excellence, US Department of Commerce, Gaithersburg, MD, December 11, 1992. A more recent elaboration is: National Institute of Standards and Technology, Manufacturing Extension Partnership, US Department of Commerce, Gaithersburg, MD, December 1994, electronic document available through http://www.nist.gov/item/NIST_Manufacturing_Extension_Partnership.html or NIST's gopher server (telnet gopher.nist.gov).

31. Advanced Research Projects Agency, Technology Reinvestment Project, Program Information Package, US Department of Defense, Arlington, VA, 1993.

32. In FY 1995, $115 million (ECU 94 million) is allocated by TRP to Regional Technology Alliances. See: Advanced Research Projects Agency, Program Information Package for Technology Reinvestment Project, FY95 Competition, Technology Reinvestment Project, Arlington, VA, Fall 1994

33. L. Reilly, "TRP filers ask for $8.4B," Washington Technology, August 12, 1993.

34. B. Bosworth and S. Rosenfeld, Significant Others: Exploring the Potential of Manufacturing Networks, Regional Technology Strategies, Chapel Hill, NC, 1993.

35. D. Giancola, "Heat in Ohio: The difficult birth of an American network," The Entrepreneurial Economy Review, 9,3, Spring 1991, pp. 19-23; B. Bosworth, "Learning to learn in networks," Firm Connections, May-June 1993, 1,2; S. Rosenfeld, Manufacturing Networks and State Policy in North Carolina, Southern Technology Council, Research Triangle Park, NC, 1992.

36. Collated from data in (a) Philip Shapira and Jan Youtie, USNet 1994 State Baseline Assessment: Preliminary Analysis, USNet Evaluation Paper 9402, Regional Technology Strategies, Chapel Hill, NC, November 1994; and (b) USNet electronic information exchange,

networking directory forum, Connect, Inc., December 1994. For earlier accounts of US networking, see R.E. Friedman, "Networking comes to America," The Entrepreneurial Economy Review, Corporation for Enterprise Development, 9,3, Spring 1991, pp. 3-12; and G.A. Lichtenstein, A Catalogue of US Manufacturing Networks, National Institute of Standards and Technology, US Department of Commerce, Gaithersburg, MD, 1992.

37. For sources and further details on these examples, see: P. Shapira, Technology Demonstration and Application Centers: Case Study Examples from the United States and Japan, School of Public Policy, Georgia Institute of Technology, Atlanta, GA, November 1994.

38. The literature describing US modernization best practices includes: B.T. Shaw, Strategies for Delivering Technology Assistance to Small Manufacturers: Lessons from Pennsylvania, American Society of Mechanical Engineers, New York, 87-WA-TS-9, 1987; Technology Management Group, How to Start and Operate an Effective Business and Technology Assistance Program, Handbook Prepared for the US Department of Commerce, Economic Development Administration, Grant Number 99-06-07263, Technology Management Group, Philadelphia, PA, 1989; D. Clifton, L.R. Edens, H.T. Johnson, and R.W. Springfield, "Elements of an effective technology assistance policy to stimulate economic development, Economic Development Quarterly, 3,1, February 1989, pp. 52-57; G. Simons, The Experience of the Northeast Manufacturing Technology Center, Proceedings of the Second Meeting on Modernizing America's Industrial Base, Detroit, May, 1991; The Modernization Forum, MTC Project Development and Management, Dearborn, MI, September 1993; P. Shapira, Best Practices for Industrial Modernization, School of Public Policy, Georgia Institute of Technology, Atlanta, GA, December 1993.

39. Performance Benchmarking Service, The Bench Press, 1, 1, Fall 1994.

40. The original seven MTCs report that they conducted nearly 2,900 technical assistance projects and assessments over the year July 1993 through June 1994. For technical assistance projects, those firms providing evaluation data indicate, on average, an annual sales improvement of over $190,000 (ECU 154,000), inventory reductions of nearly $18,000 (ECU 15,000), and the creation or preservation of about five jobs. A (rather high) economic benefit ratio of 7:1 has been calculated for each federal dollar invested in these seven centers plus five newer ones (Modernization Forum, 1994, op.cit). Favorable, if less dramatic, results have also been reported in separate evaluation studies at the Michigan-based NIST Midwest Manufacturing Technology Center (where project benefits exceeded project costs by a ratio of 2.6 in 1993-4) and of the New York Industrial Extension Service (E. Oldsman, An Evaluation of the Industrial Technology Extension Service, report prepared for the New York Science and Technology Foundation, Nexus Associates, Cambridge, MA, 1993. See also: E. Oldsman, "Do Manufacturing Extension Programs Matter," Research Policy, 1995, forthcoming).

41. See, for example, P. Shapira, J. Youtie, and J.D. Roessner, Evaluating Industrial Modernization Programs: Issues, Practices, and Strategies, School of Public Policy, Georgia Institute of Technology, Atlanta, GA, 1994; and P. Shapira and J.D. Roessner, eds., Special Issue on the Evaluation of Industrial Modernization, Research Policy, forthcoming.

42. The reference here is to the Right Place Program, Grand Rapids, MI, which the author visited in December 1993 as part of a NIST review panel.

43. M.S. Fogarty and J.C. Lee, A Manufacturing Industry Cluster Approach to Technology Deployment, Center for Regional Economic Issues, Weatherhead School of Management, Case Western Reserve University, Cleveland, OH, 1991; D. Luria, R. Cole, A. Baum, et. al., "Fixing the manufacturing base: the allocation of industrial extension," Journal of Policy Analysis and Management, 13, Summer 1994, pp. 571-581.

44. Another danger is that an over-aggressive fee-generating strategy will provoke concerns about unfair competition with private consultants. To date, however, this has not been a major issue, as most consultants have recognized the complementariness of public modernization efforts and private consulting (bigger consultants do not usually target the smaller clients of modernization programs, while smaller consultants often find follow-on work through initial public efforts).

45. "'Technology Policy is Here to Stay,' Says White House Special Assistant," ModComm, 2,1, Spring 1994.

Technology Demonstration and Application Centers: Public Programs for Technological Modernization in Japan[1]

1. INTRODUCTION

Over the last few years, greater attention has been paid to the contribution of small and medium-sized firms to Japanese economic and technology development.[2] With more than 600,000 manufacturing enterprises employing 300 or fewer workers, Japan's small firm sector occupies more than three-quarters of the country's manufacturing workforce (Table 1).[3] The pressures on these small and medium manufacturing enterprises (SMEs) have grown as the Japanese economy has become more internationalized and as traditional larger customers change supply policies and sources. Japanese small manufacturers have been hard hit by the post-1991 collapse of the "bubble-economy" and the rising international value of the yen (making exporting more difficult, offshore sourcing more favorable, and importing more attractive even in Japan's difficult-to-enter markets). There has been a renewed debate in Japan about what was once viewed as mainly an American problem – the "hollowing-out" of the national manufacturing base, with the collapse of many small manufacturers and the weakening of local economies dependent on industrial production.[4]

These developments have begun to modify the way the small firm sector is regarded by both policymakers and small firms themselves. There has long been a "dualistic view" about the position and potential of small and medium-sized manufacturing enterprises (SMEs) in Japan. On the one hand, SMEs have been seen as technologically backwards and distinct from Japan's successful large companies (with the latter traditionally receiving greater policy priority). Simultaneously, the tight vertical linkage between SMEs and their larger customers has often been identified as an important source of the technological and economic strength of the Japanese industrial base. There remains much truth in each view. But both of these perspectives are now converging, if not giving way, to the idea that Japanese SMEs, bolstered through a variety of public and private relationships, can in the coming years assume an even more pivotal economic and technological role than in the past. Many Japanese SMEs now wish to reduce traditional vertical dependencies and build stronger horizontal and lateral ties with a wider variety of other enterprises and with research centers to secure business survival and greater technological autonomy. Japanese policymakers also want SMEs to assume a more prominent place in national and regional development (induced, in part, by the internationalization of the Japanese economy which has largely taken the big firms out of the ambit of Tokyo's policy control). To support this direction, new regional technology initiatives focused at SMEs are being added to Japan's long-established programs for small firm technological modernization.

This report considers the changing position of SMEs in Japan and examines key elements of the public support system for technology promotion. The characteristics and operation of Japan's comprehensive system of local technology centers are reviewed, along with a discussion of new regional technology initiatives. The report concludes with an assessment of Japan's public policies and programs for SME technology promotion.

Table I. Small and Mid-Sized Enterprises, Japan, 1991

	Enterprises 1991	Employment 1991
	Thousands	Thousands
Small and Mid-Sized Enterprises	852.3	10,396
of which:		
under 20 employees	749.5	5,371
20-99 employees	90.9	3,517
Large Enterprises	4.6	3,691
Total	856.9	14,087
	Percent	Percent
Small and Mid-Sized Enterprises	99.5	76.6
of which:		
under 20 employees	87.5	38.1
20-99 employees	10.6	25.0
Large Enterprises	0.5	23.4
Total	100.0	100.0

Note Small and mid-sized enterprise: Japan= less than 300 employees.

Source Small and Medium Enterprise Agency, White Paper on Small and Medium Enterprises in Japan 1993, Ministry of International Trade and Industry, Tokyo, 1993 (Appendix, Tables 1 and 2).

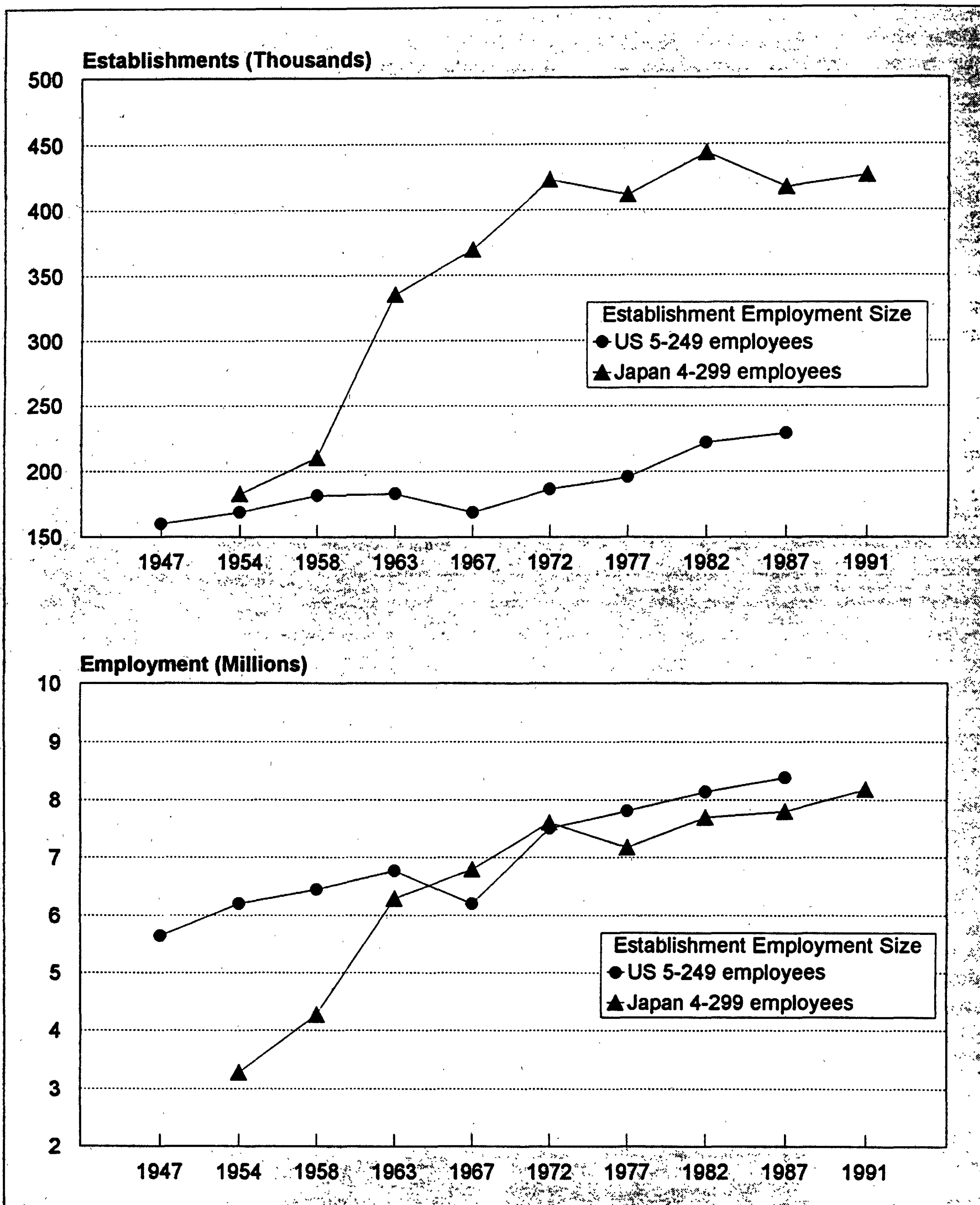
2. THE CHANGING POSITION OF SME'S IN JAPAN

Japan's small firm sector has grown significantly in terms of the number of establishments and jobs over recent decades (Figure I). Today, Japan's 850,000 small manufacturers employ three quarters of Japan's manufacturing workers and produce more than half of the manufacturing value added. These small manufacturers are diverse.[5] About half are workshops with three or fewer workers, while the rest – still a huge segment of some 432,000 enterprises – each employ between 4 and 299 people. Often, the smallest workshops are engaged in traditional Japanese crafts, while other small firms are labor-intensive operations, producing simple components or carrying out routine tasks for larger companies. Some are labor-only subcontractors, with no plant or equipment of their own, who send personnel to work inside the plants of other companies. But many small firms are involved directly in modern manufacturing, using and developing advanced technologies. For example, the technological gap between small and large firms is smaller in Japan than in the United States, and small Japanese companies are more likely to use new technologies and techniques than their US counterparts. Almost 50 percent more Japanese SMEs than US SMEs use numerical or computer-numerical control machine tools, and they use more than four times as many advanced machining centers and robots.[6] Worker training – essential to the proper use of new technology – is also relatively strong in small Japanese firms.[7]

Japan's hundreds of thousands of small, flexible, and technologically proficient manufacturers are sources of high quality inputs and technological enhancements to larger companies. Contracting in Japan is typically organized in a pyramid fashion, with large manufacturers at the top supplied by smaller firms in multiple lower tiers. Long-term relationships between the tiers of smaller and bigger firms have given the smaller units the confidence to invest in new technology, workforce training, and ongoing product and process improvement.[8] But this "carrot" is usually accompanied by the "stick" of continuous improvement: most large companies require strenuous cost, quality, and delivery schedules, further driving smaller suppliers to modernize.

While many SMEs are closely tied to their larger customers, they also seek outside sources of support. Large firms may help their suppliers by sharing information, technology, and personnel – but not always. Sometimes, large companies may have little time to deal with the problems of smaller firms; or a small suppliers may be more specialized than their larger customers or may need special training or technological expertise. In such cases, small firms have to look beyond their larger customers for assistance. They may also seek outside help to deal with problems of adjustment. As large Japanese customers rationalize or internationalize production, many smaller firms are trying to develop new products to offset reductions in their traditional business lines. In other instances, large firms are themselves diversifying, compelling their smaller suppliers to shift into new technologies. Increasing competition from low-cost Asian suppliers, a highly-valued yen, and the difficulty of attracting skilled young workers (who prefer larger firms) are also stimulating small firms to invest in new, labor-saving technologies and upgrade working conditions.

Figure I. Small Manufacturing Establishments and Employment, Japan and US



Sources: Establishment-based data from Japanese and US Census of Manufacturers, various years.

The bursting of Japan's "bubble-economy" of the late 1980s and the onset of a deep recession after 1991 has intensified the pressures on Japanese SMEs to rethink their technology and business linkages and strategies. Forced to slash costs and curtail production during the recession, major companies – especially in the hard-hit automotive and consumer electronics industries – have reduced or cut off orders from their smaller suppliers. This has occurred to such an extent as to call into question the future of Japan's tight parent company-supplier relationships. While these links are so embedded that any fundamental changes will take a long time, the recession has convinced many small enterprises not to rely so heavily on a single major buyer. Cost-cutting drives have led to a drop in SME capital investment, which in 1992 was down 9 percent from the level of 1988. SME business closures are up, while start-ups are down. At the same time, the recession appears to have opened new possibilities for SMEs with innovative technologies to exploit niche markets which larger companies are disinclined to enter.

The current recession is thus giving further impetus to a trend that had been gathering momentum during the 1980s. An expanding segment of small Japanese manufacturers wants to develop, control, and sell their own products and technologies in domestic and international markets, without the constraints set by larger customers. One indication of this is the declining proportion of Japanese small manufacturers exclusively engaged in subcontracting, which dropped from two-thirds to just over one-half during the 1980s. The last decade saw an increase in R&D spending and personnel in many small firms and an improvement in design capabilities. Geographical clusters of small innovative firms have formed, in Tokyo and other large cities, and in less-urbanized locations such as the Nagano Prefecture in central Japan.[9] New horizontal and lateral relationships are being developed, between and among small firms and in joint ventures with larger firms. A major aim of recent Japanese local and regional public technology policy is to reinforce and stimulate these emerging SME business development strategies.

