EVALUATION OF POLICY FOR IMPROVEMENT OF THE SYSTEM OF TECHNOLOGY TRANSFER TO ENTERPRISES

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GLOSSARY OF ABBREVIATIONS

ADRs	**Agencia(s) de Desarrollo Regional – regional development agencies**
AEVAL	**Agencia Estatal de Evaluación de las Políticas Públicas y la Calidad de los Servicios – Spanish Agency for the Evaluation of Public Policy and Quality of Services**
AGE	**Administración General del Estado – the Spanish national Government**
CCAA	**Comunidad(es) Autónoma(s) – the devolved regions of Spain**
CDTI	**Centro para el Desarrollo Tecnológico Industrial – Centre for industrial technological development**
CENIT	**Consorcios Estratégicos Nacionales en Investigación Técnica – national strategic partnerships for technical research**
CIT	**Centros de Innovación y Tecnología – innovation and Technology Centres**
CSIC	**Consejo Superior de Investigaciones Científicas – the Spanish national research council**
DGPYME	**Dirección General de Política de la Pequeña y Mediana Empresa – the Spanish directorate general of small and medium-size enterprises**
DRAE	***Diccionario de la Real Academia Española* – the dictionary of the Spanish Royal Academy [regarded as the authoritative lexicographical source for the Spanish language]**
EU	**European Union**
FEDIT	**Federación de Centros Tecnológicos de España – the Spanish federation of Technology Centres**
GBs	**Government bodies**
GVA	**Gross value-added**
ICEX	**Instituto Español de Comercio Exterior – the Spanish institute of foreign trade**
INE	**Instituto Nacional de Estadística – the Spanish national statistical institute**

MICINN	**Ministerio de Ciencia e Innovación – the Spanish Ministry of Science and Innovation**
MITYC	**Ministerio de Industria, Turismo y Comercio – the Spanish Ministry of Industry, Tourism and Trade**
OECD	**Organization for Economic Cooperation and Development**
OEPM	**Oficina Española de Patentes y Marcas – the Spanish Patent and Trademark Office**
OTRI	**Oficina de Transferencia de Resultados de Investigación – the Spanish office for the transfer of research outcomes**
PFE	***Plan de Fomento Empresarial* – Enterprise development plan**
PNR	***Programa Nacional de Reformas* – National Reform Programme**
PRBs	**Public research bodies**
PROFIT	**Programa de Fomento de la Investigación Tecnológica – technological research support programme**
R&DSs	**Technological research and development services**
SBs	**Services to businesses**
SCTE	**Sistema de Ciencia-Tecnología-Empresa – Science-technology-enterprise system**
SMEs	**Small and medium-size enterprises**
STCE	**Sistema de Transferencia de Conocimiento a las Empresas – system of knowledge transfer to enterprises**
TCs	**Technology Centres**
UEFs	**University-enterprise foundations**
UNCTAD	**United Nations Conference on Trade and Development**

EXECUTIVE REPORT

The Spanish Council of Ministers resolved to give the Public Policy and Service Quality Evaluation Agency a formal brief to undertake an evaluation of the policy for improvement of the system of technology transfer to enterprises, with a special focus on support for Technology Centres.

The technology transfer system is a core element of SCTE, the 'science-technology-enterprise system', and has been identified accordingly as in urgent need of improvement in order to fulfil the objectives of Spain's science and innovation policy. One of the primary purposes of this policy is to encourage a swift structural change in the economic system as needed to raise productivity and, ultimately, to support growth and employment. This objective is embodied specifically in the *Plan de Fomento Empresarial* [PFE, enterprise development plan], a section of Spain's PNR [National Reform Programme] that forms the subject-matter of this evaluation. The PFE expressly refers to the role of the network of Technology Centres in that process of improvement.

Government intervention in this domain is justified by a need to rectify market failures in research, development and innovation. Such intervention focuses on the supply of public goods and the generation of externalities. In the field of technology transfer, government intervention comprises policies as to the training of human resources, some of which become a part of the entrepreneurial fabric, as to the creation of technology-intensive enterprises, and as to the reinforcement of the market in technology services.

This evaluation is based on an examination of the components of the knowledge transfer system so as to ascertain how the system is reacting to public policy and, finally, so as to draw conclusions about how the system can be improved and what role Technology Centres might play.

For the purposes of this evaluation, technology is defined as a form of knowledge consisting of the transfer among organizations of intellectual capital and know-how that is to be used to create and develop new, commercially viable goods and services. There exists a range of channels of knowledge transfer, both tacit and mediated by a mechanism of exchange; the latter has been chosen, on the basis that it is the manner of transfer that is capable of extending technological knowledge and innovation to the largest possible number of businesses, in particular to small and medium-size enterprises [SMEs].

This paper analyzes the functioning of the market in technology services and, in particular, the market sector involving Technology Centres, owing to their status as actors in the STES [the Spanish acronym for 'science-technology-enterprise system'[1]] and to their twofold role as suppliers on the market and as intermediation agents.

[1] A graphical description of the system is available on the website of the Spanish ministry of science and innovation, MICINN: http://www.micinn.es/ciencia/jsp/plantilla.jsp?area=cte&id=2
The Agency's evaluation report on Ingenio 2010 referred to above includes, in Annex I, a SWOT analysis of the Spanish system of science and technology (SECYT).

The Spanish market in technology services suffers from a number of dysfunctions. Supply and demand both lag behind the levels present in other countries, and are mismatched in some segments, particularly those burdened by imperfect competition or by difficulties of coordination among supply actors.

On the demand side of this market, many SMEs do not regard knowledge as an element of competitive advantage, nor as anything to do with the business process. They rarely perceive knowledge (ie, technology) as an investment likely to garner returns on the market. This may be the reason why SMEs undervalue technological goods and services and are reluctant to pay market prices for them. And this would explain why companies underuse the mechanisms of knowledge transfer in comparison to other innovation-related activities. What is more, these companies do not go to the market in search of technological services so much as in the hope of finding solutions to their immediate problems. These perceptions constitute an initial barrier to SMEs' entering the technology services market and to suppliers of technology services to businesses. This barrier is manifest in the use of a different language and in an asymmetry in the perception of needs and of the goods and services on offer to meet such needs: the language of solutions to problems as against the language of the supply of scientific and technological knowledge that cater to market needs.

As to the difficulties on the supply-side of technology services -- where many agents are also knowledge generators -- there is poor coordination in the system of transfer and a need for better articulation in the stock of transferable knowledge. There are no overarching management and professional models for the generation, upkeep and transfer of patents. On the supply-side a closer link should be formed between generated knowledge and goods and services that enterprises will be able to sell, so as to attract demand and encourage buyers to pay the true value that that knowledge will earn them in terms of higher competitiveness in the markets, higher turnover and higher profit.

As mentioned above, the Technology Centres are supply-side actors that provide technology goods and services developed in-house or by third parties, on terms close to or at the open-market norm. The Technology Centres are intermediation agents geared to leading industries, but it is to be noted that they have acquired 'research body' status, whereby they can attract government aid for knowledge generation on an equal footing with public research bodies and universities. Technology Centres accordingly both compete and cooperate with other actors in the technology services market, such as universities, public research bodies and advanced service providers.

The Centres' activities are wider than the marketing of technology services; they also produce knowledge. The Centres' basic and applied research has increased in recent years in step with the development of the market segments in which they operate and their own strategic decisions. The Technology Centres' willingness to undertake knowledge generation might suggest that their traditional role as transfer agents should be reconsidered.

A review of the national government policies in the period 2000 to 2007 concerning knowledge transfer to enterprises and, more specifically, concerning the market in

technology services and the system of Technology Centres leads to a range of conclusions and recommendations the central purpose of which is to help improve the actions now in progress and those envisioned for the period 2008 to 2011, the timeframe for the new National Research and Development Plan.

Strictly, there is no express and structured policy in Spain that faithfully conforms to the name ‘technology transfer policy’. Instead, that term covers one group of measures, and, on the other hand, most policies in support of research and development are framed so as also to cater to the objective of ‘contributing to technology transfer’.

These measures pursue three main axes of action: training qualified human resources; promoting business initiative in research, development and innovation; and the extension, bolstering and functional improvement of the technology services market, having regard to its decisive role.

Public incentives affect both the strategies and capabilities of Centres providing services and the actual and potential business users of such services. Technology Centres also promote business research and development initiatives by becoming involved in those programmes on the basis of their decisions as private actors. Public managers' design of the incentives for these activities will be decisive for such involvement to be effective.

Recommendation 1

A policy to improve the system of technology transfer to enterprises must take the form of an integrated scheme in which all components function in a co-ordinated manner:

- *To promote the systematic functioning of the policies involved: training qualified human resources; fostering entrepreneurial initiatives in research and development; and transfer via the market in technology services (MTS).*
- *Suitably to design incentives so that they prove attractive to actors.*
- *To encourage actors to develop their own strategies (reinforcement of the supply side of the MTS).*
- *To encourage enterprises to respond proactively (stimulus to the demand side of the MTS).*

A systematic conception of the set of all government interventions directed towards improvement of the system of knowledge transfer to enterprises would make more rational use of existing capabilities (human capital, scientific and technical research and knowledge infrastructure) and available resources would come under a more efficient regime of allocation.

Recommendation 2

In the period of application of the National Scientific Research, Development and Innovation Plan 2008-2011, the scheme of incentives for technology transfer to enterprises deployed by the national government in coordination with the devolved regions should give priority to the mobility of qualified human resources to enterprises, the creation of new technology-intensive enterprises, augmentation of the technological profile of the economic fabric as a whole, and reinforcement of the market in technology services to which SMEs typically have recourse.

The scope of such interventions should include universities, technology transfer offices (OTRIs), public research bodies (OPIs), science and technology parks, advanced service providers and Technology Centres as actors within a single transfer system. The design of specific regulatory measures and forms of financial support should make better use of the supplementary role whereby such actors facilitate knowledge transfer to enterprises.

The achievement of a high technological profile is a necessary but not sufficient condition of raising competitiveness. There is also a need for technologically advanced end products and services on the most active markets. The development of markets that demand goods carrying new or improved technological content must keep abreast with the development of a system of knowledge transfer.

Technology is only inserted in the economic process when there is a realistic prospect of its doing well on the market and driving up business sales figures. If there is no market, there are no sales; in the absence of sales, there can be no product, no sustainable effort, and no technological demand. Such markets are widely diverse and function in very different ways. Some of them, however, offer

suitable opportunities for a number of ancillary policies, such as government purchases and involvement in international projects. The ENCYT strategy has pointed out that the sectors with the highest potential for immediate demand include those most closely involved in the investment efforts of the Spanish economy, such as infrastructure, transport, energy, environmental management, and water.

Recommendation 3

Policy for improvement of technology transfer to enterprises must be aided by policies intended to open up and foster new domestic and foreign markets, government purchases attending the major government expenditure plans, and entrepreneurial involvement in international projects (preferably in the European Union framework programme).

Over the past ten years, national government policy and resource allocation has been geared towards raising human and material capabilities: investment in research and development has increased threefold. But a lack of structure in efforts to support the transfer of knowledge thus generated has meant that existing market failures have not been entirely rectified, and enterprises may unnecessarily delay their adoption of the technological improvements already available in the system.

Recommendation 4

Increased use of the outcome indicators under the National Plan 2008-2011 may make for a more accurate picture of the maturation of past investments, difficulties in the process, and, especially, the transformation of knowledge into goods and services that enterprises have been able successfully to launch on the market.

The design of such outcome indicators should allow for monitoring the extent to which the innovative entrepreneurial base in the economy has broadened, and measuring the gains in value-added as a proportion of GDP through technological extension and intensification.

Government support intended to correct market failures inherent to research and development activities and knowledge transfer is helping to enhance the capabilities and transferable knowledge available on the supply side of the technology services market, and to raise demand from businesses, SMEs in particular.

To access technology and innovation, companies in general and SMEs in particular are chiefly reliant on the technology services market, research under contract and public-private partnerships. Accordingly, the National Plan 2008-2011 should do as much as possible to reinforce allocation of resources to these three areas.