3. MODERNIZATION POLICIES IN JAPAN

There has been an important evolution in Japan's policies toward small firms (those with 300 or fewer employees). In the years after World War II, small firms were often viewed as a backward sector in Japan. As policymakers favored building up large firms, especially in heavy and mass production industries, efforts were made to combine some small firms into bigger ones, and to shelter the rest from more efficient competition. More recently, while some protective measures still exist, the thrust of Japanese small firm policy has been to stimulate upgrading and modernization. Fostering innovative, knowledge-intensive small firms is considered vital to Japan's shift toward high technology and more flexible production methods. Small enterprise promotion and technology improvement are also seen as important regional economic development tools.

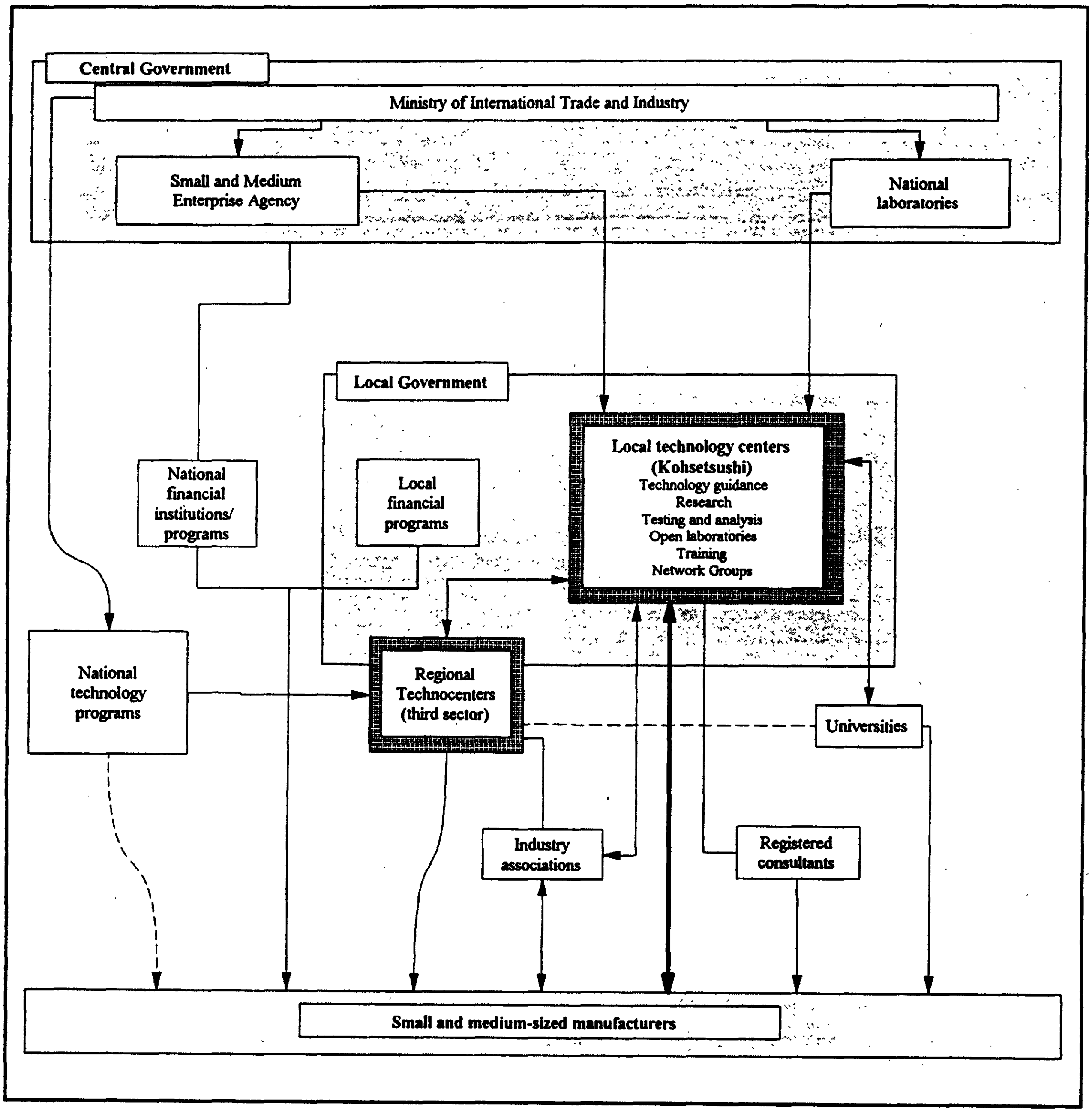
Modernization in Japan means not only strengthening technology, facilities, management, operations, and human resources in small firms themselves, but also improving entire sections of small enterprises, including inter-company and inter-industry relationships. Japan's national small enterprise laws and policies establish general mechanisms to provide finance, tax incentives, guidance, and assistance to individual companies and groups of small firms. There are also special measures to help small companies convert to new business lines and develop new products and technologies. The national government assists local programs that provide small firms with technology development support and guidance. Funds are made available for local technology centers, the clustering of companies for joint product development, marketing, and training, improvements in design abilities, information dissemination, and research and entrepreneurship.

The principal central agency responsible for small firms in Japan is MITI's Small and Medium Enterprise Agency (SMEA), whose functions include overseeing small industry guidance and technology development, subcontracting, enterprise promotion, and planning and research. Separate national councils for small and medium enterprise policymaking, stabilization, and modernization provide advice and review. Other agencies and bureaus contribute, including MITI's Machinery and Information Industries Bureau and the Agency of International Science and Technology (attached to MITI). An associated public organization, the Japan Small Business Corporation, provides guidance and financing for structural improvement and upgrading projects in small firms, training for enterprise personnel and local program staff, information and computing support, and business finance. The national government has also established three major financial institutions, targeted at small and medium-sized firms, to complement private financing and promote specific modernization policy goals: the People's Finance Corporation, which extends funds to very small-scale firms; the Small Business Finance Corporation, which supplies longer-term funds to small and mid-sized firms, and the Shoko Chukin Bank, which finances small firm cooperatives and small industry organizations (Figure II).[10]

A recent national policy encourages small firms with different specialties to work together to develop and commercialize new products.[11] This is carried out by establishing local technology plazas or meeting places, supporting mediators, sharing information, offering subsidies to business associations and fusion groups, and providing support for shared production and marketing. By 1994, about 2,500 SME fusion groups had been registered in Japan. Most of these were still at the stage of initial association and research, but some had moved to commercialize jointly-developed new products.[12]

At the local level, there are prefectural and city offices of industry promotion, which includes local small firm development and guidance. Equipment modernization loans and leasing systems for general, high technology, and information processing equipment are available for small firms, funded jointly by national and prefectural governments. Prefectures and cities also make additional funds and incentives available to local small firms for plant and equipment investments, through tax relief, interest subsidies on private bank loans, and other allowances. Area business and industrial associations play an important role in small industry modernization in Japan--a role supported by the public sector. Local chambers of commerce, industry federations, subcontractor promotion associations, and industry-specific structural improvement associations all receive public financial support.

Figure II. Japan's Public Support System for SME Technology Promotion



An example of the integration of several of these programs is found in Ehime Prefecture, on the southern island of Shikoku, where a Towel Industry Resource Center is working to revitalize local small towel firms, by promoting new computer-aided design (CAD) and manufacturing methods, design consulting, training, and joint marketing. This center is a cooperative effort involving the local industry association, the prefectural and city governments, and MITI. Next door, programmers, CAD operators, and information specialists are trained in a new Computer College established with a foundation grant from the Ministry of Labor's Employment Promotion Corporation.[13]

The variety of programs in Japan, together with the fact that small firm industrial modernization initiatives overlap with programs for general business development, regional development, and technology promotion, makes it difficult to precisely calculate Japanese spending for small-firm technology assistance. Only a small portion of small business assistance is counted in the regular central government tax budget; most central resources are provided from trust funds and other capital accounts. The US Office of Technology Assessment reckons that more than $30 billion (ECU 24 billion) – or more than 5 percent of the national regular and capital budgets in Japan--goes to support small firms each year, including non-manufacturers and loans but excluding prefectural and city contributions and spending on related regional development and technology programs.[14]

3.1. Kohsetsushi Centers

A cornerstone of Japan's system for modernizing small firms is its nationwide network of local and prefectural technology and testing centers. Known as Kohsetsushi centers (an acronym for koh, public; setsuritsu, establishment; and shikenjo, testing laboratory), these are publicly-sponsored institutions, with large engineering staffs, that serve as free or almost free resources for manufacturers with 300 workers or less.[15] Japan began to establish these industrial research, experiment, and testing institutes at the turn of the twentieth century, based in part on the US model of agricultural experiment stations and extension services. National and university institutes were the first to be founded, followed in the 1920s and 1930s by a number of local government centers to strengthen local industries. After World War II, additional local Kohsetsushi centers were constituted. In recent years, a few new centers have been added, while many older Kohsetsushi centers have expanded or built new facilities.

Today, there is at least one center in each of Japan's 47 prefectures, with 22 centers in the Tokyo metropolitan region (Map I). In total, there are more than 170 centers, employing 6,800 people, including 5,200 engineers and technical personnel (Table II). The centers usually develop expertise in technologies used by local industries, with each center maintaining several technological specialties. The greatest weight is in traditional craft industries, chemicals, metalworking, food processing/biotechnology, electrical and electronics engineering, textiles and clothing, ceramics, and distilling (Figure III). About half of the centers employ under 29 staff each. But there is a group of about 40 bigger centers, with 50 or more staff, mostly found in urban areas. The largest centers – in Tokyo, Osaka, Nagoya and other big cities – each have more than 100 staff.

in Japan

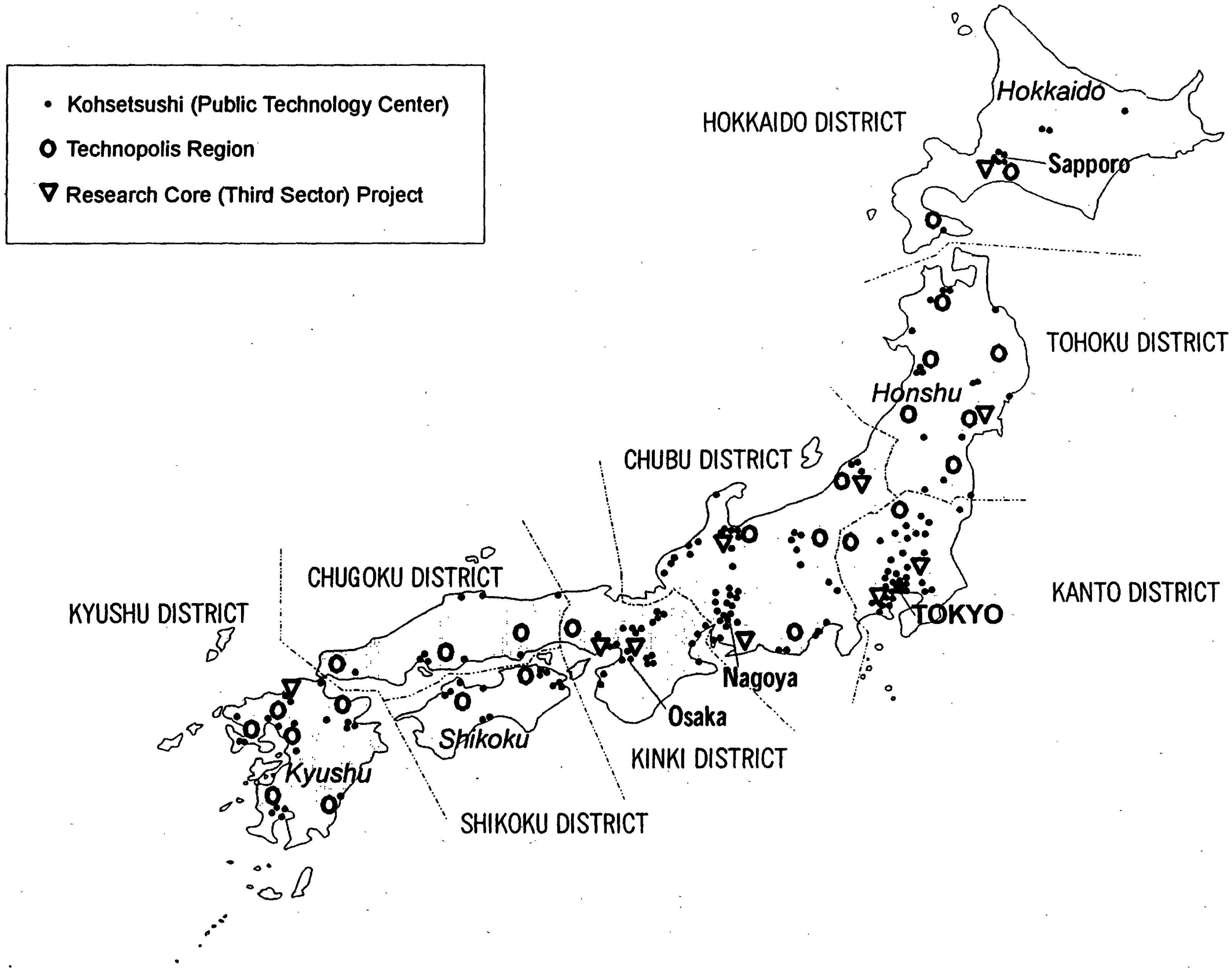
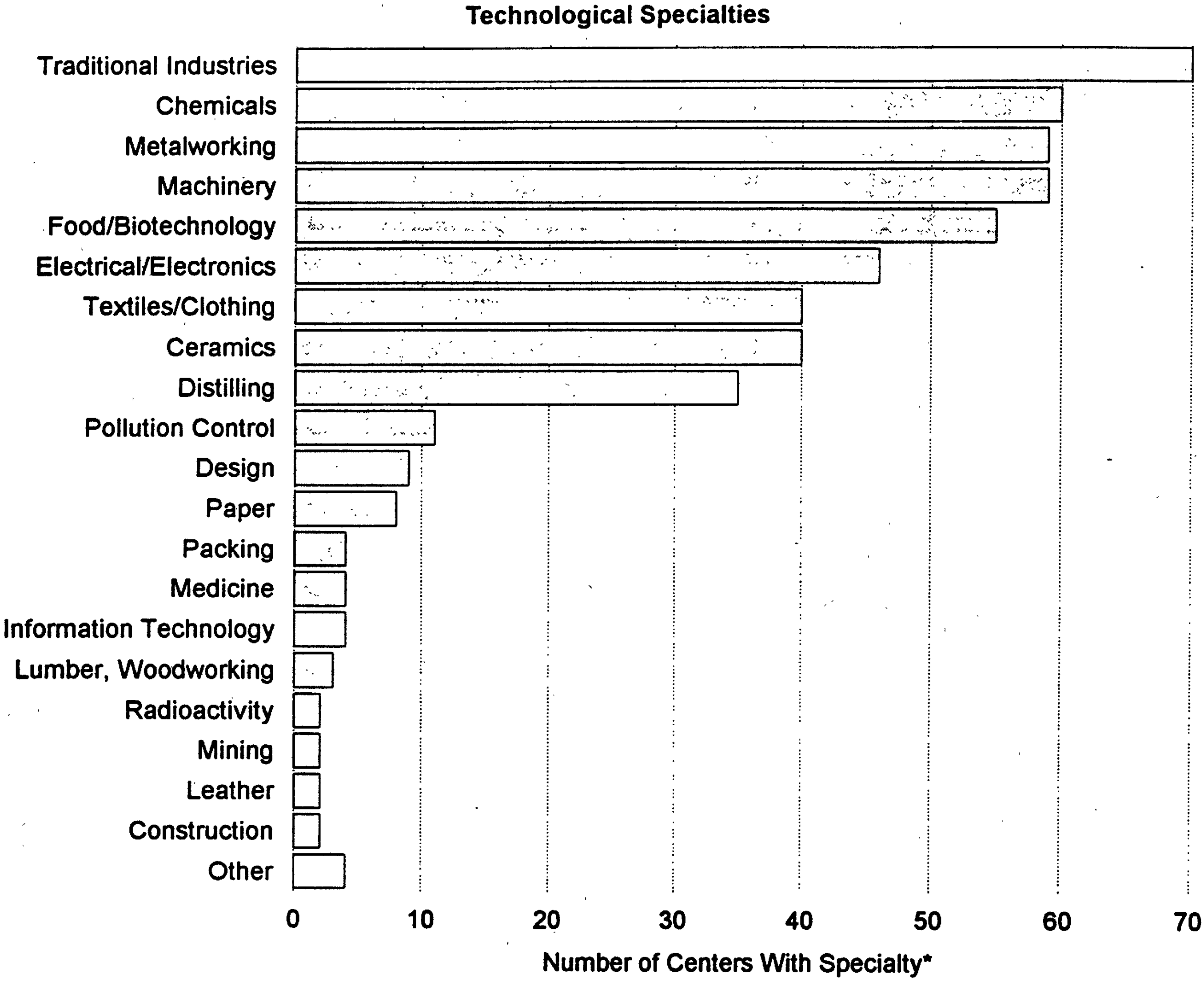
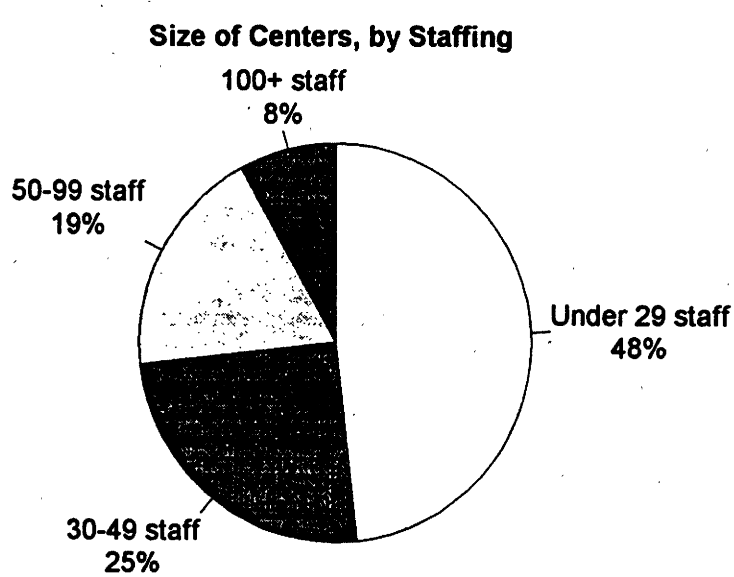

• Kohsetsushi (Public Technology Center)
O Technopolis Region
∇ Research Core (Third Sector) Project
Hokkaido
HOKKAIDO DISTRICT
Sapporo
TOHOKU DISTRICT
Honshu
CHUBU DISTRICT
KANTO DISTRICT
TOKYO
CHUGOKU DISTRICT
KYUSHU DISTRICT
Nagoya
Osaka
Shikoku
KINKI DISTRICT
Kyushu
SHIKOKU DISTRICT

Figure III. Kohsetsushi Centers Technological Specialties and Size of Staff





ıters generally have several specialties.
'ce: Calculated from 1990 data for 169 centers, Ministry of International Trade and Industry, Tokyo.