Incentives should also be accorded to the dissemination and value-enhancement of knowledge so as to encourage companies to access technology services regularly and easily.

This requires activating technology service and distribution networks, which in turn calls for closer familiarity with such networks and their uses. Technology suppliers -- and Technology Centres in particular -- and regional development agencies (ADRs) play a key role in this process.

Knowledge services must attain to an effect of 'capillarity' in the economic fabric in order for the available incentives to be effective to increase technological cooperation and raise enterprises' demand for technology services.

The main market failure of the technology services market consists of an information asymmetry between the demand side -- enterprises are inadequately conversant with available technological options -- and the technological offering of knowledge creators.

Companies are not always able to ascertain the extent to which offered technology might be of use to them in their innovation projects, nor do they always know how to access such technology or the cost involved in implementing it.

Recommendation 5

National government policy should encourage enterprises to improve their knowledge of existing technological resources by disseminating the technological profile of the actors generating such resources.

Another major opportunity to improve the system of knowledge transfer to Spanish companies is to reverse territorial inequalities in the provision of technological services, which tend to make demand lower than socially desirable. The localisation of technology service providers is a barrier to enterprises' wider access to such services.

Recommendation 6

National government policy should encourage business demand for technology services. Any company should be able promptly to locate the technology it needs to grasp a market opportunity. Any business should be able to access its technology provider regardless of their respective geographical locations within Spain.

To give the mechanism the agility it requires, a programme could be attempted of technology vouchers, that would gradually extend over a battery of standard technology services.

One of the key achievements to be expected of government programmes intended to promote knowledge transfer to enterprises -- whether deployed from national government or originating in partnerships between national and devolved regional authorities or public-private cooperation -- is an improved match between technology service supply and demand.

Recommendation 7

Regulatory and incentive measures must be taken to widen, reinforce and foster the competitive and transparent functioning of the Spanish market in technology services, in such a way as to remove barriers and information asymmetries and encourage the technology offering originating with any actor to be available throughout Spain, particularly in the case of partnership arrangements.

The role of Technology Centres in the improvement of the knowledge transfer system is a variable upon which government can act through suitable design of policy and its implementing measures and incentives.

Technology Centres are actors in the market in technology services to businesses; but they could supplement their offer of services by generating knowledge of their own, independently or in partnership with other agents.

In any event, Technology Centres and their services and possibilities should be better known to enterprises. Only if their services are distributed effectively to a greater number of businesses will the Technology Centres be making any substantial contribution to enhancing the knowledge transfer system in Spain.

At present, the role of the Technology Centres is significant insofar as they are the main suppliers of technology to SMEs, chiefly in the form of research under contract and technology vigilance and alert services; they also operate as agents for entrepreneurial and territorial development.

In future, the devolved regions will continue to play a major role in relation to Technology Centres, particularly as regards the creation of new Centres. In the light of the lines of action set out in ENCYT, there is likely to be increased cooperation between the national government and the devolved regions in building new technological capabilities and rationalising and streamlining use of existing capabilities.

These expectations spring from the execution of the CREA sub-programme of Technology Centre creation and consolidation, and of the National Programme of Scientific and Technological Infrastructure 2008-2011.

The specific support measures for Technology Centres and, more specifically, the PROFIT scheme for Technology Centres, are important for the growth and maturation of the Centres as actors in the Spanish science-technology-enterprise system. But there is a failure of alignment between the strategic objectives defined for Horizontal Action in Support of Technology Centres and the use that the Centres have made of the programme, namely, to fund their own research and development.

Hence the basic objectives defined for Horizontal Action in Support of Technology Centres have only been fulfilled with regard to the creation and reinforcement of research and development units catering to industrial businesses, this being the strategic use that the Centres have chosen to make of the programme. Among the programme's supplementary objectives, cooperation has been encouraged among Centres in the form of partnership-driven projects. Priority has been given to

supporting those projects carrying the highest technological risk; accordingly, the average size and duration of executed projects have both increased.

The objective of raising Centres' involvement in international programmes has not been achieved to a significant extent. One of the main reasons for this in the final years of the programme may have been the existence of other programmes specifically designed for this purpose, such as InnoEuropa.

Most subsidised projects have been individual; almost none involved cooperation with enterprises. Such cooperation has more typically taken the form of market-oriented projects (applied research and development) submitted to the PROFIT programme for enterprises.

Horizontal Support Action has helped enhance Centres' technological capability, as borne out by the performance of certain indicators, but it has had no material impact on their capacity as technology transfer actors. In this respect, any impact has originated with the Centres' involvement in projects subsidised by the PROFIT programme for enterprises, as partners or, more usually, as subcontractors. Interviews conducted with representatives of some of the more active Centres under these programmes show that the transfer stage is beset by difficulties. Some respondents saw the need for programmes aimed at improving the structural element underpinning this stage.

Recommendation 8

Incentives under national government policy should be designed so that Technology Centres, whether individually or in partnerships, are actively present at all stages of the route from knowledge generation to insertion of such knowledge in the market, as a result of the entrepreneurial processes of transformation and service provision.

1. INTRODUCTION

The Spanish Council of Ministers resolved on 1 August 2008 to give the Public Policy and Service Quality Evaluation Agency (AEVAL) a formal brief to undertake an evaluation of the policy for improvement of the system of technology transfer to enterprises, with a special focus on national government support for Technology Centres.

This evaluation has been conducted in the framework of Spain's National Reform Programme, under which the Agency is entrusted with an annual evaluation of the degree of application and success of programme measures.

The evaluation brief refers to one of the measures contemplated in axis 7 of the NPR and included in the business development plan: this measure points to improvement of the system of technology transfer to enterprises as a means to foster innovation, and accords a major role in this task to the Technology Centres. The NPR also ties these measures to measures in support of research, development and innovation activities under axis 4. This evaluation can accordingly be regarded as a supplement to the review by the Agency in 2007 of the INGENIO 2010[2] strategy.

Government intervention in the technology transfer system

The setting in which technology transfer takes place enables third parties to appropriate the benefits of innovative efforts, and involves increasing costs of development owing to ever-shorter product life cycles and to the complexity that attaches to new technological development. Technology transfer therefore calls for a level of investment -- the outcome of which is often uncertain -- that renders the undertaking unattractive to individual actors.

A study by Oxera in 2005 for the European Commission[3] identifies four market failures in the innovation market which may be obstructing technology transfer in the form of new or improved goods and services. The four market failures are:

1. Indirect benefits of the knowledge or technology: Innovation activity or the final outcome of a process of innovation -- a product -- often generates large benefits (positive externalities). A project which from a private perspective is unprofitable but that might generate major social benefits would never be undertaken if left to the functioning of the market.
2. Public goods and appropriation: Knowledge and innovation are often non-exclusive assets. The difficulty of preventing others from using an innovation and of holding them to an obligation to pay for the benefit they are receiving may induce businesses to relinquish certain innovation projects.

[2] E04/2007. *Evaluación del Programa Nacional de Reformas 2007*. Available at: http://www.aeval.es/comun/pdf/evaluaciones/E04-2007.pdf

[3] Innovation market failures and state aid: developing criteria. DG for Enterprise and Industry. European Commission. November 2005.

3. Failures of coordination and networks: An enterprise rarely innovates on its own, and difficulties may stand in the way of its ability to coordinate or interact with others or to transfer the innovation. The range of problems can be wide, including difficulties to coordinate research and development and inadequate access by small companies to the innovation system.
4. Information imperfections and asymmetry: This market failure is typical of financial markets. Information problems may obstruct an SME's ability to fund even a highly promising technological innovation project.

Policies in support of technology and innovation spring from the need to rectify these market failures, which would otherwise impede the development of a sufficiently wide offering of services to satisfy social needs; government intervention is accordingly required to assure access to technology, especially by small companies.[4] These policies primarily focus on the provision of public goods and the generation of externalities in the field of research, development and innovation.

In the European Union knowledge transfer policy is a priority action area within the strategy for medium- and long-term structural reform in aid of growth and employment. The common principles for the implementation of this policy are set out in integrated guidelines 7 and 8 (the latter being more closely related to innovation and knowledge transfer policy), which in turn inspire national reform programmes.[5]

In the case of Spain, the latest papers and reports on the science-technology-enterprise system[6] reveal that technology transfer to enterprises is the weak link in the innovation system, taking the form of at least the following two circumstances:

- First, Spain has few innovative companies in comparison to the EU average. The European Innovation Survey for 2006 shows that in Spain only 18% of SMEs described themselves as innovative, as against 22% across the EU.

- Secondly, Spain lags behind the EU in a range of key indicators set out in Annex II to this paper. For instance, 4.7% of Spanish exports were in research-intensive sectors, as against 16.7% across the EU.[7] Moreover, the technological profile of Spanish industry was below that of the core countries of the OECD.

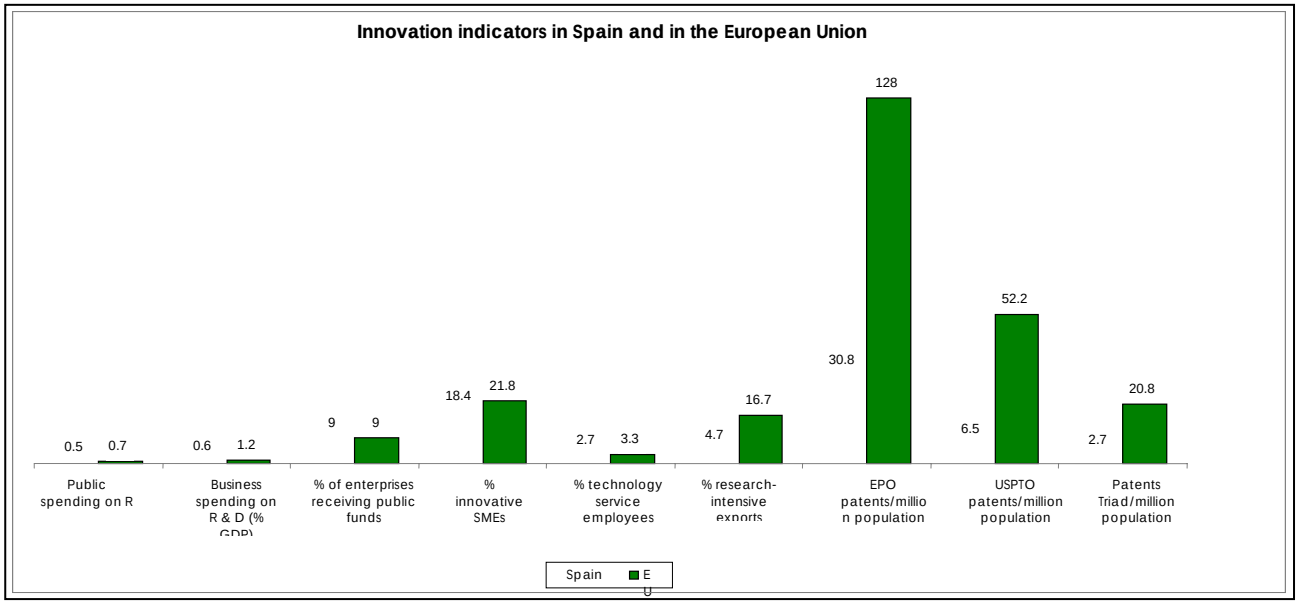
[4] Business executives are familiar with and often point out this state of affairs. For example, one senior executive said: 'Research and development is decisive. We invest 1.5% of turnover in innovation, and are aware that 85% of that investment is useless, but the other 15% enables us to learn and launch products that give us an edge.' Cinco Días: *Así tuve éxito con mi empresa*, 29 July 2008.

[5] Integrated guidelines for growth and jobs (2008-2010). COM (2007) 803 V Parte. http://ec.europa.eu/growthandjobs/pdf/european-dimension-200712-annual-progress-report/200712-annual-report-integrated-guidelines_es.pdf

[6] See COTEC Report 2008, Part I.