The Kohsetsushi centers are administered by prefectural and municipal governments, who also provide most of the funding. The overall Kohsetsushi budget was ¥98.16 billion (ECU 812.6 million) in FY 1994. Typically, the central government provides about 10 to 20 percent of the finance for each center, with funds coming from MITI, the Japan Small Business Corporation, and the Japan Bicycle Development Association (which uses betting profits from bicycle racing to improve machinery and metalworking industries). Fee income from services to private firms is small.

Kohsetsushi staff spend up to half their time on research, mainly on applied projects focused toward local industries. Projects may be organized by the center itself, or sponsored with local companies or universities. Small manufacturers often send one or two of their staff to work on Kohsetsushi research projects, providing opportunities for company personnel to gain research experience, develop new technical skills, and transfer technology back to their firms. The centers run a variety of seminars and study meetings to disseminate information on research and new technologies to local firms, as well as publish newsletters and research reports and maintain technical libraries.[16]

Conducting tests and examinations is another major Kohsetsushi activity. For nominal fees, Kohsetsushi laboratories will analyze materials and products, verify standards compliance, calibrate measuring instruments, and make sophisticated testing equipment available. These services are much used by Japan's small firms, with more than 680,000 tests and examinations conducted yearly. These services help small manufacturers to enhance quality, precision, and product development, in addition to resolving problems in materials and components.

To help small companies overcome technical difficulties and implement new technology, Kohsetsushi centers provide advice and guidance services. For simple requests, enterprise managers call in by telephone or visit the center; more complex problems are dealt with by field visits from center staff to companies. Over 400,000 contacts are handled annually, including 318,000 cases where technological consulting is provided (usually at the center) and over 21,000 instances where staff teams or advisers visited firms. About half of these visits are made through a program of technology advisers whereby Kohsetsushi centers match company needs and requests with registered private manufacturing consultants. The advisers are initially reimbursed from local and central funds, allowing them to provide a first round of services at no cost to firms.

Training in new technologies for employees of local small manufacturers is provided through Kohsetsushi group and customized programs. Employees go to the centers for classroom instruction and hands-on experience with advanced tools, computers, and software systems. Many Kohsetsushi centers offer open laboratories, making their specialized equipment available for research, prototyping, and training. Kohsetsushi centers also sponsor technology diffusion and network groups to encourage small firms to exchange information, share technology, and develop new products and markets. Each center may sponsor several such groups, with each involving up to 30 local firms.

3.2. New Regional Technology Projects and Partnerships

Complementing the long-established Kohsetsushi centers is a newer, and still growing, infrastructure of regional technology projects, industry resource centers, and technocenters. Concerned with lagging regional development outside of Japan's booming Tokyo-Nagoya-Osaka central core, MITI and other central government ministries have established a series of projects to promote the technological upgrading of existing industries and the development of new technologically-based enterprises in other regions.

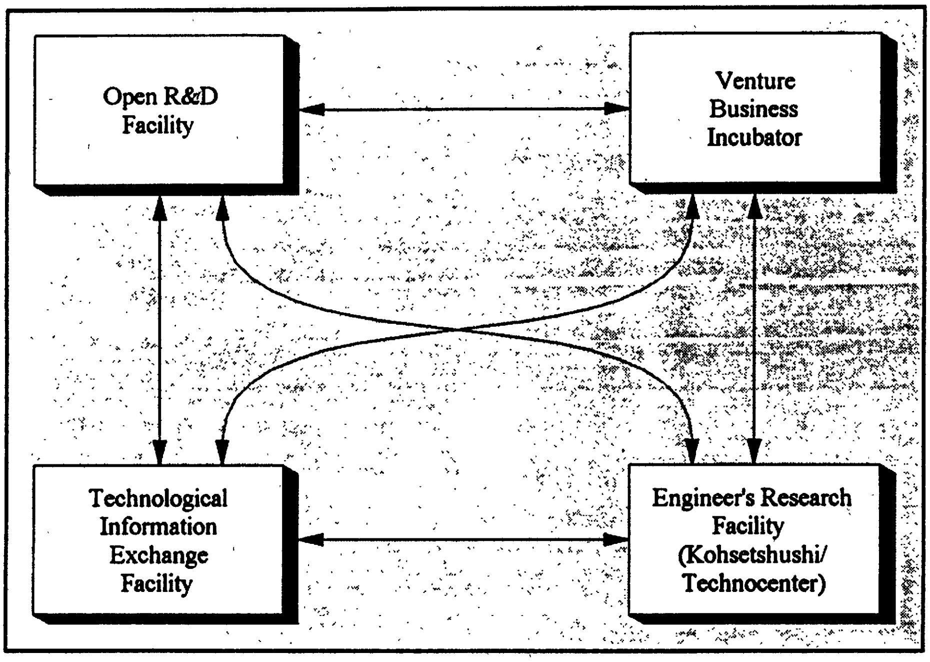
One of the most well-known of these initiatives is the Technopolis program which, in the 1980s, designated 26 areas to serve as nodes for high technology growth.[17] At many of these Technopolis sites, new technocenters have been built which are helping to introduce advanced technologies to local small firms. Regional technology development is also the aim of the Research Core program, which equips special facilities for promoting small firm technology transfer, business incubation, and training (Figure IV). Sponsored by MITI, although funded mainly by local government and the private sector, ten Research Core locations have been chosen to date.[18] Other regional technology projects championed by MITI and other ministries include the Key Facilities Concept (promoting facilities for information services and research in peripheral areas) and the New Media Community (developing new information systems in part for local firm networking).[19]

These regional technology initiatives are complemented by an expanding group of new local industry resource centers, city technocenters, and training institutes. For example, on the northern island of Hokkaido, the Muroran Technocenter is providing area small manufacturers with assistance in training, consulting, marketing, networking, information distribution, research and development, and the open use of advanced machines to help diversify the heavy industrial base of the local economy.[20]

Many of the new regional technology projects and industry centers are structured as "third sector" organizations. This usually involves a governing foundation comprised of public and private representatives, which allows more flexibility in activities and staffing, and enables resources to be leveraged from the private sector. Funding comes from private member companies, banks, utilities, and local and prefectural governments. The national government contributes equity capital and loans for third sector organizations through an Industrial Infrastructure Improvement Foundation, which is endowed with proceedings from the privatization of the telephone company NTT.

Japan's third sector approach borrows from the public-private partnership models developed in the United States. Policymakers have promoted the concept of the third sector in Japan to allow greater flexibility and autonomy than allowed in purely governmental operations. However, the desired effects have yet to be felt. Most third sector organizations use seconded government personnel who employ management systems and methods little different from those found in the public sector. Moreover, during Japan's booming "bubble-economy" era, numerous third sector organizations built (or were provided with) lavish showcase facilities.[21] In the current recession, these buildings are costly to operate and hard to fill with revenue-generating activities.

Figure IV. Research Core Concept



Source: Japan Industrial Location Center, Research Core and Key Facilities' Siting Concept, Industrial Location Project Series, Vol. 882, Tokyo, March 1989.

Further private contributions are not easy to obtain, which has forced national and local governments to supply additional soft subsidies. Good young researchers are also said to have some reluctance in joining third sector technology organizations because of the fear of instability and the lack of center reputation. At the same time, it must be added that most third sector organizations are at an early stage of development. Their primary sponsors show few signs of retreat and are likely to persist in providing support to help these organizations build capacity and become more effective.

4. ASSESSMENT OF JAPANESE APPROACHES

The combination of Kohsetsushi centers, regional and local technology projects, financial incentives, and other national and local policies provides an extensive support system for Japan's small firms. Most small firms have easy access to these assistance resources. The emphasis on examination, testing, and analysis in the Kohsetsushi centers has been valuable in helping small firms meet high standards of quality, performance, and precision. The ready access to advice and guidance services and advanced equipment, training, and information services assists firms in upgrading their operations, products, workforce, and strategies. And the centers help companies establish collaborative local research and act as a bridge to national research laboratories and universities (Table III provides a summary characterization of the Kohsetsushi centers and regional technology projects).

The Kohsetsushi centers present an intriguing illustration of nationally standardized services, but with little direct national funding. Across the country, different Kohsetsushi centers offer a remarkably standardized range of services and programs. They pursue the same policies and offer similar kinds of assistance to firms. Typically, the centers allocate about one-half of staff time to research, with the balance divided between (a) examinations and analysis and (b) technology advice and guidance. Additionally, most centers sponsor technology diffusion groups or "plazas," in conformance with MITI's emphasis on this strategy.

This harmonization of services is, of course, attributable to MITI, which has a great influence on the Kohsetsushi system even though its direct funding share is small. There are several mechanisms through which MITI achieves this influence. First, by exercising "administrative guidance" (gyosei shido) – the extra-legal means of obtaining adherence to policies and practices deemed desirable by the government which is long-standing and prevalent in (although not unique to) Japan. Second, through the linkages between the Kohsetsushi centers and MITI's national research laboratories, which guide Kohsetsushi research approaches. Third, through personal connections and personnel rotation, since many government officials at the local level (both elected and appointed) have links with MITI or are former MITI employees. Fourth, through carefully leveraging small amounts of MITI project funding for new research projects, training programs, and technology assistance and diffusion activities and funding from MITI-affiliated bodies such as the Japan Bicycle Development Association. Japan's centralized and bureaucratically-led policy apparatus readily adopts a long-run view, although the in-fighting

Table III. Structure and Organization of Japan's Kohsetsushi and Regional Technology Centers

	Kohsetsushi Centers	Regional Technology Centers
Sponsors	Prefectures and large cities	Prefectures and cities, with the private sector, though public-private partnerships
Primary users	Small and medium enterprises, 300 or fewer employees	Small and medium enterprises, 300 or fewer employees; large enterprises
Services	Research; technical advice and guidance; examination and analysis; information dissemination; training; open laboratories and equipment use; registered technical advisers; diffusion of technology groups	Research; technical advice and guidance; information dissemination; training; venture business support; research facilities for existing firms; open laboratories and equipment use; technology exchange and diffusion groups
Coverage and standardization of services	Nationwide coverage; standardized services; almost no experimentation in services	Numerous selected sites, mainly outside Tokyo and Osaka; similar services; small amount of experimentation
Staffing	Life-time staffing, little flexibility; almost all staff have engineering or technical qualifications	Dispatched staff from public and private sector
Research links	Centers maintain own research programs; links with national labs; some university links	Most have own research programs; links with local universities, labs.
Service delivery methods	Generally informal; large number of small interactions; some cooperative research projects with SMEs; no or nominal fees for service	Make high quality facilities and equipment available; provision of advice and guidance; some additional subsidies
Program evaluation	No formal evaluation systems	No formal evaluation systems
National role	Some national funds; centralized guidance over local activities; determination of overall program direction; identification of key technology priorities	Some national funds; centralized guidance; determination of overall program direction.
Program status	Mature but may soon be restructured; funding stable	Developing; massive expansion of facilities in "bubble"era; some funding shortfalls
Key Issues	Lack of flexibility; staff expertise; promotion of innovation; level of technology; relationship to new regional third-sector initiatives	Difficulty of attracting good technical personnel; "soft" systems; flexibility; barriers to new technology start-ups; quality of research

between different ministries and the stifling of local program experimentation, innovation, and flexibility by centralized control are considerable weaknesses.

Japanese firms often turn to the Kohsetsushi centers for aid in improving existing technologies and products. Companies report that local technology centers are helpful here and that the free or nominal cost of assistance encourages them to use the public services. In most cases, center staff are able to assist in these everyday problems, which usually do not require the latest technological expertise. Noting this, some Japanese observers criticize the **weak quality of Kohsetsushi** research and technology. Visits made to centers indicate a measure of truth in this view. In some instances, laboratories are visibly decayed, underused, and full of old equipment; many projects are run by single researchers who also have many other responsibilities; the average age of researchers is high; and the titles of some published papers are mundane (e.g., examining PC use in manufacturing enterprises). In other cases, Kohsetsushi research laboratories are well organized and equipped, and focused on ambitious research objectives. The general impression, however, is that most Kohsetsushi research is "catch-up" rather than being pioneering.

Paradoxically, this "weakness" in research could be considered a strength of the Kohsetsushi system. Kohsetsushi researchers spend a lot of their time catching-up on work done in national laboratories and other research centers. Some Kohsetsushi staff report that, with their other responsibilities for guidance and assistance, it is a continual challenge to improve their knowledge about developments in their fields. In this "catch-up" mode, Kohsetsushi staff are not at the leading edge of their fields. Rather, they are in an intermediate or broker position where they are not too far ahead of their small firm clients. In the past, this meant they could readily transfer knowledge to smaller firms that was useful and close to applications. However, there is an increasing concern that a growing number of Japanese SMEs have technological capabilities well ahead of those found in most Kohsetsushi centers, leading to calls to upgrade the levels of center research and technology.

In seeking to assist and foster these more innovative small firms, many local governments want to increase the role of local centers in innovative technologies by funding more future-oriented research. New third sector institutions focused on advanced technologies have also been built. However, while the physical infrastructure for these new technology centers is impressive, there is a great weakness in the "soft" infrastructure of personnel and operating procedures to support innovation. Japan's rigid labor market makes it hard to attract talented young technologists to centers which have yet to establish a reputation, and professionals with industrial experience are unable to leave their current employers in mid-career. Additionally, despite their intent, most third-sector centers are managed by dispatched public sector personnel, effectively transferring in the very practices of inflexibility and risk aversion these centers were designed to overcome.

Indeed, staffing has emerged as a major issue for most of Japan's local technology centers. The Japanese have tended to use career staff, generally with university engineering or science undergraduate degrees, to provide core services in the Kohsetsushi centers. Usually, the staff work their whole career with the sponsoring prefecture, often in a single center. This ensures stability and helps build long-term relationships with local firms, but staff skills can become outdated, and the low turnover limits opportunities to recruit young staff in new areas of technology. This is a problem now in sharp focus as the Kohsetsushi centers seek to advance the technology frontier of their research. Kohsetsushi centers are trying to address this question by hosting visiting researchers and increasing education and training for existing staff. But the Kohsetsushi centers (along with the new third-sector technology centers) continue to find it difficult to attract the best young researchers and technical staff in areas of new technology.

In the future, the policies of both central and local government to actively promote technology upgrading in small and medium manufacturers will lead to additional emphasis, resources, and demands for technology services providers at the local level in Japan. In some instances, Kohsetsushi centers are facing competition from the latest generation of regional technology programs. More frequently, Kohsetsushi centers are working with new third-sector initiatives in regional technology partnerships. However, the growing variety of regional technology schemes in Japan still presents issues of coordination of resources and, most critically, ones of relevance and effectiveness. On the latter point, the concern is whether in a fast-changing technological and business environment, Japan's public and public-private modernization systems can be sufficiently flexible, targeted, innovative, and customer-driven to meet the changing needs of the small manufacturing base.

In an acknowledgement of the challenges facing the Kohsetsushi system, the Small and Medium Enterprise Agency has established a Technology Policy Committee to provide advice about new legislation for SME technology promotion and the restructuring and future role of the Kohsetsushi centers. This effort will contribute to a new national "vision for the 21st century for technology policies for small and medium sized businesses," set to be announced by 1995.[22] It is likely that this vision will seek to shift the Kohsetsushi centers away from testing and technology guidance, to focus more on advanced research in fundamental and applied industrial fields. This research will be related to regional needs and aim to nurture the technological strengths of SMEs. Preparing the ground for this new direction, a regional study committee has already recommended the improved integration of Kohsetsushi centers in regional industrial policies, upgraded technological capabilities within the centers, wider research collaboration with other institutions and companies, improved researcher training, and a more active role in working with local companies.[23] One official has suggested that the Kohsetsushi center "in 10 years will probably have a completely different image than it has today."[24]

Japan's policy commitment to technological modernization is strong, and there is more robust political and financial support for a comprehensive system. The range of information, technical, and assistance services provided to small firms is marked by two key characteristics: (1) remarkable standardization, with little variation from place to place; and (2) a strong engineering and hard technology focus. There is little variation or experimentation in program services between different localities and formal evaluation systems are practically non-existent. This system has worked effectively in the past, but as the technological and business environment changes, Japan now seeks to find ways to evolve its system into one that is more innovative, flexible, and decentralized. New programmatic elements are being added to address the changing needs of SMEs. It remains to be seen, however, whether Japan's Kohsetsushi and regional technology centers can implement new research approaches, organizational styles and personnel systems to make them fully effective in new technology development and avoid unnecessary research duplication. This is an exacting challenge, which will require rather fundamental and difficult alterations in the way Japan's public technology programs are structured and operated in the future.

NOTES AND REFERENCES

1. Nominal exchange rates of ECU 1.00 = ¥ 120.8 = US$ 1.23 are used in this report.

2. See, for example, D. Friedman, The Misunderstood Miracle: Industrial development and Political Change in Japan, Cornell University Press, Ithaca, NY, 1988.

3. Japan's Small and Medium Enterprise Law defines a "small and medium enterprise" in manufacturing as one with 300 or fewer employees or with capital of ¥100 million (ECU 0.83 million) or less. A "small-scale enterprise" in manufacturing is defined as one with 20 employees or less.

4.. F. Sumiya, "Small manufacturers face survival fight," Nikkei Weekly, June 13, 1994, p.1.

5. See, for example, N. Chalmers, Industrial Relations in Japan: The Peripheral Workforce, Routledge, London and New York, 1989.

6. P. Shapira, "Modernizing small manufacturers in Japan: The role of local public technology centers," Journal of Technology Transfer, Winter 1992.

7. US Congress, Office of Technology Assessment, Making Things Better: Competing in Manufacturing, US Government Printing Office, Washington, DC, 1990.

8. R. Dore, Flexible Rigidities, The Athlone Press, London, 1986; M. Trevor and I. Christie, Manufacturers and Suppliers in Britain and Japan, Policy Studies Institute, London, 1988.

9. D. Friedman, op.cit.

10. For discussion of Japanese policies for small firms, see: Small and Medium Enterprise Agency, Small Business in Japan 1994, White Paper on Small and Medium Enterprises in Japan, Ministry of International Trade and Industry, Tokyo (and earlier issues of this annual publication).

11. Extra-Ordinary Law Concerning the Promotion of the Development of New Business Areas through Fusion of Knowledge of Small and Medium Enterprises in Different Industries ("Fusion" Law), 1988.

12. See: P. Shapira, "Collaborative business exchange and technology fusion: The Japanese approach," Firm Connections, September/October 1994, pp. 10-12.

13. Interviews conducted with Shikoku Towel Industry Association and Ehime Prefectural Local Industry Promotion Center, Imabari, Ehime Prefecture, February 23, 1993.

14. Office of Technology Assessment, 1990, op.cit.

15. The discussion of Japan's Kohsetsushi centers draws on field research in Japan in 1989, 1990, 1993 and 1994. The first part of this research is reported in greater detail in P. Shapira, "Modernizing small manufacturers in Japan," 1992, op. cit.; and P. Shapira, "Helping manufacturers do better: Japan looks after the little guys," IEEE Spectrum, 30, 9, September 1993.

16. For a detailed description of a Kohsetsushi center – the Tokyo Metropolitan Industrial Technology Center – see: P. Shapira, Technology Development and Application Centers: Case Study Examples from the United States and Japan, School of Public Policy, Georgia Institute of Technology, Atlanta, November 1994.

17. See: I. Masser, "Technology and regional development policy: A review of Japan's Technopolis programme," Regional Studies, 24.1, 1990, pp. 41-53.

18. An example of a Research Core Project – the Kanagawa Science Park – is detailed in P. Shapira, op.cit, November 1994.

19. See D.W. Edgington, "New strategies for technology development and information systems in Japanese cities and regions," in P. Shapira. I. Masser, and D. Edgington, ed., Planning for Cities and Regions in Japan, Liverpool, U.K.: Liverpool University Press, 1995.

20. Interview and field visit, Muroran Technocenter, Muroran, Hokkaido, January 26, 1993.

21. It is worth noting that Japan's political and budgetary systems often result, first, in the construction of a capital facility, with funding for operations gradually being allocated afterwards. In this sense, the third sector centers are not unusual, although it confirms the point that they are still being run under traditional public sector procedures.

22. "MITI to formulate 'Technology Vision' for small, midsized enterprises," Nikkan Kogyo Shimbun, June 29, 1993.

23. Kinki Bureau of Trade and Industry, Reinforcement of Small and Medium Companies, Report of the Committee on Kohsetsushi and Technology Reinforcement of Small and Medium Companies, Osaka, February 1994.

24. "Chugoku GIRI chief calls for restructuring of Kohsetsushi," Tokyo JITA News, 93FE08111, June 1993, pp. 2-3.

I. Introduction

This paper presents case descriptions of four typical technology development, demonstration, and application centers – two from the United States of America (USA) and two from Japan. The centers examined are:

- Georgia Manufacturing Extension Alliance
  Atlanta, Georgia, USA.

- Manufacturers Resource Center
  Bethlehem, Pennsylvania, USA.

- Tokyo Metropolitan Industrial Technology Center
  Tokyo, Japan

- Kanagawa Science Park
  Kawasaki City, Kanagawa Prefecture, Japan.

For each center, five elements are considered: (1) conception and objectives; (2) profile of activities and services; (3) organization; (4) indicators for effectiveness and success; and (5) trends and developments. In each cases, information is provided on staff structures and funding.[1] The broader policy context for each center is discussed and there is also an assessment of program performance and trends.

These cases have been prepared as part of a project examining technology deployment and demonstration programs in Europe, Japan, and the United States. The project is sponsored by the European SPRINT program and organized through the Fraunhofer Institute für SystemTechnik und Innovationsforschung (ISI), Karlsruhe, Germany.

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[1]Budget figures have been converted at the rates of ECU 1.00 = US$ 1.23 and ¥ 120.8 for the USA and Japan respectively. These are nominal current exchange rates, which do not take into account differences in purchasing power.

II. Georgia Manufacturing Extension Alliance

1. Conception and Objectives

The Georgia Manufacturing Extension Alliance (GMEA) is a partnership of four organizations in Georgia established to provide a new, integrated model for delivering technology and management assistance to small and medium-size manufacturers in the state. Led by the Georgia Institute of Technology (Georgia Tech) Economic Development Institute, the partnership also includes the University of Georgia's Small Business Development Centers (SBDC), the state Department of Technical and Adult Education's Quick Start program, and Georgia Power Company's Technology Applications Center (TAP).

The foundation for GMEA is provided by Georgia Tech's Industrial Extension Service (IES), which has more than 30 years of experience in supplying technical assistance to Georgia's manufacturers. IES was organized initially through Georgia Tech's Engineering Experiment Station, which then became the Georgia Tech Research Institute (GTRI). IES is now part of Georgia Tech's Economic Development Institute (EDI) – which also operates a series of parallel programs to support technology start-up enterprises, promote quality and productivity, offer training, and facilitate community economic development. By the end of 1993, EDI operated a network of 13 regional offices in Georgia. GMEA is now adding a further four regional offices, for a total of 17 offices. The regional field offices are staffed by full-time personnel with engineering, management, and industrial experience. These skilled professionals are able to provide reliable and timely advice and information to firms, resolve technical problems, and offer guidance and follow-up services to encourage the adoption and application of technology.[2]

GMEA aims to expand the capacity of existing industry, technology, management, and training services at Georgia Tech, add several new services, and promote improved coordination of services between Georgia Tech and other major service providers in the state. An integrated delivery system is envisaged to link technology, management, training, and applications assistance. Usually, GMEA services are provided without charge to client firms, although some specialized training events are fee-based and more complex technical assistance projects may require companies to co-share the cost.

The funding for GMEA derives primarily from state and federal funds, with a small amount of additional support from private utilities and fee income. In 1993, GMEA submitted a successful proposal to the federal Technology Reinvestment Program (TRP) and, in February 1994, signed a cooperative agreement with the U.S. Department of Commerce, National Institute of Standards and Technology (NIST) – the federal agency assigned by the Department of Defense's Advanced Research and Development Agency (ARPA) to manage TRP's technology deployment projects. Over a two-year period, federal funding of $6.6 million (ECU 5.4 million)

[2]David S. Clifton, Larry R. Edens, Harris T. Johnson and Robert Springfield, "Elements of an effective technology assistance policy to stimulate economic development," *Economic Development Quarterly*, February 1989, 3(1), pp. 52-57.

has been committed to GMEA, matched by an equivalent amount of state, in-kind and other funds. Toward the end of this period, GMEA intends to transition to civilian-side federal funding, as a NIST Manufacturing Technology Center, to match continuing state support.

The principal operational goals of GMEA are:[3]

- *To expand the customer base.* This will be done by opening new regional field offices to serve firms in the Atlanta metropolitan area and in the Dalton textile cluster of northwest Georgia.

- *To add new and expanded management and technical services based on surveyed needs of firms and industries.* Existing services in manufacturing technology, operations planning and control, and facility planning will be augmented by expanded and new services in management and marketing systems, quality management, information technologies, energy management, and environmental and occupational safety and health.

- *To deliver technology through an integrated network.* GMEA aims to establish an integrated delivery system combining the services and technology of Georgia Tech, Quick Start and the state's technical institutes, the SBDCs, Georgia Power's TAC, and federal labs and NASA. Additionally, a Technology Linkages Office has been established to link Georgia firms with federal and other technology resources.

GMEA further seeks to improve awareness, information, and understanding among firms in Georgia about enhanced technology and manufacturing techniques and technology assistance sources and services. Through a range of services and assistance projects, the program expects to stimulate the use of new technologies and techniques to improve products, manufacturing processes, management, and skills. In turn, it is anticipated that this will strengthen the performance and competitiveness of manufacturers in Georgia.

The broad target group for GMEA is Georgia's manufacturing sector, especially small and medium-sized firms with 500 or fewer employees. Within this broader manufacturing base, GMEA is also concerned to help defense-dependent firms transition to and compete in civilian

[3] *A Proposal to Create the Georgia Manufacturing Technology Extension Center,* Atlanta, GA: Georgia Institute of Technology, Economic Development Institute, 1993 (TRP Proposal); Georgia Manufacturing Extension Alliance, *First Year Operating Plan*, Atlanta, GA: Georgia Institute of Technology, Economic Development Institute, May 1994 (submitted to the U.S. Department of Commerce, National Institute of Standards and Technology).

markets.[4] This is consistent with a major national aim of the TRP program to facilitate the adjustment and conversion of U.S. defense suppliers in the post-cold war era.[5]

2. Profile

The GMEA partnership offers a wide range of services to single firms, individuals, and groups of firms. These services are organized into the following activity types:[6]

- *Initial contacts*. Introductory discussions by GMEA staff with clients or prospective clients about needs and potential projects. Initial contacts can include marketing efforts targeted to specific companies, quick referrals, needs assessments, site visits or proposal development.

- *Informal engagements*. Technology, management or other technical assistance provided to client companies by GMEA staff. While informal engagements usually involve a limited scope of assistance (less than a day in duration), it is usually possible to provide and exchange substantive and meaningful information.

- *Formal assessments*. These are systematic and structured diagnostic analyses of client firms, to provide an objective assessment of problems, needs, and opportunities. Feedback is provided to the client. The recommendations from a formal assessment may lead to a follow-on technical assistance project.

- *Technical assistance projects*. GMEA staff work with companies on formal projects to resolve specific problems or needs or transfer new or existing technology or techniques. Technical assistance projects are often developed after initial contacts, informal engagements, or formal assessments with clients. Technical assistance projects are generally a day or more in duration and may involve from three to five days of staff time. GMEA staff usually visit the client's facility.

- *Referred technical assistance projects*. These are technical assistance projects that are referred to external resources (e.g. private consultant, university faculty, other assistance program). GMEA staff are involved in the initial diagnosis and will monitor the progress of the referral.

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[4] A "defense-dependent firm" is defined as one with 10 or more percent of defense-related sales.

[5] Advanced Research Projects Agency, *Technology Reinvestment Project*, Program Information Package, Arlington, VA: Advanced Research Projects Agency, U.S. Department of Defense, 1993.

[6] Georgia Manufacturing Extension Alliance, *Policies and Procedures. Reporting: ProTrac Activity Forms*, September 1994.

- *Group Assistance.* This category of activities includes training events, seminars, forums, and conferences. It also includes user groups, network meetings, group demonstrations, and group technical assistance.

GMEA's service activities include problem assessments, feasibility analyses, guidance, direct service assistance, referrals and resource matching, implementation assistance, information dissemination, training, and demonstration. The technological fields where GMEA has expertise and resources include:

- Manufacturing technology
- Operations planning and control
- Facility planning, including plant layout and materials handling
- Management systems, marketing and finance
- Quality management
- Information technologies
- Training
- Energy management
- Environmental management
- Occupational health and safety

GMEA's services are available to all manufacturers in the state. There are more than 9,600 manufacturing units in Georgia, of whom 97 percent are small or medium-sized. Some 3,900 (42 percent) of the state's manufacturers are located in the 18 counties that comprise the Atlanta metropolitan area. In the Atlanta area, the major manufacturing industries (by employment) include transportation equipment, food products, electrical and electronic equipment, and machinery and computers. In the remainder of the state, the major industries include textiles, apparel, food products, lumber and wood, and transportation equipment. There are several significant industrial clusters outside of Atlanta, including Macon, Columbus, Augusta, Savannah, and Dalton. GMEA reaches these manufacturers in Atlanta and elsewhere in the state through the network of Georgia Tech regional field offices and through the many field offices of its partner organizations.

3. Organization

GMEA is a partnership between four organizations in Georgia, three of whom are state sponsored and the fourth is a publicly-regulated utility. The lead organization – EDI – is a unit within the Georgia Institute of Technology, which is itself part of the state's public university system. Georgia Tech is one of the leading technological universities in the United States.

EDI – which was established in 1993 in a reorganization of Georgia Tech's economic development and technology transfer programs – has four major groups. The New Enterprise Development group includes the Advanced Technology Development Center (ATDC) – an incubator for high-tech start-up firms that was founded in 1980. The Management Services group contains a series of centers and programs focused on productivity improvement, manufacturing information technology, international standards and quality, energy resource management, trade adjustment, apparel manufacturing technology, and procurement assistance. The Industrial Outreach group manages direct services to firms and local areas through its network of industrial extension regional field offices. The Economic Development group includes an economic development and technology policy research unit and programs for economic development training and outreach. EDI also has units for data and information dissemination and internal management systems.

Although EDI is new, most of its programs and organizations and well-established. EDI's origins go back to the Georgia Tech Industrial Development Branch (later the GTRI Economic Development Laboratory) started in 1956. The industrial extension regional field office network was started in 1961. Georgia Tech's Economic Development Council – with members from the private and public sectors – now serves as an advisory board to EDI. More than 100 full-time professionals work within EDI.

GMEA uses the resources of EDI's staff for many skills it needs in addressing client problems and needs. For highly specialized cases, GMEA can access the technological expertise of faculty and researchers at Georgia Tech and other institutions. GMEA has established a Technology Linkages Office at Georgia Tech to coordinate matches between particular company or staff needs and expert resources at Georgia Tech and federal laboratories. GMEA also draws on the capabilities of the other partner organizations: Quick Start, SBDC, and Georgia Power's TAC.

Quick Start is a program of the Georgia Department of Technical and Adult Education (DTAE) which provides job-specific training for workers. The program can provide training through the 32 DTAE technical institutes around the state, although it also uses private vendors and customer facilities. Quick Start traditionally provided customized training for new or expanding firms, but in recent years has also begun to offer workforce training for existing manufacturers. Quick Start will contribute to GMEA by providing customized training assessments and by conducting training in such areas as ISO 9000, quality management, and environmental health and safety.

The University of Georgia Small Business Development Center (SBDC) is a statewide business assistance organization sponsored by the state government and the U.S. Small Business Administration. The SBDC provides assistance to businesses and communities through a network of 18 centers in Georgia staff by about 50 professional counselors. The SBDC will work with GMEA in providing market research, market planning, and assistance with finance and capital for GMEA customers.