[7] The economic report of the President of the government (June 2008) sets out the following diagnosis: 'The main weakness of the science-technology-enterprise system is the low rate of investment by large companies in the more technological sectors' (page 85), the main effect of which is that the resulting output carries low value-added. Both factors -- lack of critical investment maths and no innovative stance of the entrepreneurial fabric -- seem to involve a structural element. In that same report: 'One possible explanation of the lower intensity of technological sectors may be the average size of Spanish companies.' Hence, in the more developed EU countries (termed the G4), 87% of business research and development is conducted by companies employing over 250 people; in Spain, however, the percentage for that indicator is 51% (page 79).

Graph 1: Innovation indicators



Sources: European Innovation Scoreboard 2006: *Strengths and Weaknesses Report* (European Commission, 2007), survey on technological innovation in enterprises. 2006 (INE), *Estadística sobre actividades en I+D* [statistics on research and development activities] 2006 (INE)

Raising the technological profile of the Spanish economic fabric entails a structural change in the economy. That change is feasible only insofar as there exists a final market in new and improved goods and services capable of rewarding investment in technology, and to the extent that that necessary technology reaches those loci where it is needed.

Enterprises will increase their technological effort if and to the extent that it commands a final commercial payoff. It is for this reason that the development of domestic and foreign markets in new and improved goods and services, the generation of the necessary technology and the transfer and incorporation of technology to business and manufacturing processes must all progress in parallel.

Raising the technological profile of the Spanish economic fabric entails a threefold effort: the development of markets in new or technologically improved products; the generation of technology; and the development and reinforcement of technology transfer mechanisms.

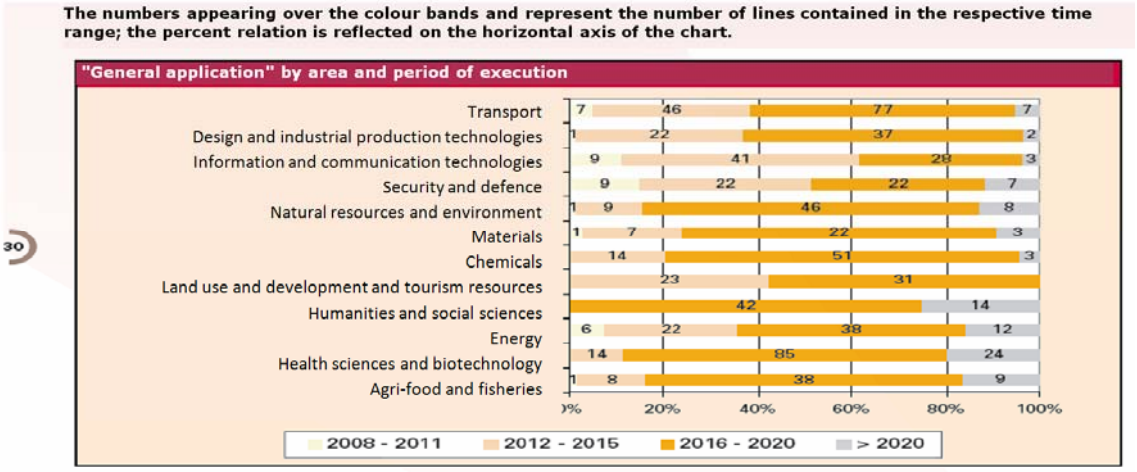
Based on this approach, ENCYT, the national science and technology strategy[8], includes among its objectives the improvement of the capability for transfer to the economic system of the outcomes of publicly funded research. More specifically, by 2015 ENCYT aims to place Spain in the technological forefront.

[8] See Estrategia Nacional de Ciencia y Tecnología [ENCYT]. Fundación Española para la Ciencia y la Tecnología (2007), pp.5.

To that end, the following lines of action are stipulated:

- ✓ promoting a highly competitive entrepreneurial sector;
- ✓ integration of the devolved regions with the science-technology-enterprise system;
- ✓ investment in research, development and innovation;
- ✓ creation of conditions encouraging the dissemination of available science and technology;
- ✓ fostering the internationalisation of the system.

These lines of action are directed to the economic sectors set out in the following chart.

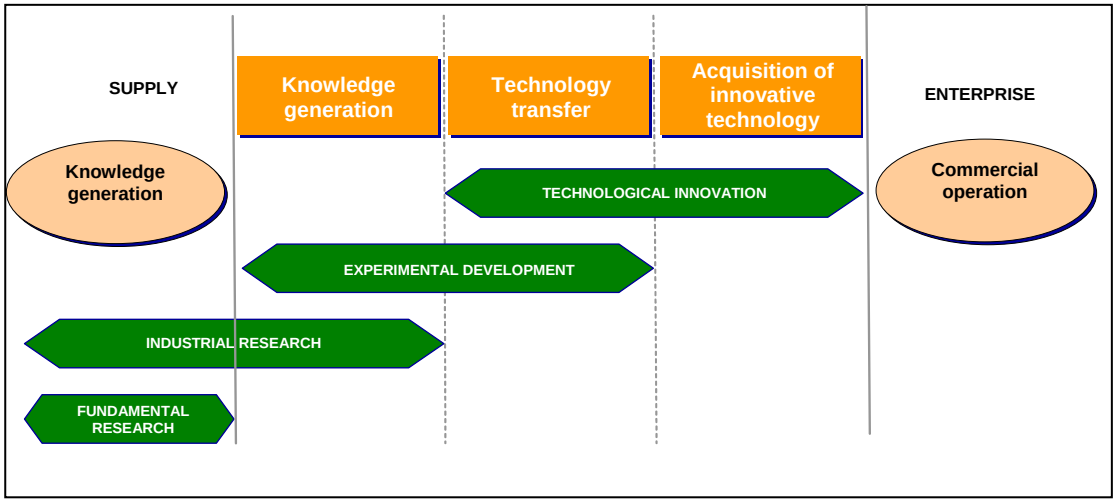


Source: ENCYT, the Spanish strategy paper for science and technology

Subject matter and scope of the evaluation

Activities relating to technological innovation -- from the creation of technological infrastructure to the acquisition of innovative technology and its use in the market -- can be represented as a non-sequential process, as demonstrated by non-linear innovation models. The relationship with the definitions under the Community Framework for State Aid to Research and Development is shown in the following graph.

Graph 2: Technological innovation process



Source: Community Framework for State Aid for Research, Development and Innovation (2006/C 323/01).

As shown in the graph, the differences among system components are only subtle. The first concept to be defined for the purposes of this evaluation is the concept of technology transfer, itself based on a definition of technology that describes it as a form of knowledge.

Technology is thus defined as 'the set of techniques enabling the use of scientific knowledge for practical purposes',[9] often tied to the instruments and industrial procedures of a given sector or type of goods. 'Technology transfer' is defined as the transfer of intellectual capital and know-how among organisations for use in the creation and development of new, commercially viable goods and services.[10]

Based on these definitions, this evaluation uses the concept of 'technology transfer' in its more general meaning of 'knowledge transfer', in line with the EU definition.[11] This paper accordingly refers in all instances to the STCE, the Spanish acronym for 'system of transfer of knowledge to enterprises'.

[9] See *Diccionario de la Real Academia Española*.
[10] European Academy of Sciences.
[11] 'processes for capturing, collecting and sharing explicit and tacit knowledge, including skills and competence. It includes both commercial and non-commercial activities such as research collaborations, consultancy, licensing, spin-off creation, researcher mobility, publication, etc.' Improving knowledge transfer between research institutions and industry across Europe: embracing open innovation. Communication of the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions. Brussels, April 2007.

One implication of the EU definition is that the overall process of incorporation of knowledge to marketable goods and services as the outcome of an organisational or manufacturing process can take place in any of a variety of ways:

Knowledge transfer	
Through the exchange mechanism: • Technology services market	Exchange via a price for the medium carrying the generated knowledge
Tacit forms:	
• Business initiative/appropriability	Incorporation to the economic process through the same agent as the one generating the knowledge.
• Mediated by people	Direct transmission to enterprises by people: Scientists, technology specialists and researchers.

Over the past few years measures have been implemented bearing upon these three avenues of transmission. This evaluation focuses on an analysis only of those measures that impinge on the first avenue, a specific mechanism of exchange, on the basis that it is the manner of transfer that is capable of extending technological knowledge and innovation to the largest possible number of businesses, in particular to SMEs.

The objective of this paper is accordingly to examine the effects that the national government's measures and incentives aimed at enhancing the system of technology transfer have had on the functioning of the market in technology services.

Against that background, and so as to fulfil the evaluation brief, this paper focuses particularly on the measures affecting Technology Centres, owing to their status as actors in the 'science-technology-enterprise system'[12] and to their twofold role as suppliers on the market and as intermediation agents.

[12] A graphical description of the system is available on the website of the Spanish ministry of science and innovation, MICINN: http://www.micinn.es/ciencia/jsp/plantilla.jsp?area=cte&id=2
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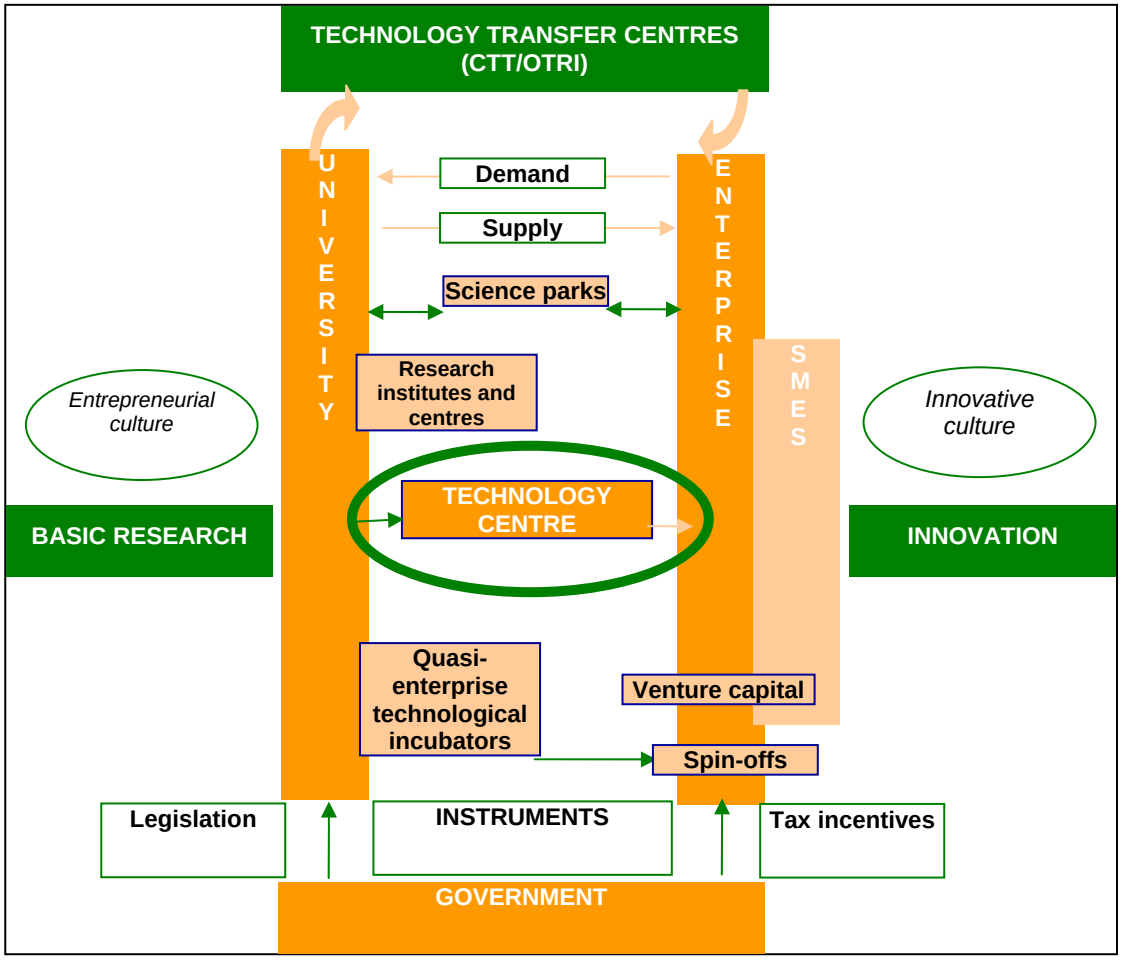
Graph 3: Actors in the Spanish science-technology-enterprise system



Source: COTEC, based on Leydesdorff, H Etzkowitz, "Emergence of a Triple Helix of University-Industry-Government Relations"

The evaluation also scrutinises a range of regulatory measures making up the statutory framework of the technology services market and Technology Centres themselves. These measures include patents policy, the rules on access to certain programmes through the CIT [Innovation and Technology Centres] register, and, finally, the Community Framework for State Aid for Research and Development activities, to which the aid programmes under evaluation must conform.