The Technology Applications Center (TAC) of Georgia Power (a public utility company) demonstrates how manufacturers can cut costs, improve quality and productivity, and address manufacturing problems with advanced manufacturing processes. TAC offers services in the areas of technical assistance, equipment demonstration, product testing, manufacturing process evaluation, materials analysis, and production. TAC's specialized technical fields include powder coating, ultraviolet curing, plasma arc technologies, infrared drying, microwave heating, laser processing, energy efficiency, computer control and integrated manufacturing, and quality management. TAC is contributing to GMEA by offering demonstration and training programs in these areas and by expanding its capabilities in advanced information systems for smaller firms. A facility (under construction) will offer hands-on facilities for demonstration and training in information-based manufacturing, engineering, and management. Firms are matched with TAC through a variety of means, including Georgia Power's own industrial engineering field staff, Georgia Tech's regional field offices, and TAC's own outreach activities. Founded in 1987, TAC's 10-person staff consists of engineers and their support personnel. Its services are provided without charge to firms in the service area of Georgia Power's parent company (which includes Georgia and other southern states).[7]

GMEA is a member of the national Manufacturing Extension Partnership (MEP), led by the U.S. Department of Commerce, National Institute of Standards and Technology (NIST). The MEP is a broad-based effort to build a nationwide system of technology services for America's small and mid-sized manufacturers that will helps firms upgrade their equipment, improve their processes, and strengthen their business performance. The MEP has its origins in the 1988 Omnibus Trade and Competitiveness Act, which established a series of Manufacturing Technology Centers (MTCs) and promoted the development of state technology extension programs. Funding through the present administration's defense conversion initiative, the Technology Reinvestment Project (TRP), matched by state funds, has supported a major increase in the size of the MEP. The current number of centers in the MEP is 44 (37 funded by TRP). By 1997, 100 MEP centers are planned to be in operation across the country.[8]

Before GMEA, the activities of EDI and its industrial extension regional field offices were funded primarily from state funds. The industrial extension element was supported through an annual state allocation of about \$3 million (ECU 2.4 million). With GMEA, the new federal funding now supporting a considerable expansion of effort and activity, not only of the industrial extension regional field offices but also for related EDI and partner services.[9] GMEA's planned budget (See Table II.1 for a function breakdown) over the two-year life of its TRP award is \$13.2 million (ECU 10.7 million), comprised of equal federal and state contributions each of \$6.6 million (ECU 5.4 million). The state's share includes a cash commitment of \$5.8 million (ECU 4.7 million), in-kind contributions of \$325,000 (ECU 264,000), and planned fee income of

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[7]Information on TAC obtained during a site visit, October 6, 1994.

[8]For further updated electronic information on the MEP, access NIST's home pages (http://www.nist.gov/item/NIST_Manufacturing_Extension_Partnership.html) or NIST's gopher server (telnet gopher.nist.gov). See also: Executive Office of the President, *Technology for Economic Growth*, Washington, DC: February 22, 1993.

[9]Note, however, that only part of EDI's activities are combined into the GMEA funding package.

$450,000 (ECU 366,000).[10] GMEA's actual spending in the first nine months of its operation has fallen below the planned level, largely due to unexpected time lags in staff hiring and opening new offices. For its first three quarters, GMEA spent $2.3 million (ECU 1.9 million), with the largest element (52 percent) going toward hiring additional staff for the expanded regional field office network.

Table II.1 GMEA: Functional Budget, 1994-1996

Functional activity area	Two-year budget, 1994 through 1996	
	$ million	*ECU million*
Service delivery	11.4	*9.3*
Expanded industrial extension service	5.6	*4.6*
Strategic management/marketing	1.3	*1.1*
Quality management	1.0	*0.8*
Information-based manufacturing technologies	0.8	*0.7*
Energy management	0.7	*0.6*
Environmental	0.7	*0.6*
Technology linkages	1.1	*0.9*
Management and support services	1.6	*1.3*
Evaluation	0.3	*0.2*
Total	13.2	*10.7*

Includes both federal and state shares. Source: Georgia Manufacturing Extension Alliance, *First Year Operating Plan*, Atlanta, GA: Georgia Tech Economic Development Institute, May 1994.

To support the expansion of its activities, GMEA's staff has expanded from 45 in February 1994 to 72 full-time equivalent positions in September 1994. At this latter point, the staff comprised 25 field engineers, 24 technical specialists (including engineering, management, quality, energy, and information specialists), and 23 management or support staff. The field engineers are mostly located in the regional offices. The technical specialists are mostly located at the Atlanta campus of Georgia Tech. Most of the staff are full-time. Within these totals are Quick Start and SBDC coordinators (2) supported in part by GMEA to facilitate linkages (TAC supports its own coordinator). GMEA also uses a number of consultants for client-related and other services, typically averaging about 15 per three-month quarter.

[10] Georgia Manufacturing Extension Alliance, *First Year Operating Plan*, Atlanta, GA: Georgia Tech Economic Development Institute, May 1994.

4. Indicators for Effectiveness/Success

GMEA has an explicit evaluation element designed around these three main aims:[11]

- Provide consistent feedback about the effectiveness, targeting and impacts of GMEA's services.

- Support systematic learning about how services are being delivered and what services and approaches work best and why, to assist the ongoing improvement and management of program services

- Furnish evaluative information to GMEA's major stakeholders and sponsors, including the state of Georgia and NIST.

To assess the effects of GMEA on firm performance, the measures that GMEA uses in its evaluation include:

- *Program inputs* – staff; time; costs.

- *Customer profiles* – industry; location; size; ownership; defense dependency.

- *Customer inputs* – time commitment; cost share.

- *Program outputs* – clients served; projects completed; duration of service; activity types (informal, technical assistance, etc); substantive categories (e.g. CAD, quality).

- *Customer satisfaction* - with GMEA staff and services; referrals.

- *Customer intermediate actions and impacts* – operational changes; decision-making; training; investment, etc; anticipated impacts.

- *Business outcomes* – post-project and controlled changes in sales, value-added, productivity; exports, customers; new products.

- *Developmental outcomes* – employment, wages; business stability; defense conversion.

Information on these measures is tracked through several means, including customer profiling and service monitoring protocols, customer evaluation procedures, and benchmark surveys and assessments with customers and non-customers (to provide controls). GMEA is also introducing procedures to evaluate training and other group activities and assess its own

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[11]Philip Shapira and Jan Youtie, *Georgia Manufacturing Extension Alliance: Overview of the Evaluation Plan*, GMEA Working Paper E9401, Atlanta, GA: Georgia Institute of Technology, August 1994.

institutional performance. The evaluation of GMEA's activities is directed by a Georgia Tech faculty member,[12] working with EDI staff.

GMEA is also evaluated through the NIST MEP program, using a subset of measures that is consistent with those tracked by GMEA's own evaluation component. Furthermore, NIST maintains oversight of the program through its regional managers and the agency is expected to conduct a full review of GMEA toward the end of its second year.

In terms of its principal operational goals, GMEA has made significant progress during its first nine months of operation. Three new field offices were opened (Northwest Metro Atlanta, South Metro Atlanta, and Dalton), bringing the number of regional offices from 13 to 16. The process of opening a further office (Northeast Metro Atlanta) was begun. The planned Technology Linkages Office was established. GMEA's existing portfolio of services was augmented by the setting up of new or expanded services in five areas: strategic management; quality/ISO 9000; information-based manufacturing technologies; environment, safety and health; and energy management

Over this three-quarter period, from February through September 1994, GMEA served some 911 manufacturing firms through nearly 1,140 meetings, engagements and projects.[13] Informal engagements comprised almost one-half (535) of all assistance activities (Table II.2). Technical assistance projects (317) made up about a further quarter of all assistance cases. There were relatively few referred technical assistance projects. GMEA also provided training and seminar opportunities to 1,730 individuals from almost 570 companies. Adding training customer firms to other assisted firms, (excluding duplication), brings the total to 1,007 client firms served. This is nearly 11 percent of the manufacturing firms in Georgia.[14] GMEA mostly served smaller firms through informal engagements – more than 40 percent of this category of assistance went to firms in the 20-99 employee size range. Conversely, technical assistance projects focused more on firms in the 100-249 employee size category.

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[12]As the responsible party for GMEA's evaluation, I have to declare an interest here.

[13]These numbers include cases where multiple types of assistance are provided to a single client firm.

[14]Total based on Bureau of the Census, *County Business Patterns, Georgia State Report.* U.S. Department of Commerce, Washington, DC: 1991.

Table II.2. GMEA: Activities Delivered, By Company Size

Activities Delivered	Third Quarter, 1994						Cum Total
	Employment Size					Qtr	2/94
	1-19	20-99	100-249	250-499	500+	Total	-9/94
	%	%	%	%	%	No.	No.
Initial contacts	17.4	26.7	24.4	19.8	11.6	86	236
Informal engagements	17.5	41.0	22.4	11.5	7.7	183	535
Formal assessments	28.6	28.6	14.3	14.3	14.3	7	30
Technical assistance projects	12.7	23.7	35.6	16.1	11.9	118	317
Referred technical assistance projects	50.0	50.0	-	-	-	2	20
Training events	7.7	25.5	17.4	19.8	29.5	247	569
Total (without duplication)						587	1,007

Georgia Manufacturing Extension Alliance, *Quarterly Report, July-September 1994*, Atlanta, GA: Georgia Tech Economic Development Institute. Note: cumulative total is for nine month period.

The services provided by GMEA through its engagements, assessments, and projects focused particularly on assistance with quality, environmental, and process improvements. More than one half the 842 cases of GMEA service to firms fell within these three major categories.[15] Assistance with human resources, market development, energy conservation, and business systems encompassed a further quarter of GMEA's service cases (Table II.3).

[15]This comparison of cases does not take into account the relative time allocated by staff to different service activities.

Table II.3 GMEA Services, By Technological Field, 1994 Q1 through Q3

	Number of Activities			
Service Category	Quarter 1	Quarter 2	Quarter 3	Total
Quality/Inspection	41	65	77	184
Environmental	31	35	70	132
Process Improvement	43	38	47	127
Human Resources	18	28	31	77
Market Development	26	17	17	60
Energy Conservation	1	19	31	50
Business Systems	21	16	26	50
Product Development	22	14	14	46
EDI/Communications/LAN	11	11	12	36
Plant Layout/Cells	11	15	10	35
Material Engineering	7	11	6	23
Expansion Planning	4	6	1	11
CAD/CAM/CAE	1	2	1	5
Automation	0	3	1	4
Control/Integration	0	1	1	2

Georgia Manufacturing Extension Alliance, *Quarterly Report, July-September 1994*, Atlanta, GA: Georgia Tech Economic Development Institute. Note: cumulative total is for nine month period.

5. Trends and Developments

After just three quarters, it is still too early to evaluate the full impact of most of the activities and services provided by GMEA.[16] At this point, information is available on GMEA's *anticipated* customer impacts. A more definitive analysis will be possible after the second quarter of 1995 when GMEA will conduct one-year client progress reports.

The concept of integrating different service providers in the state is an important one. Within GMEA, the closest links have been forged between Georgia Tech's EDI programs and Georgia Power. Georgia Tech's links with Quick Start and the SBDC business assistance centers have yet to be fully developed. In the first year of operation, Quick Start has been involved in developing new curricula. Georgia Tech staff have also provided training for Quick Start staff on ISO 9000 procedures, which the Quick Start staff can use in the field. Training based on these courses should begin in 1995. A few projects are also beginning to occur with SBDC staff and, in selected locations, the co-location of Georgia Tech and SBDC offices is being pursued.

[16] However, previous assessments of GMEA's core component – the Georgia Tech industrial extension regional field offices – have been favorable. See, for example, U.S. Congress, Office of Technology Assessment, *Making Things Better: Competing in Manufacturing*, OTA-ITE-443, Washington, DC: U.S. Government Printing Office, 1990 pp. 177-184 (which draws on earlier work by the present author)..

However, GMEA still seeks ways to best combine the resources of these technology and business components.

GMEA's core service – one-on-one field service to manufacturers provided by the Georgia Tech regional offices – is expanding. This approach has been effective in the state's small and mid-sized cities and rural areas. With the new offices opening in Atlanta – where the industrial base is larger and more complex – GMEA may need to consider whether other approaches to reaching firms are also needed, for example, placing more emphasis on group services and industry networking (where common problems can be addressed jointly). Successful quality and ISO 9000 user groups have already been established, providing a base of experience for further group promotion efforts. Methods of marketing will also need to be considered in Atlanta. In the past, the regional offices – being well-established – did not have to do much outreach. In Atlanta, a more active outreach approach will probably be necessary, at least initially.

GMEA is currently challenged by issues of growth, involving hiring, service expansion, and the development of new services and facilities. In 1995, growth will level off, allowing increased management attention to monitoring and strengthening the quality of services and partner linkages. It may be possible to extend GMEA's federal funding beyond the planned two-year period to adjust for the start-up lag in the first year. GMEA anticipates – as do other MEP programs – a transition to NIST-funded MTC status after year two. However, possible changes in congressional and administrative policies and priorities at the national level in 1995-96 may make this difficult. If federal funding diminishes, GMEA may have to consider other alternatives, including seeking additional state funding or fee generation or scaling back some program operations.

III. The Manufacturers Resource Center

1. Conception and Objectives

The Manufacturers Resource Center (MRC) – located in Bethlehem, Pennsylvania – provides expert advice and assistance to help manufacturers use the latest off-the-shelf technologies and manufacturing techniques. The MRC aids area companies to identify and define problems and opportunities, gain easy access to modern technologies and to manufacturing, business and quality methods, manage project implementation, and co-share the cost of assistance.

Since its founding, the Bethlehem-based MRC has provided one-on-one service to firms. After a staff diagnosis of a client company's problems and needs and some short-term technical assistance, most often appropriate private consultants are identified to provide further specific assistance to the firm. The consultants' cost is co-shared by MRC and the assisted firm. MRC gives follow-up support to the firm, as necessary. The center has also sought to leverage its resources by coordinating its activities with other service providers and promoting company peer groups, forums, seminars, and training. In the most recent fiscal year (1993-4), the Bethlehem-based MRC had a budget of just over $1.4 million (ECU 1.1 million). The two biggest sources of revenue were the Commonwealth (about $0.95 million or ECU 0.77 million) and fees from engagements with private firms ($0.32 million or ECU 0.26 million).

Under IRC program guidelines, MRC's state-supported services are generally restricted to manufacturing firms with fewer than 500 employees.[17] The MRC's service area under the IRC program covers five counties and half a sixth, with over 2,200 manufacturing companies. Although these firms are in diverse industries, there are significant concentrations in the machining and metalworking sectors. In 1994, MRC formed an alliance with the Northeastern Pennsylvania IRC (NEPIRC) and was awarded a grant from the federal Technology Reinvestment Project (TRP) of $3.25 million (ECU 2.64 million) over a two year period, matched against existing state funds. The new federal funds – administered through the Manufacturing Extension Partnership (MEP) of the National Institute of Standards and Technology – will allow a further expansion of program activities and a leveraging of resources. The new alliance – known as the North/East Pennsylvania Manufacturing Extension Partnership – will be coordinated by the MRC. The primary service area of the combined program covers a 17-county region in north/eastern Pennsylvania containing more than 4,050 manufacturers. Most of these firms are small and medium-sized, with fewer than 500 employees. The largest industry sectors in this area (by number of manufacturing establishments) include apparel, non-electrical machinery, fabricated metals, printing and publishing, lumber and wood processing, food processing, and rubber and plastics.

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[17] Pennsylvania Industrial Resource Center Network, *Program Guidelines, Fiscal Year 1993-1994*, Harrisburg, PA: Commonwealth of Pennsylvania, Office of Technology Development, April 1993.

2. **Profile**

MRC currently has five main activity areas.[18]

- *Needs assessment.* MRC's industrially-experienced staff will visit companies to discuss needs and make a preliminary assessment of the most crucial items that need attention. In some cases, the staff will conduct a more detailed review (involving three to five days of staff time) and make a presentation to the company, supported by a written report of findings and recommendations. The MRC staff will provide follow-up guidance to the firm, including arranging for further help through a one-on-one manufacturing assistance project (see below). About one-half of the needs assessments conducted by the MRC are provided without charge to firms. For the others (usually more complex assessments requiring from three to five days of staff time), the firm may share the cost, typically paying $800 (ECU 650) although some go up to $2,400 (ECU 1,950)

- *One-on-one manufacturing assistance projects.* Where a needs assessment indicates that additional specialized assistance is required, the MRC will help match the company with qualified outside consultants. To aid consultant selection, MRC maintains a data base of more than 400 screened and qualified private firms, individuals, and educational institutions. The client firm and consultants meet to discuss the firm's needs and proposals are then drawn up which define the scope of work, expected results, fees, staffing, and scheduling. The client firm chooses the consultant(s) it wishes to engage and is not obligated to accept any consultants or proposals. If the client decides to go ahead, MRC can co-share the cost of consultants' fees and customized training for companies with 500 or fewer employees. The typical project costs about $5,000 (ECU 4,065) in consulting fees. MRC may also help in identifying other sources of project financing. The center seeks to ensure that the manufacturing projects it subsidizes are tied to a longer-term company commitment to improve its competitive ability. This may be done by informal or formal reviews of the company's goals and strategies.

- *Facilitation of peer development groups.* MRC staff help to reorganize and support several group activities. These include Users Groups focusing on quality and ISO 9000. MRC has also backed a management support group--the CEO[19] Forum. The MRC was instrumental in the foundation in 1989 of the Lehigh Valley Apparel and Textile Network. - a group of companies, unions, and technical institutions that came together to address problems in the region's apparel and textile industry through labor/management cooperation, training, and technology adoption.[20]

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[18]Manufacturers Resource Center, *Year End Report, 1993-1994.* Bethlehem, PA: 1994.

[19]Chief Executive Officer.

[20]Lehigh Valley Apparel and Textile Network, USNet database of networks, Connect Inc. electronic information system, 1994. See also: G.A. Lichtenstein, *A Catalogue of US Manufacturing Networks*, National Institute of Standards and Technology, US Department of

- *Information seminars and training programs.* MRC offers a range of information seminars and training programs targeted at small manufacturers. These efforts seek to increase awareness and timely access to information and provide specific knowledge in such areas as quality and exporting.

- *Coordination with other organizations.* To strengthen coordination and leverage resources, MRC staff work with other economic development and technology assistance groups in the region. The activities range from broad policy coordination to joint projects and specific client referrals.

MRC functions primarily in the areas of problem assessment, service brokering, technology promotion, and regional industrial organization. The technological fields that MRC indicates that it covers encompass both "hard" and "soft" technologies, including:[21]

- Implementation and management of quality programs
- Manufacturing strategies and plant operations
- Technology improvement
- Production planning and inventory control
- Factory automation
- Information systems
- Equipment justification
- Cost management
- Facilities planning and management
- Business planning
- Market expansion
- Workforce development

However, in terms of the types of assistance that MRC actually delivers, it is mainly in "soft" areas of technology involving longer-term changes. The most frequently delivered services (see also section 4) are quality management, manufacturing strategies and operations, and business planning. Currently, much of the activity in quality management is focused on ISO 9000.

The manufacturing base of MRC's region is diverse and firms in many different sectors are served. Among the sectors with the largest number of projects are the machinery, electrical, and plastics and rubber industries. Most of the firms who are helped are small or medium-sized, with firms in the 20-99 employee representing the largest single category of service.

Commerce, Gaithersburg, MD, 1992.

[21]Manufacturers Resource Center, *An Affordable Source of Assistance for Pennsylvania Manufacturers*. Bethlehem, PA: Brochure, n.d.

3. Organization

The MRC is organized as a non-profit corporation, associated with Lehigh University. Administratively, the MRC is part of the university's Iacocca Institute. Other centers and programs within this institute include the Agile Manufacturing Group (which analyzes and promotes manufacturing productivity), a Small Business Development Center (which provides business planning and management assistance to small firms), and a Ben Franklin Technology Center (which funds and supports advanced technology development and technology start-ups). However, the MRC has considerable flexibility within this structure. The MRC has its own board of directors, of whom a majority are regional manufacturing owners and managers. While the university's regents approve appointments to the MRC's board, it is the MRC board that assumes responsibility for overseeing the program.

The MRC is one of eight Industrial Resource Centers (IRC) started by the Commonwealth (state government) of Pennsylvania in 1988 to help improve manufacturing competitiveness, technology adoption, and operations.[22] This IRC network forms part of a broader technology strategy initially formulated by Pennsylvania to address the economic, industrial, and community impacts of the 1980s restructuring and downsizing in its steel, auto, and other basic industries.[23] Staffed by experienced industrial personnel, the IRC's are established as independent non-profit corporations. Each IRC pursues its own operating strategy to address the specific needs of its regional manufacturers. The IRCs work with private consultants, local development and industrial groups, Ben Franklin Technology Centers, universities, federal agencies, and other related organizations in providing services. The Commonwealth provides annual funding, which is matched by a combination (depending on the particular center) of local funds, engagement fees, and support through foundations, utility companies and other grants. From the founding of the centers through to 1993, the eight IRCs have assisted more than 1,800 companies in 3,100 contracted projects. Over the same period, the Commonwealth invested $41.7 million (ECU 33.9 million) in the program. This was matched by over $107 million (ECU 87 million) from private sources.[24] The state's funding, guidance, and review of the IRC program are carried out through

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[22]The seven other Pennsylvania centers are: Delaware Valley IRC, Philadelphia; Industrial Modernization Center, Montoursville; Northwest Pennsylvania IRC, Erie; Manufacturing Technology IRC, York; Northeast Pennsylvania IRC, West Pittston; Southwestern Pennsylvania IRC, Duquesne; and Bioprocessing Resource Center, University Park.

[23]Factory jobs declined by 22 percent in Pennsylvania in the 1980s (Michael Schroeder, "Small business has a friend in Pennsylvania," *Business Week*, April 6, 1992, p. 75). The origins of Pennsylvania state technology strategy, including the Ben Franklin Partnership which provides support for advanced research and development, education and training, and high technology spin-offs, is described in David Osborne, *Laboratories of Democracy*, Boston, MA: Harvard Business School Press, 1988 [Chapter 2. 'Pennsylvania: The Economic Development Model,' pp. 43-81].

[24] KPMG Peat Marwick, *Customer Satisfaction Survey of the Pennsylvania Industrial Resource Centers*. Harrisburg, PA: Pennsylvania Department of Commerce, 1993 (p.5).

the Office of Technology Development of the Pennsylvania Department of Commerce, under Pennsylvania's Ben Franklin/IRC Partnership.[25]

MRC, as the host organization for the North/East Pennsylvania Manufacturing Extension Partnership was designated as a federal Manufacturing Technology Center in 1994 and is now an affiliate of the NIST Manufacturing Extension Partnership (MEP).[26]

For the 1993-94 financial year, the MRC's operating budget was $1.43 million (ECU 1.16 million), with 67 percent derived from the Commonwealth of Pennsylvania and 23 percent from private company engagements (Table III.1). In addition, the MRC raised a further $141,000 (ECU 115,000) or 10 percent of its revenue through seminars, the CEO Forum, county contributions, utility and bank donations, and assessments. The federally-funded Pennsylvania Manufacturing Extension Program: North/East Region is significantly augmenting the MRC's resources, beginning in mid-1994.

Table III.1 Manufacturers Resource Center, Operating Budget, FY 1993-94

	State		Private Match		Total	
	$ thou.	*ECU thou.*	$ thou.	*ECU thou.*	$ thou.	*ECU thou.*
Staff personnel costs	617.3	*501.9*			617.3	*501.9*
Outside consultants	84.4	*6.6*	251.2	*204.2*	335.6	*272.8*
Other operating costs	125.5	*102.0*			125.5	*102.0*
Ongoing initiatives	54.8	*44.6*			54.8	*44.6*
Total expenditures	882.0	*717.1*	251.2	*204.2*	1 133.2	*921.3*

Source: Manufacturers Resource Center, *Year End Report, 1993-1994*. Bethlehem, PA: 1994. Note: Table excludes funding income and expenditures for a youth apprenticeship program and so differs slightly from totals provided in text.

MRC has five professional staff plus administrative support. The professional staff are experienced in manufacturing environments. The center also contracted with about 45 outside consultants over the last year. With the new federal MEP funding, MRC will increase its core personnel by an additional three professions and two administrative staff.

[25]In 1993, two of Pennsylvania's major technology assistance programs – the Ben Franklin Partnership (with four regional advanced technology development centers) and the IRC program (with its eight technology deployment sites) – were brought together under a single majority-business board. This board, chaired by the state's Secretary of Commerce, oversees both programs.

[26]The federal Manufacturing Extension Partnership program was described earlier, in the discussion of the Georgia Manufacturing Extension Alliance.

4. Indicators for Effectiveness/Success

For its assessments and one-on-one projects, the MRC tracks activities (company requests, visits and projects), service characteristics (market penetration, project types and industry categories), indirect client valuation (cash, in-kind), and – where feasible – value-added. With its group and training activities, MRC measures its effectiveness by levels of participation, willingness to pay, and satisfaction.

MRC is evaluated using state and federal criteria, as well as its own measures. In general, the Commonwealth of Pennsylvania is concerned about the extent to which MRC and other IRCs assist small and medium size companies to address the pressures of increasing competition and help maintain and expand jobs. But, specifically, the state tracks only a few measures. It reviews the number of engagements performed by the MRC, the number of companies served, market penetration, and whether companies report that the service they received increased value added. At the federal level, NIST pursues its own set of measures that the program has to collect and report, including activity counts, assessments of benefits, and impacts on manufacturing performance, technology levels, and corporate sales, value-added, and jobs. Internally, the MRC has also established its own criteria to help track its performance and provide focused information to its board. This set of 15 primary measures include some of those required by the state and NIST, plus items such as the percent of new customers served, time from initial contact to project completion, and cost per engagement.

A summary of MRC's activities in its most recent fiscal year (FY 1993-4) and for its cumulative six years of operation is given in Table III.2. In FY 1993-94, the MRC's actual activity level exceeded its goal to conduct 91 engagements with 72 companies.

Table III.2. MRC Activities, 1993-4 and Cumulative, 1988-94

	1993-4	Cumulative, 1988-94
Company contacts	302 contacts with 191 companies	1 196 contacts with 539 companies
Company engagements	143 engagements with 90 companies	675 engagements with 312 companies
Project contracts	119 contracts with 79 companies	555 contracts with 263 companies
Group activities	42 companies, 95 individual manufacturing participants	
Seminars and training	450 event attendees from over 300 companies	

Source: Manufacturers Resource Center, *Year End Report, 1993-1994*. Bethlehem, PA: 1994

The major categories of assistance given by MRC to companies through its projects were in the areas of quality management, manufacturing strategies and operations, and business planning. There were a smaller number of projects dealing with technology improvement and workforce development (Table III.3).

Table III.3. MRC Assessment and Project Assistance, By Type, FY 1993-94

	Requests for assistance	Consultations	Engagements	Implemented Projects
Quality management	106	106	60	8
Manufacturing strategies	76	76	43	12
Business planning	55	55	32	8
Technology improvement	33	33	5	3
Workforce development	17	17	6	5
Other	15	15	6	2
Total	302	302	143	38

Source: Manufacturers Resource Center, *Year End Report, 1993-1994*. Bethlehem, PA: 1994

For 1993-94, the MRC estimates that the total value of its projects with companies was about $7.5 million (ECU 6.1 million). This consisted of $1.4 million (ECU 1.1 million) in project costs (including IRC personnel costs, IRC match, company cash match, and company in-kind costs) and an estimated investment of $0.8 million (ECU 0.7 million) in new equipment, $4.7 million (ECU 3.8 million) in new plant, and $0.6 million (ECU 0.5 million) in workforce training. The ratio of costs to investment was 22.3 percent.

5. Trends and Developments

MRC has developed a series of assessment tools and software systems to help staff and clients in analyzing company needs. These tools provide assistance in operations, quality, information systems, and accounting. The MRC is also exploring the use of NIST-supported performance benchmarking and quick analysis tools. The aim is to provide a more thorough and objective analysis of client needs and to allow the development of comparative data for diagnosis and evaluative purposes.

In response to recent customer demand, MRC has developed its staff capabilities in quality, including ISO 9000. Staff serve as quality examiners in national and local award schemes. The MRC also reports that its efforts at promoting group activities and networking are having more success now than in the past, and that these are leading to beneficial joint projects. MRC plans to extend and expand its group efforts.

The center does provide multiple services to individual companies and has experienced an increasing number of projects with repeat customers. Fluctuations in state funding and greater efforts to promote group initiatives have led to small decreases in the number of individual companies served compared with previous years. However, the additional staff and other resources now coming on-line through MRC's federal funding are now likely to lead to significant growth in the numbers of firms served.

The North/East Pennsylvania Manufacturing Extension Partnership became operational in the Spring of 1994 and in its first quarter, from April 1, 1994 through June 30, 1994, conducted 51 initial meetings, conduced 22 technical assistance projects, four formal assessments and made eight referrals to other service providers.[27] These service activities were shared between the MRC and its partner NEPIRC. In addition to continued efforts to help regional manufacturers deploy improved technologies and practices, the new program will seek to strengthen community-wide and group activities to help firms address their common needs.

[27] North/East Pennsylvania Manufacturing Extension Partnership, *Quarterly Report*, 42. Manufacturers Resource Center, Bethlehem, PA: 1994.

IV. Tokyo Municipal Industrial Technology Center

1. Conception and Objectives

The Tokyo Metropolitan Industrial Technology Center (TMITC), is a long-established public testing establishment (or *Kohsetsushi*).[28] The center is located near Akabane, in a mixed industrial-residential district in inner northern Tokyo. TMITC's origins go back to the former Tokyo Metropolitan Industrial Research Institute (established in 1921) and the Tokyo Metropolitan Electrotechnical Laboratory (founded as a city facility by the old Tokyo Power Company in 1924). In 1970, these two organizations were combined into the Tokyo Metropolitan Industrial Technology Center to form a comprehensive institution for technical research, testing, and guidance for small and medium enterprises.[29]

TMITC is a publicly-funded center within the structure of the Tokyo metropolitan government. Funding is largely provided by the metropolitan government, with some additional funds from central government agencies. The center also generates a small amount of fee income.

TMITC's services are aimed primarily at helping small and medium-sized manufacturers (with fewer than 300 employees). There are just over 80,000 manufacturing facilities in the Tokyo metropolitan area, of which 99.7 percent are small and medium-sized. These small and medium firms employ about 615,000 workers – about 71 percent of Tokyo's manufacturing workforce – and account for around 60 percent of value-added by industry.[30] Very small firms are prevalent in Tokyo – almost one-half of metropolitan manufacturing enterprises have three or fewer workers. Factories with more than 100 workers comprise just one percent of Tokyo's plants – although this group of plants accounts for about 54 percent of shipments, by value.[31] These larger units typically have higher investments in technology and equipment, while many smaller firms serve as "vertical" subcontractors to larger manufacturers. However, "horizontal" complexes of innovative small firms have formed in some of Tokyo's industrial districts, most notably in Ota-ku in the southern part of the city.

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[28]This section draws on interviews conducted with TMITC staff and client firms on July 25-26, 1990; February 16-17, 1993; and October 27, 1994, together with a review of center provided materials.

[29]Japan's Small and Medium Enterprise Basic Law (1963, as amended 1973) defines a "small and medium enterprise" in manufacturing as one with 300 employees or less, or with capital of ¥100 million (ECU 0.83 million) or less. A "small-scale enterprise" in manufacturing is defined as one with 20 employees or less.

[30]Bureau of Labor and Economic Affairs, *Industry and Labor in Tokyo*, Tokyo: Tokyo Metropolitan Government, 1994.

[31]Tokyo Metropolitan Government, *Tokyo Industry: A Graphic Overview*, Tokyo: 1989.

By sector, Tokyo's huge industrial base is diverse, with particularly significant concentrations in printing and publishing, electrical machinery, transportation equipment, and precision machinery (in total, there are over 35,000 small and mid-sized firms in metalworking and machinery). There are also many small firms in traditional industries such as textiles, apparel, furniture, paper products, leather, and wooden goods. The number of factories in Tokyo grew by three times between 1965 and 1985, but since then there has been some decline due to planning restrictions on the expansion of large factories and the restructuring of industry, especially with the recession that began in Japan in 1991 and the subsequent revaluation of the yen. These changes have particularly affected small and mid-sized firms, leading to new pressures for technological and product upgrading. Many smaller firms have shifted investment from factory machinery into research and development. There also ongoing enterprise needs in areas of energy and resource conservation, pollution prevention, and safety.

TMITC is one of nearly 180 similar Kohsetsushi centers in Japan which form part of a nationwide public system of support for technology adoption and development.[32] These centers have been established by prefectural and city governments, under national guidance, to assist in developing small and medium-sized firms and local industries. The Kohsetsushi centers conduct research and provide testing, training, and technical assistance services. The centers also make their equipment available for open use by small and mid-sized companies and administer a system of registered consultants who help manufacturers to resolve problems and improve technology.

2. Profile

The activities undertaken by the Tokyo Metropolitan Industrial Technology Center include:

- *Research.* The professional and technical staff at the center spend from 20 to 50 percent of their time on research projects. Historically, the TMITC has concentrated on electricity and lighting, but today the range of research is wider, including fine ceramics, new materials, and new manufacturing technologies. About 90 percent of the research effort involves applied research or is related to technology development or manufacturing production. However, researchers at the center say that in the process of doing applied research, they have to do some basic research too, which they estimate to comprise about 10 percent of their research effort. There are two kinds of research projects at the center: general projects, initiated by the center's staff, and special projects, developed with and partly-funded by MITI – Japan's Ministry of International Trade and Industry. Staff at the center are linked to researchers at MITI's National Research Institutes and visit these Institutes for research projects and training.

[32]Philip Shapira, "Modernizing small manufacturers in Japan: The role of local public technology centers," *Journal of Technology Transfer*, Winter 1992, 17,1 pp. 40-57.

- *Testing and examination.* The center undertakes three broad categories of tests and examinations for smaller firms. First, it will certify whether the functions, quality, or tolerances of a product meet Japanese, American, or other foreign industrial standards. Second, the center undertakes product examinations in cases where there are disputes, claims, or accidents. Third, the center's sophisticated analysis equipment is available to help firms developing or improving products, for example to understand why materials fail. Ten examination areas are offered: industrial materials, sophisticated measurement, chemicals, machinery and equipment, electrical and electronics, acoustic and vibration, lighting, environment and temperature, product manufacturing, and design. The fees for testing are very low--much cheaper than charged in private labs. About 30 percent of staff time at TMITC is spent on testing and analysis. Beyond conducting tests at the center, staff also teach courses on quality control and statistical techniques and go out to visit companies to provide assistance on quality control.