This report is structured into five chapters as follows:

- First, the paper addresses the context of the measures under evaluation, describing the market in technology services and the system of Technology Centres.
- Secondly, the paper specifies the national government measures under evaluation.
- Next, an overview is provided of the approach and tools used for this evaluation.

- An analysis is undertaken of the effectiveness of the measures aimed at improving the functioning of the market in technology services, particularly those measures targeting Technology Centres as market actors.
- Finally, this paper advances a number of conclusions and recommendations that are hoped will help improve the system of knowledge transfer to enterprises in Spain in the short and medium term, with a special emphasis on the potential role of Technology Centres.

2. POLICY FOR IMPROVEMENT OF THE SYSTEM OF KNOWLEDGE TRANSFER TO ENTERPRISES IN THE CONTEXT OF THE TECHNOLOGY SERVICES MARKET

2.1. Description of the context: the market in technology services and the system of Technology Centres

Proper evaluation of the measures that directly impinge on the functioning of the technology services market, and measures in support of Technology Centres in particular, calls for a preliminary analysis of their context. To arrive at a self-consistent conception of the possible role of Technology Centres in improving the system of transfer of knowledge to enterprises, this analysis first turns to consider the existence and functioning of the market in technology services.

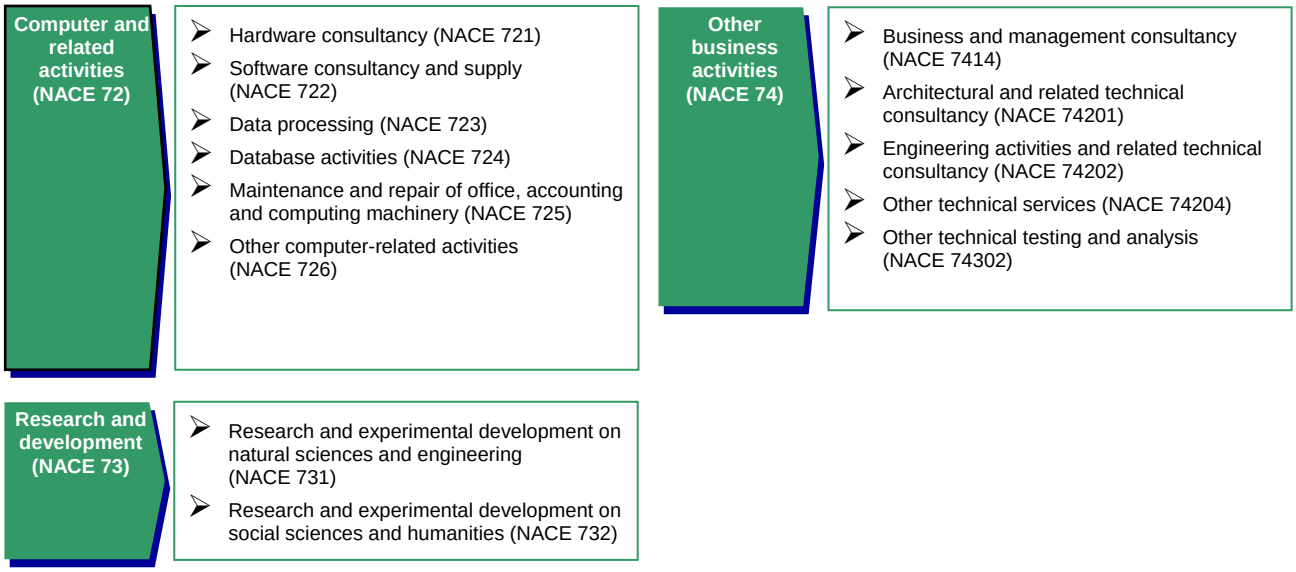
Technology Centres might be regarded, as private non-profit entities, as supply-side actors that supply technology goods and services to enterprises on terms close to or at the market norm. In that market, Technology Centres accordingly both compete and cooperate with other actors, such as universities, public research bodies and advanced service providers.

<table>
<tr><th colspan="2">Technology services market</th></tr>
<tr><td>Supply</td><td>Demand</td></tr>
<tr><td>Technology Centres</td><td rowspan="2">Enterprises (particularly SMEs)</td></tr>
<tr><td>Rest of actors:
• Universities, OTRIs
• Public research bodies
• Advanced service companies</td></tr>
</table>

2.1.1. Description of the technology services market

Technology services are activities rendered by providers to client enterprises. The main subject matter of exchange is formed by scientific knowledge and technical solutions derived from it.

Technology services can be classified as follows:



Not all technology services, however, should be treated as technological or non-technological innovation services. Innovation services, as defined in the third edition of the Oslo Manual, also include technological innovation services in products and processes and innovation in management and marketing.

The economic size of the technology services market can be estimated in various ways. This evaluation uses the data produced by INE [the Spanish statistical Institute] as to turnover and gross value added (GVA) aggregated across various economic activities. In 2005, the absolute size of the market exceeded €40 billion, and accounted for around 7.3% of Spain's total services market. About half that volume represented value creation, or about 2.2% of GDP.

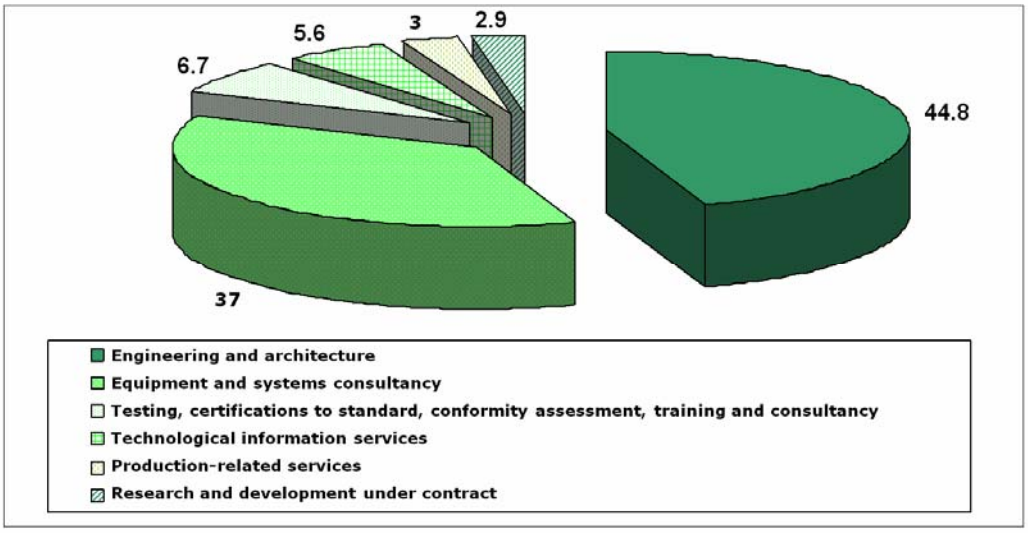
Table 1: Estimated market size by segment (2005)

Activity	NACE	BV*	GVA*	% BV*	% GVA*	GVA/BV * ratio
IT equipment and systems consultancy	721 and 722	14,792.7	6,703.1	37.0	34.2	0.45
Information, processing and database activities	723 and 724	2,239.0	1,211.4	5.6	6.2	0.54
Production-related services	725 and 728	1,192.5	552.7	3.0	2.8	0.46
Research and development	73	1,178.3	789.0	2.9	4.0	0.67
Architectural and engineering services	742	17,919.3	8,681.3	44.8	44.3	0.48
Testing, analysis, training and advisory services	743	2,685.8	1,671.9	6.7	8.5	0.62
Total		40,007.6	19,609.4	100.0	100.0	0.49

Source: Prepared by the authors based on research and development statistics released by the Spanish Statistical Institute (INE 2006).
* Business volume (BV), gross value-added (GVA)

The following graph shows these segments by market share:

Graph 4: Distribution of the technology services market



Source: Annual services survey. INE 2006

As revealed by the following table, the goods exchanged on the technology services market range from patent and utility models to specialised technical knowledge in the form of viability studies, project designs, plans, diagrams, models, instructions, guides, formulas, design, specifications, and technical, management and training advisory services.

This evaluation is especially interested in research under contract, a market segment in which government intervention, and Technology Centres specifically, play an important role, particularly with regard to SMEs.

Table 2: Services offered, by market segment

Market segment	Market share	Description of services
Engineering and architecture	44.8%	Design, process validation, prototypes, viability studies, pilot experiences, automation and project management. These services are provided on a competitive basis.
Equipment and systems consultancy	37.0%	Encompass industry, environment and information technology. The training activities in this segment relate to applied knowledge rather than academic knowledge, and typically accompany technical support for the commissioning or overhaul of machinery, tools and equipment. These services are provided on a competitive basis.
Testing, certifications to standard, conformity assessment and assurance, training and consultancy	6.7%	Advisory services are provided in relation to intellectual property management, particularly as regards registering patents and utility models.
Technological information services	5.6%	Services provided in the form of technology vigilance or alerts to clients.
Production-related services	3.0%	Manufacture of prototypes, computer-assisted manufacture and other services
Research and development under contract	2.9%	These services are provided subject to confidentiality. Companies operating in the segment contract for particular inventions or goods and process improvements to their technology suppliers.

Advanced service providers, universities, research outcomes transfer offices (OTRIs), public research bodies and Technology Centres make up the supply side of this market. The demand side comprises businesses -- many of which are SMEs -- that use service providers to acquire the scientific and technological capabilities that they need to incorporate into their economic process and would otherwise lack, usually by reason of their small size or scale. The universe of client enterprises which, in accordance with need, might call upon one of the categories of technology services described above potentially encompasses all businesses in the market; more specifically, it at least includes the 49,415 innovative enterprises detected by the Spanish Statistical Institute, INE, in its 2006 Survey of Technological Innovation in Enterprises.

In the Spanish market in technology services, the dysfunctions mentioned in the introductory section with reference to the wider context of innovation systems in general are of course in evidence: supply and demand both lag behind the levels present in other countries (as shown by the innovation indicators cited above), and are mismatched in some segments, particularly those burdened by imperfect competition or by difficulties of coordination among supply actors. It is precisely these segments (testing, technological information services, production-related services, and, particularly, commissioned research and development) which, though representing less than 20% of the overall market, attract the greater part of government intervention intended to rectify these problems. These government measures are analysed in chapter 4.

A further matter affecting the functioning of the technology services market is the imbalance in terms of geographical location of technological and innovation capabilities. Hence:

Resources are tightly clustered in six territories:

- 77.1% of research and development expenditure in proportion to regional GDP clusters in: Madrid, Catalonia, Andalusia, the Basque Country and the Region of Valencia (five devolved regions).

- 71.9% of domestic expenditure on innovation is clustered in: Madrid, Catalonia, the Basque Country, Andalusia, Region of Valencia and Galicia (six devolved regions).

- 77.5% of people employed in technology-intensive sectors are in: Madrid, Catalonia, the Basque Country, Andalusia, Region of Valencia and Galicia (six devolved regions).

The allocation of human and material resources in relation to regional wealth is relatively unbalanced. For the above indicators, the range among devolved regions across mainland Spain, island regions and Ceuta and Melilla are as follows:

- Research and development expenditure in proportion to regional GDP: from 1.98% (Madrid) to 0.80% (Cantabria; 2.5 times), 0.29% (Balearic Islands) and 0.19% (Ceuta and Melilla).