- *Technical information.* TMITC maintains a technical library and publishes newsletters containing information about center research and upcoming events, courses, and lectures. Technical pamphlets and technical guides on a range of topics are also published.

- *Technical assistance.* The center responds to questions and requests for assistance and guidance on technology and productivity in small and medium firms in a wide range of fields, including machinery, metals, electricity, chemistry, and industrial arts. A separate advice section deals with incoming requests. Almost two-thirds of these came in by phone, the rest through visits by companies to the center. The section has about eight staff members, all of whom are researchers who are rotated into the advice section for about two to three years and then rotated out. About one-half of all requests are resolved in about 5-10 minutes. Examples of these easily resolved requests include questions about foreign country standards or sources of materials or components. About 5 per cent of requests are classed as referrals, where the company is advised to contact someone else to resolve their question. If after talking with a company for more than 10 or 20 minutes and the problem is not resolved, the advice section will set up a one-hour appointment with the company at the center. The advice section takes cases that can be resolved in a maximum of half-a-day. If a company needs more time, the problem is passed on to other staff in the center for assistance or to a registered technological adviser (see below). The advice section does have access to some computer data bases that it uses to provide information to firms, although the advice section reports that it uses computerized data bases in only a very small percentage of cases.

- *In-plant advice and technological advisers.* The center has two main systems for providing on-site technical advice and guidance to firms. Center staff go out regularly to visit companies to provide advice and assistance, when requested, usually for about 2-3 hours. On these technology guidance tours, as they are termed by the center, staff go out in teams of two people in about two-thirds of the cases, and individually for the rest. Many, but not all, of the research and technical staff are involved in guidance tours. For more complex or time-intensive problems, the center also sends out technical advisers, registered and commissioned by the Tokyo Metropolitan Government. These advisers usually spend about six days over a period of time with firms, or a cumulative total of close to 36 hours. The advisers are outside personnel, generally university professors or retired TMITC staff.

- *Training.* The Institute offers a range of training programs and seminars, generally aimed at technical personnel in smaller companies. The courses vary in length from one day to several hundred hours over three months. Courses in electronics are especially popular. A few courses are run at central government behest, with costs covered one-third by MITI, one-third by the Tokyo Metropolitan Government, and one-third by companies. Other courses are projects of the Metropolitan Government, funded half by the city and half by companies. Still other courses are entirely free. Center managers said that the funding source did not really affect what was offered in the courses, although for MITI-sponsored courses the center has to follow a course outline approved by the ministry and cannot increase enrollment over the established number. According to these managers, the center responds to a list of courses MITI would like to see offered and applies for funding. Not all applications are funded, since MITI has limited funds, as does the Metropolitan Government which has to provide a match. TMITC also accepts individual trainees, sent from small and medium enterprises to gain training and experience in new technologies.

- *Open research labs and use of equipment.* Small and medium firms that lack testing and research facilities or which do not have certain machine tools can use labs and equipment at the center. Nominal charges are levied. The center also provides training on using equipment and machines where necessary. For example, in one lab, TMITC has a Mitsubishi 25C Carbon Dioxide Laser System – costing ¥65 million (ECU 0.54 million) and paid for by the Tokyo Metropolitan Government and MITI. The system is used for mold-making, cutting, welding, and heat treatment. Lab staff say that the machine is used for research 50 percent of the time, with the other 50 percent used for training and making molds and prototypes for small and medium companies. Similarly, another lab has a large Swedish-made Lagen programmable press. The press is used equally for research, training, and manufacturing/mold-making by outside companies. Other equipment in the center ranges in scale and sophistication from a scanning electron microscope to CAD/CAM and personal computer systems.

- *Technology exchange plazas.* The center organizes technology diffusion exchange plazas, consisting of groups of small and medium companies who meet to exchange technical information and cooperatively develop new products and technologies. TMITC organized its first technology plaza in 1984, at MITI's request, and has sought to organize one new group every year. There are usually about 30 member companies in each group, with most companies having fewer than 100 employees. TMITC staff usually spend a year organizing the initial meetings and talking to individual company presidents to encourage them to join the plaza. After the first year, the plaza is developed and can generally organize itself. One or two center staff will attend each meeting and will provide technological advice on subjects such as automation, design, or computerization, as requested. The center's technology plazas are organized with firms from varied industries in each group, with the aim of generating new "fusion" processes and products developed through combining together different technologies and capabilities. This fusion approach is encouraged by legislation and policy at both central and prefectural levels. The central government provides financial incentives and tax relief when companies from different industries jointly develop technologies.[33] Similarly, the Tokyo Metropolitan Small and Medium Enterprise Development Corporation provides additional assistance when companies from two different industries develop new products or technologies. There are several hundred technology exchange plaza groups in Tokyo, many of them sponsored by organizations such as Chambers of Commerce. Often, the sponsors just provide a place to meet. TMITC's staff say that they go beyond this because they also can provide technological assistance.

The technological fields covered by the center include:

- Mechanical engineering (design, measurement, mechanical engineering, electromechanical, vibration).
- Metalworking (machining, stamping, CAD/CAM, factory automation).
- Metallurgy (ferrous and nonferrous metals, casting, metallurgical powders, nondestructive testing).
- Optics and acoustics (illumination, acoustics, infrared radiation, static electricity).
- Electronics (electronic devices, circuitry, radio-frequency).
- Electrical engineering (power electronics, medical equipment, high voltage, magnetics, materials).
- Electrical measurement and control (instruments, controllers, standards, computers).
- Inorganic chemistry (glass, waste treatment, analysis, plating, aluminum, anodizing).
- Organic chemistry (fungicides, plastics, material resources, paints, analysis).
- Industrial arts (industrial design, painting, screen printing, wood materials).

[33]At the national level, fusion policies are guided by MITI's Small and Medium Enterprise Agency, under the 1988 Extra-ordinary Law Concerning the Promotion of the Development of New Business Areas through Fusion of Knowledge of Small and Medium Enterprises in Different Industries. See also: Philip Shapira, Collaborative Business Exchange and Technology Fusion: The Japanese Approach, *Firm Connections*, September/October, 1994, pp.10-12.

3. Organization

The Tokyo Metropolitan Industrial Technology Center is a publicly-organized center within the Commerce and Industry Division of the Tokyo Metropolitan Government's Bureau of Labor and Economic Affairs. The Bureau develops and carries out metropolitan Tokyo's policies and programs for commerce and industry, small and medium enterprises, technology and design, labor, vocational training, and agriculture, forestry and fisheries. Of the Bureau's ¥449.5 billion (ECU 3.7 billion) FY 1994 budget, by far the largest share – 85 percent – was allocated to measures to support small and medium enterprises. This included ¥317.0 billion (ECU 2.6 billion) in financial assistance and credits for small and medium firms, with smaller sums for management and technology assistance.[34]

In addition to TMITC, the Bureau sponsors several other enterprise assistance centers, including a textile research institute, an isotope research center, a leather technology center, a trade center, and management consultation and small and medium-sized business promotion centers. Also supported are twelve advanced vocational schools and a technical skills development training institute. There is also a complementary structure of small and medium business and industry promotion centers run by Tokyo's 23 ward (*ku*) governments. In several cases, personnel from TMITC staff the technology consulting sections of these ward centers, alongside the ward's regular staff.

The Tokyo center is one of the largest of Japan's Kohsetsushi centers. All told, there are 178 comparable public research and testing institutes, employing over 7,100 staff (including 5,400 engineers and researchers). Over 50 of these Kohsetsushi centers are located in the Kanto region, comprising greater Tokyo, Yokohama, Kawasaki, and adjacent cities and prefectures.[35] National guidance and coordination for Japan's network of Kohsetsushi centers is provided through MITI, by its Small and Medium Enterprise Agency and the Agency of Industrial Science and Technology (which oversees Japan's national laboratories). In FY 1994, Japan's overall spending for all the Kohsetsushi centers was ¥98.2 billion (ECU 812.6 million) – an average of ¥551 million (ECU 4.6 million) per center. Most of this funding is provided by prefectural or city governments.

The president (chief-general) of TMITC is appointed by the Governor of Tokyo. This officer oversees a center organized into four sections (general affairs, equipment, planning, and consulting and public affairs) and ten departments (covering the main technological fields listed in the previous section). The largest departments (by staff numbers) are inorganic chemistry, electrical measurement and control, electrical engineering, metallurgy, and mechanical engineering.

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[34]The allocation for financial assistance is for all sectors of small and medium firms, not only those in manufacturing.

[35]The densely-populated Kanto region also has Japan's greatest concentration of private research facilities, universities, national laboratories, and other technology centers.

The Tokyo center's annual budget is about ¥3.1 billion (ECU 25.5 million), including ¥1.8 billion (ECU 14.9 million) for personnel (Table IV.1). The balance of ¥1.3 billion (ECU 10.6 million) goes to facility, equipment, research and other operational costs. Over 90 percent of the budget comes from the Tokyo Metropolitan Government, six percent from joint research projects with companies, a little over one percent from MITI and other central government bodies, and about two percent from other sources, including training fees. In past years, the center has received additional funding from the central government, including up to ¥100 million (ECU 0.8 million) from the MITI-affiliated Japan Bicycle Development Association (JBDA) for the purchase of new machinery. However, this funding has been reduced as part of central government policies to upgrade research facilities and economic conditions in regions outside Tokyo.

Table IV.1 Tokyo Metropolitan Industrial Technology Center: Budget, FY 1994

Category	Funding		Distribution
Uses of Funds	¥ million	*ECU million*	Percent
Facilities and operations	1,275	*10.6*	41.5
Personnel	1,800	*14.9*	58.5
Total	3,075	*25.5*	100.0
Sources of Funds			
Tokyo Municipal Government	2,797	*23.2*	91.0
Personnel account	1,800	*14.9*	58.5
General account	997	*8.3*	32.4
National budget	36	*0.3*	1.2
Commissioned research and testing	186	*1.5*	6.0
Other	56	*0.5*	1.8
Total	3,075	*25.5*	100.0

Source: Tokyo Metropolitan Industrial Technology Institute.

There are more than 200 staff at TMITC, including 163 engineers and scientists. The professional staff is mostly educated to the bachelors level, although a number have masters degrees and there are eight with doctorates. The center also has 14 engineers or technicians on secondment from private companies. TMITC has a further 150 (outside) registered technical consultants and advisors.

4. Indicators for Effectiveness/Success

TMITC maintains comprehensive records of its service activities. There is no formal evaluation system of its activities. The center does consult informally with local and national government, national labs, companies, and industrial associations to obtain guidance about the direction of its activities, although generally the direction of research and the conduct of advice and guidance is the responsibility of the center's own staff.

In 1994, TMITC reported the following performance parameters:

- Research projects under way on 60 research themes.
- 97 domestic and 24 foreign patents.[36]
- About 50,000 tests conducted annually--down from about 66,000 in 1988.
- Over 30,000 cases of technical consulting a year. Nearly two-thirds of these were conducted over the telephone.
- 2,000 cases a year of dispatched on-site guidance or training--half by TMITC staff members and half by registered consultants.
- About 40 training courses and seminars offered annually, with between 8,000-10,000 participants.
- More than 5,000 cases a year where center equipment is used by firms and about 2,000 cases where equipment instruction or training is given.
- 11 fusion groups (technology exchange plazas), with about 230 member companies.

The cases of technical consulting focus in areas of production technology, process control, and product development. TMITC reckons that it is providing services to about 10,000 companies a year--more than 10 percent of metropolitan firms. The center mainly serves firms above a certain size threshold which allows the company to use its advice and resources (ie. not the numerous small 1-3 person shops). The center also consults with and helps more than 100 industrial associations a year.

5. Trends and Developments

While TMITC is among the largest Kohsetsushi centers in Japan and runs many programs, it also faces several problems and challenges. There is a sense – shared by other Kohsetsushi centers – that whereas once they were technologically ahead of most small firms, today the situation is reversed and they are less able to meet the needs of many of Tokyo's most innovative small companies. The leading small and medium companies are often capable of resolving their own process and control problems and are increasingly focused on technology-based new product development. TMITC is responding to these developments by renewed efforts to upgrade the technological skills of its own personnel, improving equipment and facilities, and upgrading the level of its technological support to companies. The center is also attempting to promote more cooperative R&D projects with companies.

The center has a stable labor force – once employed after university graduation, few researchers leave before retirement age (usually 55 years). This relatively permanent labor pool allows firm, long-term relationships to be developed between center staff and client firms. At the same time, with fixed staffing levels, it difficult for the center to move rapidly into new areas of technology. The average age of staff is high (45 years) and, usually, young researchers in new

[36]For center-sponsored research, TMITC obtains patents, but these are not proprietary and are available for use by Tokyo firms. But for joint TMITC-company research projects, the company has proprietary rights to any new technology.

technological areas can only be hired as positions open through another staff member's retirement. TMITC is addressing this issue by increasing the training of its own staff. Some are seconded to national laboratories for periods of time, to gain expertise in new technological areas. Several staff are conducting research for doctorate degrees, which the center encourages. TMITC is also accepting visiting researchers, from large as well as small companies. Issues of mismatch of staff skills and changing firm needs are found in other centers and, as a metropolitan-wide institution, TMITC is pursuing a role in providing training for personnel from other assistance organizations who are involved in technology and business assistance.

TMITC staff face continuing demands by firms for assistance and, simultaneously, greater pressures to catch up with developments in technology. This makes it hard to get researchers to devote more time to providing technical assistance to smaller firms. A few researchers prefer to spend more time on their research than on advice and guidance, but generally most researchers accept that at a Kohsetsushi center they have to be involved in guidance as well as research. On the other hand, the center receives large numbers of small requests for guidance and testing. As a public institution, it is not possible to turn down these requests. It is likely, however, that the burden of small tests and analyses will continue to gradually fall, as it has been doing in recent years.

V. Kanagawa Science Park

1. Conception and Objectives

Kanagawa Science Park (KSP) is new urban technological development complex in Kawasaki City, Kanagawa Prefecture, about 15 km south of Tokyo.[37] KSP is a third (*daisan*) sector, public-private initiative that aims to foster the development and application of high technology to industry. Research facilities, laboratories, incubator and start-up rooms, training, and business exchange and service facilities are located in the complex.

There has been a growing concern in Japan that while it has been successful in processing and mass production industries, it is lagging behind in developing high technology venture businesses.[38] New efforts are underway to promote a shift from "commodity production" to "innovation-based" activities. KSP represents one of the new generation of technology centers that seek to help Japanese firms to strengthen and diversify their technologies and promote entrepreneurship in high technology fields. These new centers are also attempting to combine the resources or both public and private sector stakeholders, to develop institutions that can be more flexible than traditional public centers in meeting industrial and technological needs.

In concept, KSP has been designed prefectural, city and private interests to be consistent with the "research core" initiative promoted by Japan's Ministry of International Trade and Industry (MITI). A research core is a grouping of four facilities: an open research and technological development facility, an education/training facility, a technological information exchange facility, and a venture business incubator.[39] The aim is to establish a nucleus that can promote technology, entrepreneurship, and regional development. Drawing on studies of technological start-ups, industry-university collaboration, and research spin-offs in the United States, MITI initiated the research core concept in the mid-1980s as part of a broader policy to promote comparable public-private partnerships in Japan.[40] KSP was the first project to be approved (in 1986) under the new policy. By 1993, a total of 11 research core projects had been

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[37]This section draws on field research at KSP and with member companies on February 3, 1994 and October 26, 1994.

[38]There has also been a long-run decline in business openings among Japanese small and medium sized manufacturers and, since 1989, an increase in the business closings – to currently raise the ratio of closings above that of openings. Small and Medium Enterprise Agency, *Outline of Small and Medium Enterprise Policies of the Japanese Government*, Tokyo: Ministry of International Trade and Industry, 1994 (reference 6, p. 13).

[39]Japan Industrial Location Center, *Research Core and Key Facilities Siting Concept*, Tokyo: Industrial Location Project Series Vol. 882, March 1989.

[40]Law for Promotion of Private Participation in Public Projects, 1986.

approved,[41] although there are also many other regional and local projects that have adopted similar principles.[42] The research core initiative supplements a succession of other central government policies and programs to promote regional technology development in Japan.[43]

KSP also has the objective of retaining and strengthening the industrial and technological base of its region, which forms part of the Keihin Industrial Complex (including southern Tokyo, Kawasaki City, and Yokohama). This industrial area – which has been at the center of Japan's post-war economic growth – has suffered decline and restructuring in recent years, for several reasons. These include the relocation of production (especially by its electrical and automotive manufacturers), government planning controls (to promote over regions of Japan), and rapid increases in land costs (which attracts manufactures to sell their land for other uses and makes it hard for new firms to start). KSP seeks to promote firms based on developing high value-added new technology products, although it is recognized that mass production may take place elsewhere.

The KSP facility, which was opened in 1989, is operated by a semi-public corporation with funding from both public and private sources. Over the long-term, it is hoped that KSP will become self-sufficient, although currently it receives a variety of "soft" public and private subsidies (for example, through seconded staff, low interest loans, and other types of support).

KSP has several overlapping target groups. Its incubator facilities have been established for entrepreneurs and/or researchers in other institutions (especially universities) who seek to establish technology start-up companies. KSP's research facilities are aimed at stimulating and supporting existing companies who are upgrading technologies and developing new products. The center's information, guidance and exchange facilities are targeted broadly to companies in the surrounding region. KSP's training programs are also designed to serve managers, researchers, and engineers in the region.