- Percentage of innovative enterprises (with 10 or more employees in the industrial, construction and service sectors), by devolved region: 31.2% (Navarre) to 14.78% (Extremadura; 2.1 times), 19.37% (Balearic Islands) and 17.74% (Ceuta).

- Percent employment in technology-intensive sectors: 12.33% (Basque Country) to 2.88% (Cantabria; 4.2 times), 2.86% (Balearic Islands) and 1.37% (Ceuta and Melilla).

The above data suggest that the public policy in support of research, development and innovation could encourage a territorial rebalancing of the country by bringing new infrastructure and bolstering technological development in the regions most in need: Aragon, Asturias, Baleares, Canary Islands, Cantabria, Castilla y León, Castilla-La Mancha, Extremadura, Murcia, La Rioja, Ceuta and Melilla.

Annex III includes a more detailed description of the knowledge transfer market and its actors.

2.1.3. Technology Centres

Historically, Spanish Technology Centres emerged as the response of the entrepreneurial fabric to the shortfall in services needed for industrial progress or and to make up for the deficiencies in the services provided by public institutions, particularly institutions of higher education and vocational training. This historical background partly explains the present geographical distribution of the Centres.

The devolved regions have played and continue to play a key role in the creation and functioning of the Technology Centres. This explains why the Centres have developed very differently in each region as regards their timelines and the underlying causes of their emergence and consolidation. The devolved regions' decision to establish Technology Centres was a bid not only to boost entrepreneurial competitiveness through technology but also to aid local economic development.

Spanish Technology Centres owe their existence to both top-down and bottom-up strategies, typically concurrent or deployed in swift succession.

As part of a top-down strategy, regional policy has used the Technology Centres as the technological engine for industry by actively allocating resources to infrastructure, equipment and human resources, fostering Centres' consolidation,

and supplementing their financial needs with public funds if market proceeds proved insufficient. A top-down model tends to reflect the concerns of industrial policy and sector-targeted priorities.

In the bottom-up direction, industry itself, with the support of regional government, met the needs of the entrepreneurial fabric by founding Technology Centres to develop or outsource scientific and technological capabilities. This second model generally serves to explain the initiatives seen in regions undergoing far-reaching processes of restructuring and subsequent re-industrialisation.

Description of Technology Centres

Technology Centres are non-profit private entities which can take the legal form of an association or of a foundation; some Centres have qualified as entities in the public interest. In these latter cases the objects pursued entail a role that goes beyond that of a strictly economic agent. Depending on its legal form, a Technology Centre is governed by a board of directors [*Junta*] or a board of trustees [*Patronato*].

A Technology Centre can be a beneficiary of government aid in its own right or a manager of aid directed towards companies. It must accordingly include in its constitutional document the objects of forming partnerships, entering into temporary consortia with other beneficiaries, or becoming registered with the various registries that aid management bodies require.

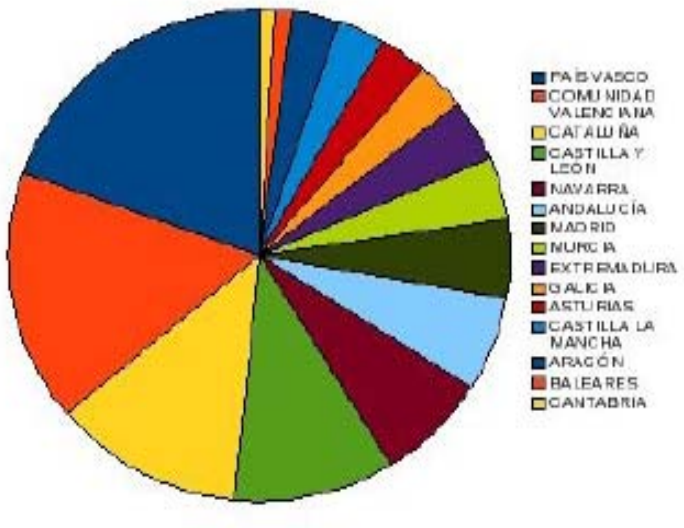
Membership of various sector-integration associations may also introduce additional variants or requirements to the configuration, regime or provided services of a Technology Centre.

There is no single, uniquely valid and acceptable form of Technology Centre applicable to every situation. Rather, there are many types of Centre depending on the specific function required of them; while broadly similar, they are not identical to one another.

Data released by the Spanish ministry of science and innovation (MICINN) show that the number of Technology Centres registered in Spain in June 2008 was one hundred.[13] The geographical distribution of Centres reveals a tight clustering in the Basque Country, the Region of Valencia and Catalonia, which account for almost half of all Spain's Centres. The main reasons for this asymmetrical distribution are, on one hand, the asymmetry of government support in each devolved region for the formation and development of Centres, and, on the other hand, the very structure of the Spanish entrepreneurial establishment.

[13] A full list of currently registered Technology Centres is provided in Annex XX to this document.

Graph 5: Territorial distribution of Technology Centres



Source: Prepared by the authors on the basis of MICINN data.

At present, 55% of all Spanish Technology Centres are members of FEDIT, the Spanish Federation of Technology Centres,[14] an organisation that represents private non-profit Technology Centres so as to advocate, support and bolster innovation in business and society. The large number of Centres within this organisation allows for networked integration nationwide, thus facilitating cooperation towards enhanced efficiency in the services that Technology Centres provide to their clients.

Of the 45% of registered Technology Centres that are not members of FEDIT, about half are public Technology Centres, and thus excluded from membership by law. Other registered Technology Centres are also legally precluded from FEDIT membership, e.g., business groupings that fall short of formally constituting a Technology Centre but are sometimes accepted for registration. The rest of private Technology Centres outside FEDIT either fall below the turnover, organisational and staffing thresholds required for membership or are simply not interested in being represented by a common organ.

Technology Centres are funded from various sources:

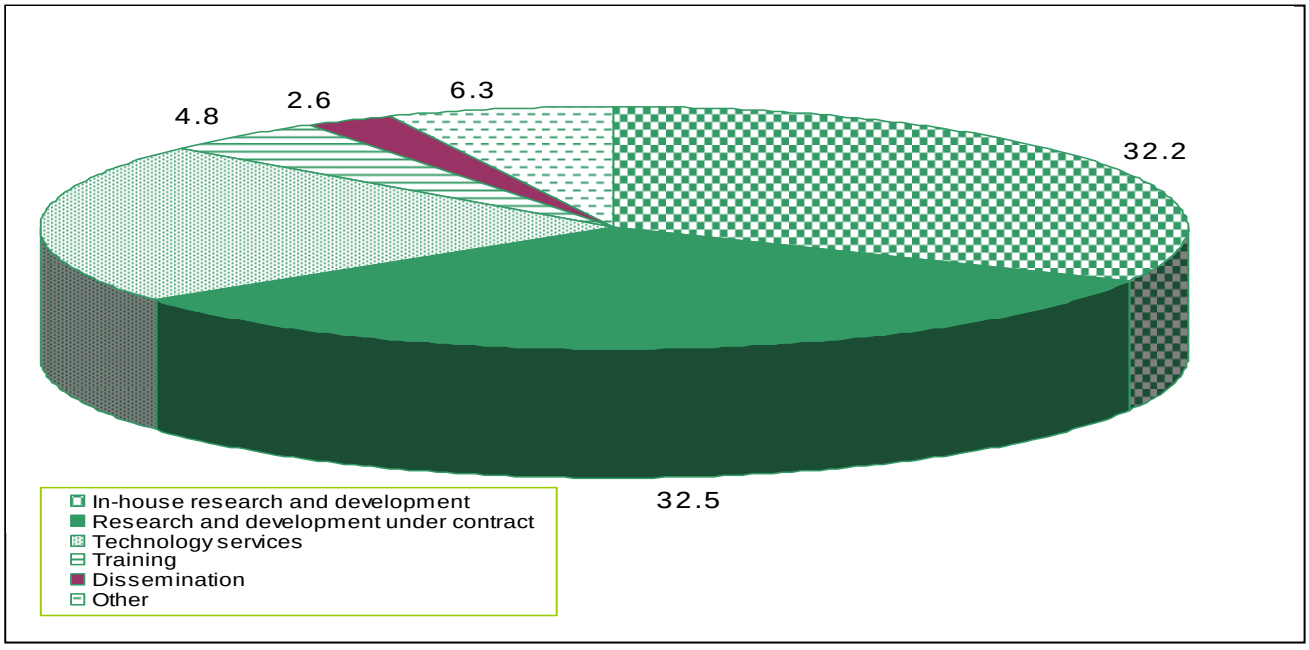
[14] Own calculation.

Contracts	Revenue from contracts with private and public entities (competitive tenders).
Non-competitive public funding	Subsidy funding to cover the ordinary costs of operation (including staff), defined as subsidies attracted individually by the Centre and thus excluding any aid received under government award processes and programs open to participation in the same manner by other bodies or entities.
Competitive public funding	Subsidy funding received from government award processes and programs open to participation by other bodies or entities.
Other (non-government)	Private (non-government) income not included in any of the above categories, such as financial income, non-recurring (non-government) income, etc.

The funding model of Technology Centres is mixed, therefore; they undertake both market (current revenues from services to enterprises) and non-market transactions.

These non-market operations include fundamental research, industrial research and experimental development, which the Centres fund by competing in a very wide range of subsidy award schemes, notably national research and development plans.

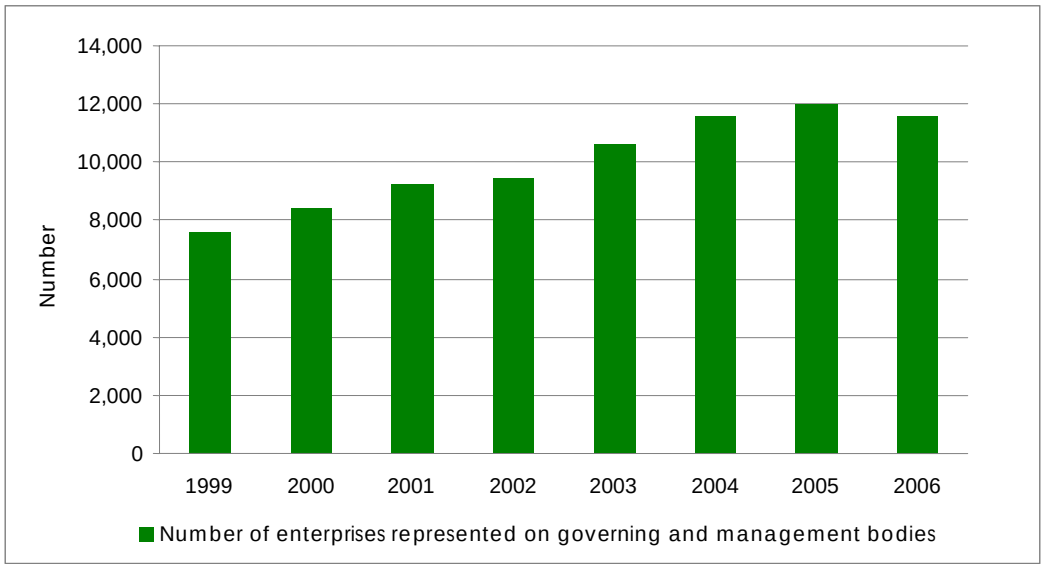
Graph 6: Distribution of Technology Centre revenue by type of activity (FEDIT TCs, 2007)



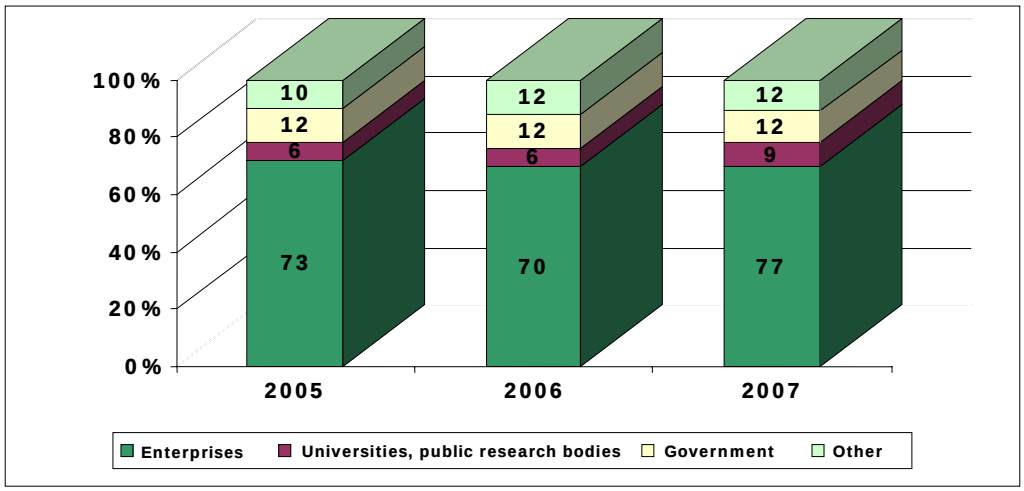
Source: FEDIT

From 2004 to 2007, the average number of enterprises represented as members or associates of Technology Centres within FEDIT was 10,830, or 70% of voting rights. In 2007, the remaining decision-making power at Centres was distributed as follows: 12% devolved regions and other government authorities, 6% universities and public research bodies, and the remaining 12% for other trustees.

Graph 7: Involvement of enterprises in Technology Centre governing bodies



Graph 8: Structure of the board of management



The role of Technology Centres in the technology services market

As mentioned above, the Technology Centres are supply-side actors that provide technology goods and services developed in-house or by third parties, on terms close to or at the market norm.

The Technology Centres are intermediation agents geared to benchmark industries, but it is to be noted that they have attracted "research body"[15] status as regards their 'non-economic' activities. The Centres are accordingly eligible to receive government subsidies for their knowledge generation activities; to such an extent, in fact, that aid can make up as much as 100% of computable costs, placing Technology Centres on an equal footing with public research bodies and universities. Technology Centres accordingly both compete and cooperate with other actors in the technology services market, such as universities, public research bodies and advanced service providers.

The Centres' activities are wider than the marketing of technology services; they also produce knowledge. The Centres' basic and applied research has increased in recent years in step with the development of the market segments in which they operate and their own strategic decisions.

They offer a wide catalogue of services, ranging from technological vigilance and alerts to technology creation through research projects under contract:

- Technological research and development
  - Strategic research and development (new technologies)
  - New and/or improved production processes
  - New and/or improved products
  - Hybrid services
  - Manufacture of prototypes and commercial pre-series
- Innovation advisory services
  - Scientific and technological diagnostics and audits
  - Advanced technological information services
  - Technology strategy and innovation management
  - Trend analysis and viability studies
  - Technological outlook consultancy
  - Studies and reports
  - Commercialisation of technology portfolios
- Technology services
  - Testing and analysis
  - Standardisations
  - Certifications
- Technological dissemination
  - Promotional actions
  - Research outcomes dissemination actions
- Training
  - Postgraduate courses
  - Continuing training of technical staff
  - Tailored education
  - Virtual learning

The breadth of Technology Centres' activities is revealed by the FEDIT report 2006, which describes its member Centres' involvement in national government programmes promoted by the ministries of education and science, of industry, tourism and trade, of development, of environment, and of labour and social affairs, and by CDTI, the Spanish centre for technological and industrial development. The amount of aid received was in excess of €74 million, 60% as indirect subsidies and the remaining 40% as direct grants.

International outlook of Technology Centres

Technology Centres undertake international activities for two main purposes. First, a Centre may look to foreign markets to sell services based on technologies that the Centre has mastered. Here, the Technology Centres' main clients are in the regions of Latin America and North Africa. Secondly, Technology Centres frequently

[15] According to the definition in section 3.1 of the Community Framework.

buy emerging technologies from European countries, the United States and Canada so as subsequently to add them to their portfolio of offered services. In either situation, Centres usually work with organisations with expertise in the promotion of foreign ventures, such as ICEX, the Spanish institute of foreign trade, and regional export development offices managed by the devolved regions.

About 30% of evaluated Centres (20 of the 68 members of FEDIT) were carrying on these activities effectively. A

2.2. National government measures affecting the market in technology services and support for Technology Centres

The national government measures impinging on the technology services market, and specifically those lending direct support to the system of Technology Centres, form part of what is broadly termed 'research, development and innovation policy'. As discussed earlier, research and development policy is primarily concerned to provide public goods in aid of economic growth, by increasing the value-added of the goods and services supplied by enterprises to the markets, which are increasingly open, and increasingly demanding, as to quality, innovation and standard of service.

Support measures are designed to rectify market dysfunctions and to encourage innovation in aid of competitiveness by acting on three fronts: supply, demand, and the relationship between the two.

Knowledge and technology aligned to business needs	➢ Creation of new structures meeting present and future needs of enterprises ➢ Consolidation and reinforcement of existing structures ➢ Specific instruments for the adoption of new knowledge by the scientific and technological supply-side
Enterprises' absorption capacity	➢ Support for the acquisition of innovative technology ➢ Recruitment of technology specialists to enterprises ➢ Support for the acquisition of technology consultancy and training ➢ Support for the preparation of project proposals for submission to international
Mechanisms of relation between supply and demand	➢ Support for cooperation among enterprises and the scientific and technological supply-side through instruments encouraging cooperation and subcontracting: support for research and development commissioning, support for the acquisition of technology services, such as licences, patents, know-how, product certifications, etc. ➢ Creation and consolidation of networks and groupings of innovative businesses, including supply-side actors ➢ Support for the emergence of new technology-based enterprises

The 2004-2007 National R & D Plan is the fundamental instrument for the promotion of technological innovation and the development of scientific knowledge. The major objectives of the plan are to encourage an alignment of knowledge and technology with the needs of enterprises, to enhance enterprises' ability to absorb

technological innovations, and to bolster the mechanisms underlying the relationship between the supply and demand of technology services. To that end, the following lines of action are stipulated:

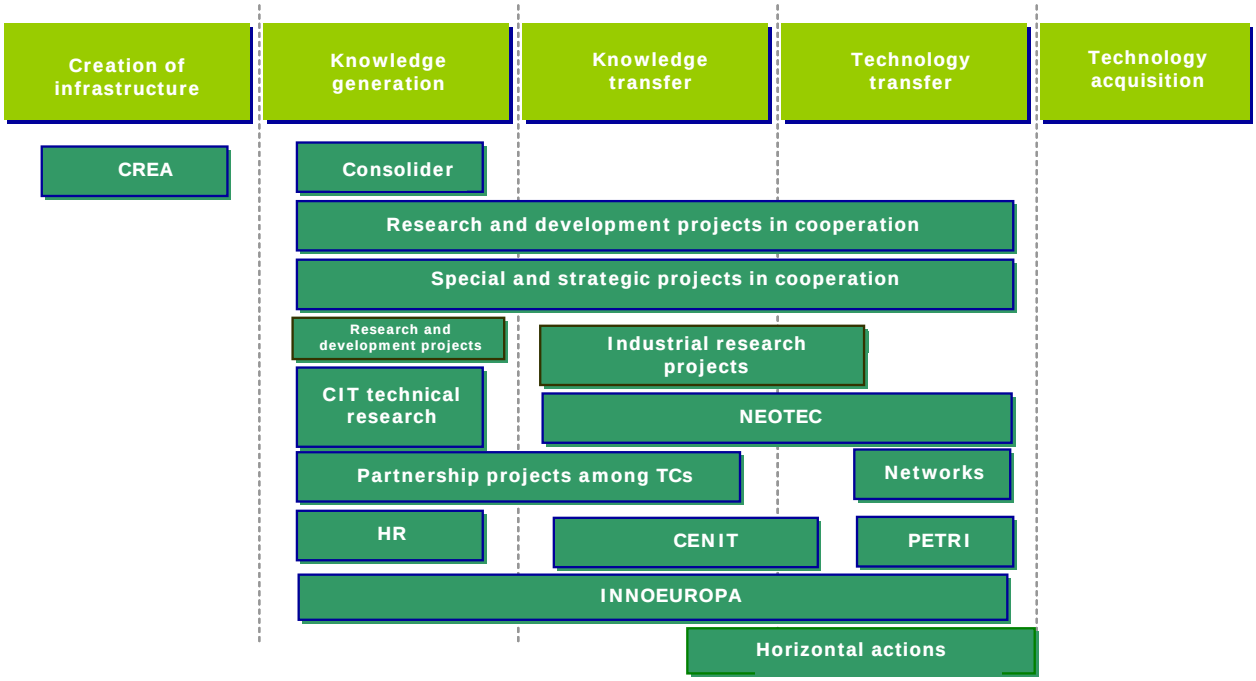
Knowledge and technology aligned to business needs

- **Human resources:**
  - Educational grants
  - Recruitment of research staff
  - Mobility of research staff among actors
- **Infrastructure and knowledge**
  - Construction and enlargement of Technology Centres
  - Research projects
  - Technological development projects

Enterprises' absorption capacity and mechanisms of relation of supply and demand

- **Technological development projects**
- **Technological innovation projects**
- **Creation of and support for new technology-based enterprises**
- **Support for the creation and functioning of new interface units**
- **Spanish involvement in international programmes**
- **Creation of theme-driven networks**
- **Technological dissemination and training**

The Plan was later reinforced with the Ingenio 2010 initiative. Both schemes have been implemented through a wide range of programmes directed towards the various stages of the innovation process.



As shown by the graph, at least before 2008 there was, strictly, no express and structured policy in Spain that faithfully conformed to the name 'technology transfer policy'. Instead, that term covers one group of measures, and, on the

other hand, most policies in support of research and development are framed so as also to cater to the objective of 'contributing to technology transfer'.[16]

Despite the absence of a specific policy directed to encouraging or facilitating technology transfer, virtually all policies in support of technology innovation include among their objects the support of technology transfer.

The national government's intervention mechanisms include financial support for actors, regulatory measures and tax measures. The measures implemented in the period 2000-2007 were the following:

Financial support measures:

PROFIT (*Programa de Fomento de la Investigación Tecnológica* – technological research support programme)

From 2000 to 2007, PROFIT has operated as an instrument calculated to enhance competitiveness by encouraging entrepreneurial innovation. The formulation, implementation and execution of the scheme reflects both sector-based conventional approaches and more novel methods under horizontal programmes. An example of the latter are the PROFIT actions to stimulate Technology Centres' supply of value-added services to enterprises (particularly SMEs).

The structure of the PROFIT scheme can be delineated on the basis of the scientific, technological and sector-based subject areas prioritised under the 2000-2003 and 2004-2007 National Plans for Scientific Research, Development and Innovation, of which the PROFIT scheme formed a part. These discrete subject areas lent the programme a vertical structure and were termed National Programmes. They were undergirded by annual individual subsidy award procedures. All the themes were placed in relation to one another by two horizontal actions also funded by the PROFIT scheme:

- A Horizontal Action in Support of the System of Guarantees, to give entrepreneurial research and development projects access to bank credit.
- A Horizontal Action in Support of Technology Centres, for the execution of projects under National Programmes for those sector-based and scientific/technological subject areas.

The Horizontal Action in Support of Technology Centres was designed to achieve a range of priority goals:

- To bolster the research and development units of Technology Centres catering to industrial enterprises;
- to encourage the use of technology in business through pilot experiences, technological demonstrations, and other research and dissemination actions;

[16] The MICINN website includes the following elements under the title 'technology transfer': Research results transfer offices (OTRI), PETRI projects, *Fomento de la Investigación Técnica* [technical research support], *Proyectos singulares y Estratégicos* [special and strategic projects] and science-technology networks. See http://www.micinn.es/ciencia/transferencia/

- to increase Spanish entrepreneurial involvement in national and international technological cooperation programmes;
- to raise the presence of SMEs in international cooperation projects and in the European Community Framework Programme for research, demonstration and technological development actions.