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[41]The other designated research core projects are: Eniwa Research Business Park, Hokkaido; 21st Century Plaza, Sendai; Nagaoka Research Core; Tsukuba Center; Toyama New Industry Foundation; Toyohashi Science Core; Senri Life Science Center; Amagasaki Research Incubation Center; Fukuoka Soft Research Park Center; and the Kurume Techno Research Park.

[42]For example, the Kyoto Research Park – a new technology, research, information exchange, and incubator complex developed under the leadership of the Osaka Gas Company.

[43]See, for example, David W. Edgington, "New strategies for technology development in Japanese cities and regions," *Town Planning Review*, 1989, 60(1), pp. 1-27.

2. Profile

The main activities of KSP are in these lines of business:

- *Incubation.* KSP provides space for individuals and teams who want to launch new businesses based on the research, development and commercialization of new technology. KSP offers support to these efforts through: (1) financial incentives; (2) high-quality, relatively low-cost space; (3) technical guidance; and (4) business and administrative support services. KSP looks for incubator business possibilities that can grow, develop proprietary technological know-how, be developed in a space of about 75 m^2. For some incubator companies (type A), KSP provides up to ¥100 million (ECU 0.8 million) in financial support over three years, to be paid back after seven years (if the company is successful). For other start-ups (type B) – already in business, but less than five years old – KSP provides up to five years of space, at low rent, plus support services.

- *Research laboratories.* KSP has built the first multi-tenant large-scale R&D building in Japan, which makes space available (on a rental basis) to private companies, private research institutes, and public research institutes. Private companies are able to locate their R&D personnel in these facilities. This allows them to have high quality space and have contacts and exchange with other researchers in the complex. Public research facilities are also located in the complex, allowing private companies to use their facilities and equipment and to consult with their staff. The Industrial Research Institute of Kanagawa Prefecture has a branch at KSP.[44] These facilities provide testing, measuring, consulting, and research services to KSP tenants and other prefectural small and medium enterprises. The Kanagawa High-Technology Foundation (KTF) – a new prefectural initiative to support advanced technology – is also based at KSP. This foundation supports research and maintains staff and well-equipped laboratories at KSP in the areas of testing and material characterization, technological information, and technology networking (Figure V.1). Several research laboratories are also supported at KSP by another prefectural foundation – the Kanagawa Academy of Science and Technology (KAST).[45] These labs support university and private company researchers in advanced fundamental research projects in such areas as molecular spectroscopy, bio-signal pathways, photon control, ultimate mechatronics, and supermagnetic materials.

- *Training and exchange.* KSP offers a range of training programs and seminars in business management and enterprise start-up and in various fields of technology. Networking and exchanges among the complex's tenants and regional firms are also promoted, along with

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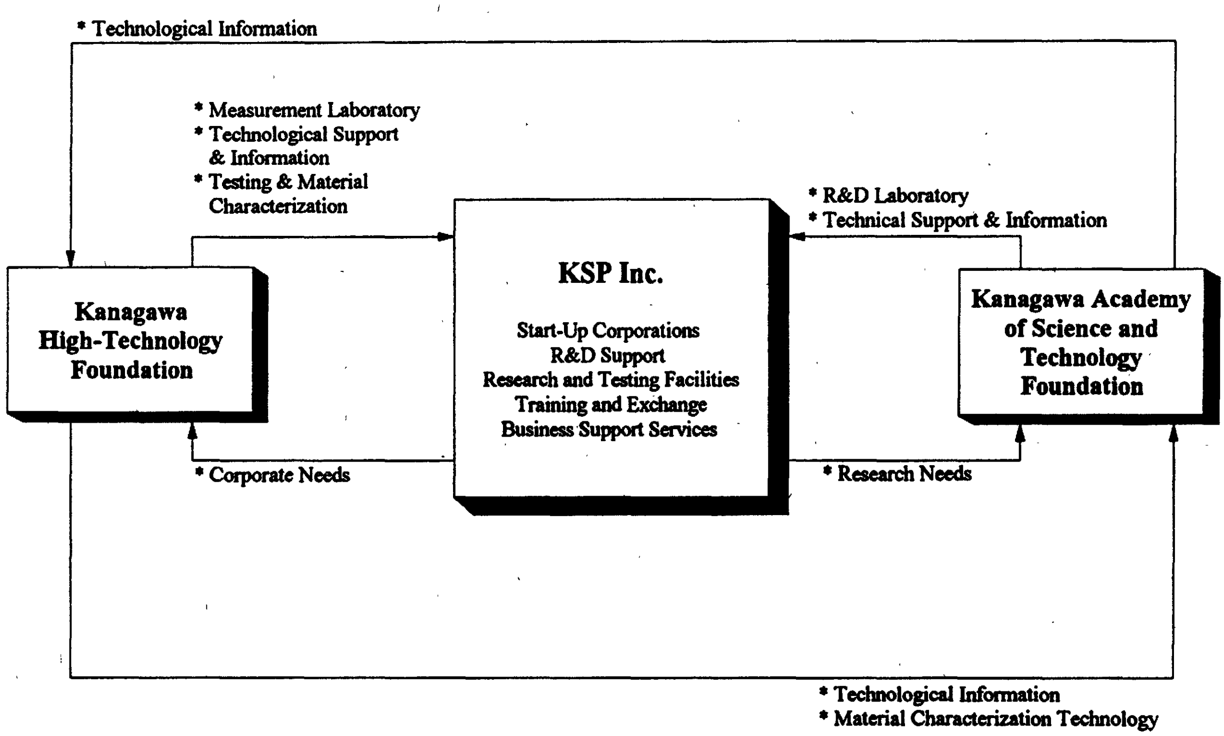
[44]This institute is one of Japan's 178 Kohsetsushi centers – see earlier discussion of the Tokyo Metropolitan Industrial Technology Center.

[45]The Kanagawa Academy of Science and Technology supports research (through grants for advanced fundamental research projects), education and training for researcher and engineers, exchange activities, and information and cultural support.

exhibitions of new technologies and products. Some of KSP's exchange and educational activities are supported by KAST (see above). KTF also promotes exchange activities at KSP, including a Kanagawa Techno Club and a Techno Bank information service, which seeks to promote technology transfer by matching needs of technology suppliers and buyers.

- *Business services and support.* The facilities in the KSP complex include a hotel, restaurant facilities, conference and training rooms, and exhibition facilities – which are available for commercial use. A business support division also matches KSP tenants with specialists in consulting, patenting, and other technical and business services.

Figure V.1. Kanagawa Science Park and its Related Institutions



Source: Kanagawa Science Park

The technological fields covered by KSP are diverse. The KTF laboratories specialize in analysis (surface characterization and chemical analysis); material structural analysis (scanning tunnelling microscope and other advanced analyses); material property testing; and environmental testing. The corporate users and research projects associated with these facilities are frequently engaged in electronics, thin film, optical, and metal technologies. KTF hopes its facilities will be a base for semiconductor development.

Kanagawa Prefecture – one of KSP's primary sponsors – is one of Japan's leading industrial areas and is the hub of the nation's machinery manufacturing industries. The prefecture has 16,500 manufacturing enterprises, employing over 650,000 workers. Electrical machinery and transportation equipment make up about 50 percent of the total shipment value of goods made in Kanagawa. Small and medium-sized manufacturers make up 98.1 percent of all manufacturing companies in the prefecture, employ nearly 52 percent of the manufacturing workforce, and account for a third of manufactured shipments, by value.[46] Within the prefecture, there are over 900 public and private research institutes and centers, including (mostly) private company research labs, university facilities, and prefectural institutions.

3. Organization

KSP Inc. – a semi-public corporation – is the central organizing entity of the Kanagawa Science Park. KSP Inc was established in 1986. The governing body of KSP Inc. is drawn from its public and private shareholders.

KSP Inc. has a capitalization of ¥4.5 billion (ECU 37.3 million), comprised of ¥1.5 billion (ECU 12.4 million) of public sector equity and ¥3 billion (ECU 24.8 million) from the private sector. The public funds were invested by Kanagawa Prefecture, Kawasaki City, and the Japan Development Bank. The private funds were invested by the Tobishima Corporation (which holds about 30 percent of KSP's equity), Meiji Mutual Life Insurance, Nippon Life Insurance, and Nippon Landic (which hold approximately 17 percent of equity respectively), and a number of other private companies.

The KSP building, opened in 1989, comprises a total of 146,300m^2 of floor space on a 55,400m^2 site. There are three major structures in the complex. Innovation Center A is a six-story structure which is 100 percent owned by KSP Inc. About half the 10,800m^2 floor space in this building is leased to young start-up businesses (at rents of 50-60 percent of the market rate). The balance is used by public institutions and foundations for research, measurement, testing, and prototype design laboratories. The ten-story Innovation Center B, containing 34,900m^2, is one-third owned by KSP Inc. This space is used for meeting facilities, training rooms, and exhibition space. The other two-thirds of the building is privately-owned, and leased to the hotel, banks, post office, and other commercial facilities. The R&D Business Park Building – a 12-story structure with 99,400 m^2 – is leased at market rates to private tenants to use for research facilities. KSP owns 7 percent of this building, with the balance shared between four private companies.

The total construction cost of the KSP complex was ¥65 billion (ECU 538 million). While public sources provided some of the cost of construction, most was provided by the private stakeholders. KSP Inc.'s annual revenues are about ¥1.6 billion (ECU 13.2 million). Rental fees

[46]Department of Commerce and Industry, *Kanagwa Prefecture New Industrial Plan*, Yokohama: Kanagawa Prefectural Government, c. 1990.

constitute about 70 percent of this income. It should be noted that most of its staff are "dispatched" – from the prefecture and other institutes – and hence are funded through other personnel budgets. The prefecture has provided other operating funds and subsidies to KSP.

KSP has 26 board members and five staff members. Four of the staff members are seconded from the Kanagawa prefectural government. KAST – which has a foundation of ¥4 billion (ECU 33 million) sourced mostly from the prefecture, with some private funds – has 50 staff, of whom 20 are dispatched from the prefecture. KTF – with a foundation of ¥1 billion (ECU 8.3 million) from the prefecture and ¥200 million (ECU 1.7 million) from Kawasaki City – has 40 staff, of whom 20 are dispatched from the prefecture. The Kanagawa Industrial Research Institute dispatches 13 of its measurement specialists to KTF's staff.

KSP – with KAST and KTF – forms a major element in Kanagawa Prefecture's industrial and technology policy. The prefecture has been pursuing a long-term project called the "Brain Center Concept" which aims to transform the prefecture's industrial base to a world-class information- and technology-intensive structure. Besides KSP, as series of technology-based initiatives have been developed, including high-tech and research parks and new research, development, and technology transfer facilities.[47]

4. Indicators for Effectiveness/Success

KSP does not have any specific systems for evaluation. Its senior managers suggest that it should be judged on its performance in creating jobs and start-up companies, promoting regional technology transfer, and fostering a new image for Kanagawa. However, there have not been any systematic or controlled reviews of how well KSP is doing on these measures.[48]

However, KSP can point to several accomplishments within the complex:

- 120 companies now rent space in the KSP complex, employing about 4,200 people. This includes employment in the hotel, banks, and other commercial facilities.[49] In the R&D Business Park building, more than 70 industrial or technology companies rent space for research (and, sometimes, other commercial purposes). The companies here range from

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[47]For background to Kanagawa's high-tech plans, see Mamoru Obayashi, "Kanagawa - Japan's brain center," in Kuniko Fujita and Richard Child Hill, *Japanese Cities in the World Economy*, Philadelphia, PA: Temple University Press, 1993.

[48]KSP managers note that it is hard to statistically measure the complex's industrial impacts, for example by focusing on changes in value-added or shipments. KSP's broad aim is to upgrade research and technology levels in the prefecture. This may employ a significant internal R&D labor force but only have large physical production effects outside the prefecture (or even Japan).

[49]The former occupant of the KSP site before its reconstruction – NC machine-maker Ikeda Steel – employed about 260 workers.

large (Fujitsu, NEC, Sumitomo) to small. Several foreign companies and joint ventures rent space (for example, Du Pont Japan, Fuji Xerox, Nippon Otis).

- There are about 35 start-up and incubator companies at KSP, employing around 220 people. These companies typically range in employment size from five to ten people.

- Between 1990 and 1993, over 300,000 people attended events at KSP, including conferences and seminars. These participants came from both inside and outside the prefecture.

- KAST has funded 10 major research projects, involving young (under 45 years) university and private sector researchers. Up to ¥1 billion (ECU 8.3 million) will be provided to each of these research teams over five years for research, followed by up to ¥0.5 billion (ECU 4.2 million) for a further three-year period for commercialization. Patent rights are to be shared equally by KAST and the researchers. KAST has also made available a series of smaller research grants (or about ¥8 million or ECU 66,000 for a year) and supports around 30 seminars and training courses a year.

- The branch office of the Industrial Research Institute (IRI) of Kanagawa Prefecture at KSP offers open lab and testing services, and conducts about 1,500 tests and analyses for private companies and other researchers annually.

KSP was conceived and built during the peak of Japan's "bubble economy" era – a period (1986-1991) of high economic growth rates and considerable willingness to invest in prestige development projects. Subsequently, as KSP came on-line, the Japanese economy has been buffeted by a severe recession. Several companies who originally rented space at KSP have left, and there is some vacant research space in the complex (some of which has now been rented as commercial space).

5. Trends and Developments

KSP is a "flagship" project, combining in new ways (for Japan) several key elements of technology development and deployment. It has provided a model for other Japanese research core and urban science park projects. Unlike other comparable projects in North America and Europe, there is no university "attached" to KSP. Japanese universities – especially in the public sector – have mostly lacked mechanisms, procedures, and capabilities to promote research spin-offs and entrepreneurial start-ups.[50] In a sense, KSP has sought to get around this by establishing itself (with KTF and KAST) as a core research and technology development center in its own right. At the same time, KSP is also trying to provide new opportunities for university

[50] It should be noted that higher education and public university research is under the control of the Ministry of Education – whose policy directions, constituencies and perceived interests do not necessarily coincide with those of MITI.

researchers to work in a flexible and supportive environment, alongside private researchers and entrepreneurs.

Nonetheless, there are still many barriers to establishing start-up enterprises in Japan. While research funding is now becoming more flexible, the availability of private risk and venture capital is still limited in Japan and public share offerings by small companies are difficult. Most of the available public loan schemes are not helpful to start-up enterprises, although the central government is seeking to address this by establishing new small business investment mechanisms. promoting policies for small firm innovation, and (slowly) reforming restrictive financial and legal regulations and practices.[51] Other issues of business attitude and labor market practice also make start-ups hard. The fear and reality of failure is an issue, since an entrepreneur who goes bankrupt will find it very difficult to operate a business again. Moreover, the best young scientists and engineers in Japan still aspire to working in prestigious large companies rather than small start-up firms. The rigidities of Japanese employment practice (which have benefits in other contexts) make it difficult for a researcher to leave a large company for a small start-up (or leave to start-up a new venture). Similarly, a researcher who joins a small start-up after graduation will find it hard to get a position in a larger company, if the small company fails.

KSP represents an initiative to overcome some of these barriers. The center's prestigious (and expensive) buildings and facilities are designed not only to attract companies to the complex, but also (implicitly) to attract young researchers, particularly to work in start-up companies and other smaller firms leasing research space. KSP has also attracted young visiting foreign researchers (from Russia, Europe, and elsewhere in Asia) who are more willing than their Japanese counterparts to take a risk in a new start-up venture or experimental research project. In at least one case, KSP has also leased space to a start-up entrepreneur (in precision casting) who had suffered a business failure in the past and had trouble in reestablishing himself.

In this respect, KSP and similar projects in Japan represent a significant effort to establish and make respectable a new model of business and technology development in Japan. This requires change in social and business practices, perhaps even more so than in methods of research and technology development and diffusion. This is a long-term proposition. Up to now, KSP has invested a significant amount of private and public money. Measured by real estate leased and the image it now presents as a new technological focal point in Kanagawa prefecture, KSP has provided significant returns. It remains to be seen whether KSP can stimulate the type of research that will lead to spin-offs and whether, indeed, these spin-off opportunities will be fully explored through new start-up high technology companies. It may be that KSP will find that it can be more effective in working with existing companies in promoting technology fusion and diversification.

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[51]For further discussion of emerging Japanese policies for small firm innovation, see: Small and Medium Enterprise Agency, *Small Business in Japan 1994*, Tokyo: Ministry of International Trade and Industry, White Paper on Small and Medium Enterprises in Japan, 1994.

APPENDIX

Addresses of case study centers:

Georgia Manufacturing Extension Alliance
Georgia Institute of Technology
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Tel: +1-404-894-8989
Fax: +1-404-853-9172

Manufacturers Resource Center
125 Goodman Drive, Bethlehem, PA 18015, USA
Tel: +1-610-758-5599
Fax: +1-610-758-4716

Tokyo Metropolitan Industrial Technology
Center, 3-13-10 Nishigaoka, Kita-ku
Tokyo, 115 JAPAN
Tel: +81-3-3909-2151
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Kanagawa Science Park
West 3F 304 Innovation Center Building
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