These objectives have remained part of the philosophy of the programme throughout its existence, although some slight changes have been made. In 2005 and 2006 the subsidy award procedure in support of Technology Centres underwent the most significant changes, such as:

- The ceilings of priority objectives were raised. The aim was now broadened from encouraging Technology Centre client enterprises to become more involved in European research and development programmes to stimulating the involvement of the Technology Centres themselves.
- In 2005, a new priority objective was introduced: to promote cooperation among Technology Centres so as to rationalise the use of existing resources and achieve the critical mass required to undertake certain technological development projects. In the final year of the life of the programme, this objective gave rise to a specific subsidy award procedure (subsidies to Technology Centres through partnership projects), as described in more detail later in this paper.
- From 2006 onwards, there was introduced the priority objective of supporting higher-risk projects involving greater technical complexity.

Under the terms of the first subsidy award procedure in the framework of the Horizontal Action in Support of Technology Centres, in 2000, Technology Centres were the sole class of eligible aid applicants. From 2001 onwards, the range of actors eligible for aid was widened; only Technology Centres could file applications, but the possibility was allowed that a company or non-profit entity involved in a cooperation project could receive aid under the programme.

In 2004, the class of potential beneficiaries of aid for cooperation projects was confined to Technology Centres on file in the CIT register created under Royal Decree 2609/1996, whereas in 2005 the class of eligible parties was again broadened to companies and non-profit groupings and associations. Also in this year, a limit was set on cooperation with public research bodies, and it was made a requirement that the ownership or the governing body of the applicant Technology Centre not rest with or be controlled by a government authority.

The types of project supported by this Horizontal Action remained virtually unchanged throughout the lifetime of the PROFIT scheme. The projects eligible under the first aid award procedure in 2000 included:

- Industrial research projects,
- Technical viability studies,
- Pre-competitive development projects,
- Technological demonstration projects,
- Special actions (dissemination, etc),

- Actions fostering involvement in international programmes,
- Socio-economic research projects, and
- Infrastructure-building projects.

From 2001 onwards, it became a requirement that candidate projects be listed on the applicant Technology Centre's annual action plan. The following year, this requirement was dropped for projects encouraging involvement in European programmes, so as to simplify the procedural steps entailed.

One of the project-related requirements introduced in 2004 was the condition that a candidate project have a minimum budget of €60,000. In 2005, this threshold for eligible projects was held in place, and a further threshold of €1 million was set for projects backed by borrowings.

Aid under the PROFIT scheme could be awarded concurrently with soft loans granted by CDTI, the industrial technology development centre, but the aggregate support could not exceed the ceiling set by the Community Framework for State Aid for Research and Development (96/C 45/06).

As to the types of aid available, the 2000 subsidy award procedure contemplated subsidies only. From 2001 onwards, the possibility was allowed that projects requiring new infrastructure could receive aid in the form of refundable advances; the predominant form of aid, however, continue to be the subsidy. In 2005, a ceiling was set on the cost of infrastructure for research and development projects (€200,000); above that ceiling, a project could receive support in the form of a loan instead of subsidies.

From 2005, projects of a duration exceeding one year became eligible for aid, thus encouraging more complex projects. The 2005 subsidy award scheme afforded coverage for the costs of projects scheduled for completion by 2007. In the 2006 and 2007 processes, the only allowable duration of a beneficiary project was cut down to just one year after the year of the award.

The forms of involvement allowed for PROFIT-backed projects were, throughout the lifetime of the programme, just two: individual or collaborative. In the first years of the programme, the form of involvement had no attached requirements. From 2004 onwards, however, involvement in collaborative projects was circumscribed to partners whose individual budget exceeded €18,000, and the total number of partners could not exceed six. In 2005, requirements were also imposed on the types of partners that could become involved in industrial research projects, viability studies and technological development projects; cooperation with public research bodies was barred, because these entities were beneficiaries of other forms of government aid. All these requirements applied to collaborative projects in all subsidy award processes conducted up to the end of the programme in 2007.

The following table summarises the main changes introduced to the programme over its lifetime.

Table 3: Summary of the main changes in the definition of the Horizontal Action in Support of Technology Centres under the PROFIT programme 2000-200 one 7

OBJECTIVES	From 2000: • Reinforcing Centres' R&D units • Encouraging business use of technologies • Increasing entrepreneurial involvement (especially by SMEs) in national and international technological cooperation programmes In 2005, widened to: • Increasing TCs' involvement in international programmes • Encouraging cooperation among TCs (partnership projects) In 2006, widened to: • Supporting projects involving higher technological risk
BENEFICIARIES	In 2000: • Sole applicants and beneficiaries: Technology Centres From 2001: • Beneficiary class widened to embrace enterprises, public research bodies and non-profit entities. In 2004: • Sole applicants and beneficiaries: CIT-registered Technology Centres From 2005: • Beneficiary class widened to embrace enterprises and non-profit entities. • Public research bodies excluded.
PROJECT TYPES:	From 2000: • Industrial research projects • Technical viability studies • Pre-competitive development projects • Technological demonstration projects • Special actions (dissemination, etc) • Socio-economic research projects • Actions fostering involvement in international programmes • Infrastructure-building projects In 2004: Support is dropped for socio-economic research projects. In 2005: Support is dropped for infrastructure-building projects. All project types allow for two forms of involvement: individual or collaborative. In addition: • From 2005: support given to multi-year projects • From 2007: partnership projects introduced as a new class

Source: Prepared by the authors.

CREA Sub-Programme of Creation and Consolidation of Technology Centres under the National Programme of Scientific and Technological Infrastructure Projects (National Research and Development Plan 2004-2007)

This sub-programme provides aid for the creation and consolidation of Technology Centres that have not yet attained to optimal thresholds of structure and performance, with a view to rationalising the map of technology centres in accordance with the needs of industry and mitigating the imbalance in the geographical location of existing Technology Centres and the entrepreneurial fabric. In addition, CREA seeks to ensure that the new Technology Centres meet or stimulate the emergence of fresh demand and do not curtail the demand now catered to by existing Centres. Newly created Technology Centres benefiting from the scheme must arise from entrepreneurial need and have the full backing of the devolved region in which they are located.

CREA gave continuity to the first subsidy award procedure in 2007 under Order ITC/2242/2007 for the creation and consolidation of Technology Centres, the objectives of which were the same as those subsequently adopted by the new National Plan.

The budget for aid granted under the CREA sub-programme in 2008 was €15,362,540, somewhat above the €9 million allocated in 2007.

The types of activities funded by this sub-programme include: Technical/economic viability studies for new Technology Centres or Centres seeking to cement their position; projects designed to create Technology Centres for those entities which at the time of application are non-operational; and projects for the consolidation of existing Centres in order that they reach the standard required by companies' technological demand.

The programme limits the duration of an eligible project: one year for viability studies, two years for Centre consolidation projects, and three years for Centre creation projects.

A Technology Centre created or consolidated under the aid scheme must satisfy a number of requirements: It must have its own legal personality, it must be privately controlled, and it must be non-profit; one of its principal objects must be the conduct of research and development and the dissemination of research results; a majority of its executives must come from private companies or business associations, and the presence of government authorities must always be in the minority; its profits must be allocated to fund the activities within the scope of its objects; and any entity must be able to benefit from its activities.

In addition, within five years -- for newly created Centres -- or within three years -- for consolidated Centres -- the following further requirements must be satisfied:

- at least 15 employees must be university graduates;
- direct billing to enterprises must account for 35% of the Centre's revenue, or turnover must have grown by at least 10%;
- the proportion of non-competitive funds must not exceed 30% of total revenue;
- revenue from research and development activities and technological consultancy must exceed 40% of total revenue, and the customer base must be on a rising trend.

Under the CREA sub-programme, the class of potential beneficiaries may, depending on the type of project, go beyond Technology Centres to encompass companies, associations and groupings (economic interest groupings or non-profit industry associations), and private non-profit research and development Centres.

Not all Spanish Technology Centres are eligible under the sub-programme. It covers only those regions listed in paragraph 3a of the Treaty Establishing the European Community (Andalusia, Canary Islands, Castilla la Mancha, Extremadura, Galicia, Asturias, Ceuta, Melilla and Murcia).

The aid on offer can take the form of a subsidy or of a loan. Depending on the type of project, one and the same participant may even be in receipt of both forms of aid. The aid is also compatible with other support from other national or European government authorities.

The loans are similar to those typical of other aid schemes. The maximum repayment period is 15 years, subject to the features of the specific project.

The costs susceptible of subsidy are those relating to the Centre's own research and development activities and those activities from which any enterprise may benefit.

As to assessment criteria, the viability study for a new Technology Centre or the consolidation plan for an existing one must analyse whether there is a need for the Centre, and must examine the value of its strategic goals.

Partnership projects [*proyectos consorciados*]. (National Research and Development Plan 2004-2007)

In the final year of the life of the programme, there appeared a new subsidy award process in support of Technology Centres through partnership projects [*proyectos consorciados*]. These new subsidies were intended to encourage cooperation among Technology Centres based in different devolved regions, to improve efficiency and reach a critical mass of resources required to undertake projects garnering high value-added for industry. The new award process was designed to support two types of cooperation:

- First, stable strategic alliances formed to make use of synergies and boost the volume of research on spearhead technologies for Spanish industry.
- Secondly, one-off partnerships for the purpose of high-risk technological projects with a potential high impact on industrial competitiveness.

The goal of this new form of support for Technology Centres was to create larger multidisciplinary teams, but also to enable Centres to break out of the regional limits within which they had hitherto operated. This cooperation was calculated to use the advantages of open science by generating new knowledge from existing knowledge, eliminate the duplication of effort and encourage technology transfer among geographically remote Centres. Support for such alliances was also in consonance with the 'Plan for Activation of Involvement in the European Framework Programme', since the newly formed consortia would be capable of undertaking the larger projects typical of that programme.

The projects to be supported by this new aid award process had to be industrial research or technological development efforts of considerable size. There was accordingly set a threshold budget for candidate projects of €1 million, a minimum duration of two years, and a requirement of involvement by Technology Centres based in at least three different devolved regions. Scoring looked not only to technological proficiency but also to the quality of the consortium. A range of restrictions on eligibility to file applications under the process was also put in place: a single Technology Centre could take part in no

more than two such projects, and its contribution to each could not be less than 15% of the total project budget.

INNOEUROPA programme

The InnoEuropa Programme arose in 2007 as part of the launch of Ingenio 2010, within the National Reform Programme towards fulfilment of the Lisbon Agenda. It was also one of the measures set in motion as part of the EUROINGENIO initiative to increase the Spanish returns under the Seventh European Research and Development Framework Programme.

The core aim of InnoEuropa is to raise the economic yield garnered by Technology Centres under the Seventh Framework Programme. That overall objective translates into the following specific objectives:

- Maintain or increase the 9% rate of return achieved by Technology Centres in the Seventh Framework Programme.
- Bolster the leadership of Technology Centres in projects under the Seventh Framework Programme.
- Encourage the involvement of Spanish companies in consortia under the Seventh Framework Programme by promoting the recruitment to these efforts of new enterprises.

A candidate Technology Centre must present a Strategic Action Plan for involvement in the Seventh Framework Programme, setting out ambitious goals that entail a quantitative and qualitative leap.

Only Technology Centres on record in the CIT register created by Royal Decree 2609/1996 are eligible; the forms of involvement include individual projects and projects partnering more than one Technology Centre. The aid takes the form of a non-refundable subsidy.

The InnoEuropa budget for the period 2007-2008 was €3,700,000.

In addition, national research and development plans encompass a whole raft of programmes that in one way or another impinge on the system of knowledge transfer in general and the technology services market in particular. These programmes are to be borne in mind in the context of any analysis of the behaviour of the technology services market. The PROFIT and InnoEuropa schemes discussed above have therefore operated alongside *Proyectos Singulares y Estratégicos*, the PETRI programme, the *Fomento a la Investigación Técnica* programme (driver projects) or the CENIT programme, launched in the framework of the Ingenio 2010 strategy. And in the period 2000 to 2007 a whole range of horizontal measures led to the creation and support of technology-based enterprises and support for the creation and functioning of interface units.

Regulatory measures:

- Community Framework for State Aid for Research, Development and Innovation,[17] setting out the limits as to purpose and intensity of incentives.[18]
- Patents policy: Patents are a means of transforming knowledge into an asset, which can later be transferred and traded on the technology services market. This paper uses this perspective to examine patents policy in Spain and the actions of Technology Centres in this field.
- The register of public research bodies created under the Order of 16 February 1996 of the Spanish ministry of education and science.
- The Innovation and Technology Centres Regulations enacted under Royal Decree 2809/1996.

National government measures planned for the period 2008-2011

These measures are not of course the subject matter of this evaluation, but it is nonetheless necessary to identify the principles that are to guide the policies and incentives surrounding knowledge transfer and support for Technology Centres in the next four-year period of the 2008-2011 National Plan of Scientific Research, Development and Technological Innovation. The Plan will be implemented through six instrumental lines comprising 13 National Programmes and five Strategic Actions or Programmes. The following measures emphasise knowledge transfer:

Under Instrumental line 1 on **human resources**	Support for the recruitment of technical staff dedicated to research outcomes transfer work at research outcomes transfer offices (OTRIs).
Under Instrumental line 2 on **research and development projects**	Support for knowledge transfer from research teams to the economic fabric (continuation of the PETRI programme) and incentives for collaborative applied research and experimental development. The aim is to support entrepreneurial projects conducted in cooperation with the public research institute, which may involve actors such as the technology centres and technology parks.
Under instrumental line 4, **scientific and technological infrastructure**, through the sub-programme for special scientific and technical installations (ICTS)	Creation of new experimental units, equipping them with the required infrastructure. Such units are intended to reinforce integration among scientific and technological actors (enterprises, technology centres, universities and public research bodies) with the focal point of significant actions, the successful completion of which entails high levels of technical or commercial risk and a minimum budget of €6 million per project.
Under under instrumental line 5, **use of knowledge and technology transfer**, through the national programme of value enhancement and promotion of technology-based enterprises (JEI).	To supplement the NEOTEC initiative, as a venture capital tool designed to reinforce newly created companies.

[17] The framework now in force is set out in document 2006/C 323/01 (OJEC 30.12.2006).

[18] Article 87 of the EC Treaty provides that any aid granted by a Member State in any form whatsoever which distorts or threatens to distort competition by favouring certain undertakings or the production of certain goods shall, insofar as it affects trade between Member States, be incompatible with the common market. Aside from this general restrictive principle, Community law allows the grant of some forms of aid required to foster sustainable growth and jobs. The Commission takes the view that aid to innovation should be authorised as a function of the measures it is intended to implement, for specific activities unequivocally directed to rectify market failures, the benefits of which amply offset any detriment that might be caused to competition and trade.

Under instrumental line 6, **system articulation and internationalisation**:	National networks program, national programme for public-private cooperation, and CENIT, the programme for national strategic consortia in technical research.
Programme of science and technology parks	The purpose of this program is to encourage the creation of knowledge transfer networks and technology-intensive enterprises in these physical spaces (CEIPAR programme).

A key development in the articulation of this complex of measures was the creation in April 2008 of the Spanish ministry of science and innovation (MICINN),[19] with powers regarding universities, knowledge transfer and science and technology policy. MICINN's recent initiatives include the issue of an Integrated Knowledge Transfer Plan intended to update and enhance the value and the transmission of knowledge in the system. The core goal of the plan is to shorten the interval between the generation of knowledge and its use in the business value chain. The plan hopes to influence actors, raise the effectiveness of transfer structures, improve the management of available instruments and later reduce the regulatory burden.

It is expected that the plan will instantiate an attempt to modernise the regulatory framework of knowledge generation and transfer, to reinforce public-private alliances, and to bolster the policies in support of human resources, infrastructure, innovation and the entrepreneurial capability of scientists and technology specialists.

MICINN has accordingly created the knowledge value enhancement and transfer team, which held its first full meeting on 26 June 2008. The team is divided into three working committees, addressing the following areas of concern: The structure and business of public research bodies; new processes of transfer, value enhancement, and marketing; and the evaluation of the technological merits of human resources.

[19] Created by Royal Decree 438/2008, of 14 April 2008.

3. EVALUATIVE APPROACH

As indicated earlier, this evaluation has focused on knowledge transfer through the Spanish market in technology services by examining the effectiveness of national government interventions impinging on that market, and particularly on Technology Centres. Special attention is paid to the effects of measures encouraging complementarity and synergies among Technology Centres and the rest of actors supplying services on that market, particularly universities and public research bodies. The implementation of the PROFIT scheme directed to Technology Centres in the period 2000 to 2007 is evaluated with regard to its effectiveness in relation to its stated objectives. An evaluation is likewise undertaken of the extent to which lessons learned from the various subsidy award processes have informed subsequent policy.

Annex I describes the evaluation tools used. Such instruments include documentary analysis and bibliographical review of the concepts of knowledge transfer and technology transfer used in this paper; an analysis of the legislation and policy deployed by the national government since 2000; an analysis of the available data about the implementation of the main aid programmes evaluated (the PROFIT scheme for Technology Centres in particular); interviews with executives and experts; and, finally, an expert panel, given a brief to scrutinise the main conclusions drawn from these enquiries. In addition, the evaluators have had the support of two consultancy interventions; one produced a detailed study of the market in technology services; the other focused on analysing the implementation of the PROFIT programme for Technology Centres.

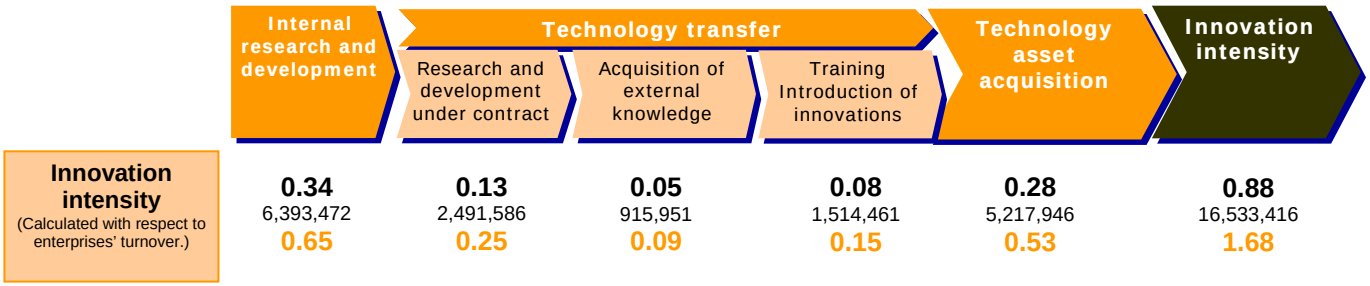
4. ANALYSIS AND EVALUATION OF NATIONAL GOVERNMENT MEASURES FOR THE IMPROVEMENT OF THE SYSTEM OF KNOWLEDGE TRANSFER TO ENTERPRISES AND SUPPORT FOR TECHNOLOGY CENTRES

4.1. The problems of the market in technology services and the measures designed to improve its functioning

The experts consulted for the purposes of this evaluation accorded special significance to the mismatch of supply and demand, and to the fact that many SMEs do not have recourse to the technology services market through unawareness or perceived lack of need.

On the **demand** side, many SMEs do not regard knowledge as a competitive advantage, nor that competitive edge as anything to do with the business process. They rarely perceive knowledge (ie, technology) as an investment likely to garner returns on the market. This may be the reason why SMEs undervalue technological goods and services and are reluctant to pay market prices for them. This would explain why companies underuse the mechanisms of knowledge transfer in comparison to other innovation-related activities.

Graph 9: Innovation intensity in Spain



Source: INE [Spanish Statistical Institute] Survey of technological innovation in enterprises 2006. In bold type, as a percentage of turnover. Absolute values, figures in thousands of euro, In orange type, as a percentage of Spain's GDP

The Spanish technology services market is hence characterised by sub-optimal demand from enterprises, owing to the 'timidity' with which they regard that market or to their lack of awareness of its very existence, particularly among the smallest companies -- those with fewer than 200 employees. These companies do not go to the market in search of technological services so much as in the hope of finding solutions to their immediate problems. These perceptions constitute an initial barrier to SMEs' entering the technology services market and to suppliers of technology services to businesses. This barrier is manifest in the use of a different language and in an asymmetry in the perception of needs and of the goods and services on offer to meet such needs: the language of solutions to problems as against the language of the supply of scientific and technological knowledge that cater to market needs.

SMEs need technological supply to be more visible, more accessible and more closely in accord with their needs, in the form of adapted solutions.

As to these demand-side problems, government intervention has sought to encourage business demand for research and development services, particularly from SMEs, chiefly through the PROFIT scheme, and to reinforce suppliers' knowledge-generation capabilities and output.

As to the difficulties on the supply-side of technological services -- where many agents are also knowledge generators -- there is poor coordination in the system of transfer and a need for better articulation in the stock of transferable knowledge. There are no overarching management and professional models for the generation, upkeep and transfer of patents. On the supply side, a closer link should be formed between generated knowledge and goods and services that enterprises will be able to sell, so as to attract demand and encourage buyers to pay the true value that that knowledge will earn them in terms of higher competitiveness in the markets, higher turnover and higher profit.

One programme that set out as one of its express objectives the promotion of cooperation among system actors -- in particular, enterprises and knowledge-generating bodies -- was the CENIT programme, launched by the national government in 2005 in the framework of the Ingenio 2010 strategy. The CENIT programme funds large, integrated strategic industrial research projects with far-reaching scientific and technical implications, geared toward planned research in technological areas exhibiting attractive future prospects and a potential for international expansion.

Under the CENIT scheme, project leaders -- large companies and a number of associated SMEs -- must sub-contract half of the subsidy received from the CDTI (50% of the total cost of the project) to research bodies. This feature is generating a large market for commissioned research services, to the benefit of universities, public research bodies and Technology Centres.

Data are not yet available as to how these partnerships are working in practice. However, their composition (an average of over 15 research bodies or teams each) and the mechanism of mandatory subcontracting appears to have split the new market among the various actors; it seems to have failed to bring about a sharing of resources in such a way as to encourage complementarity and synergies among actors taking part in consortia.[20]

It is important to consider the role of the State as a provider of incentives for the supply of technology services and as a promoter of the use of such services by an atomised demand side made up of SMEs, against the background of a market in which competition with the private sector in terms of prices and service standards should be regarded as salutary, given their social function.

[20] See the Agency's evaluation dated 2007 of the Ingenio 2010 programme, referenced above.

In the light of the problems seen in the functioning of the technology services market, government intervention should play a twofold role. On the demand side, government should encourage SMEs to incorporate technological goods and services to their economic processes by making such services visible and accessible -- in other words, by creating the market. In a complementary way, on the supply side government intervention should help organise supply, give the market a rational pattern and enhance its transparency, in order to bolster the value of technological services and their underlying knowledge products.

4.2. The behaviour of Technology Centres in the market in technology services and specific measures of support for Technology Centres

4.2.1. The involvement of Technology Centres in the technology services market and their market orientation

From 2002 to 2007, an average of 19,000 companies contacted Technology Centres as prospective purchasers of technological services, and 2,500 companies commissioned Technology Centres for research projects, according to data provided by FEDIT, the Spanish federation of Technology Centres. In relative terms, this average figure of about 21,500 client enterprises[21] retaining services from Centres represented 43.5% of the number of innovative enterprises identified by the 2006 Survey of Technological Innovation in Enterprises conducted by the Spanish Statistical Institute. These figures bear out the importance of the role of Technology Centres in the Spanish technology services market, and their significance in any prospective bid to increase the number of innovative companies swiftly and successfully (in 2007, the percentage of innovative SMEs in Spain was still only 84.4% of the Community average).

As indicated in the second chapter, Technology Centres operate in the market segments covering the following technology services: testing, analysis, training and advisory services, technological information and alerts, and support for production, research and development, chiefly in the form of commissioned research and development. For the sake of simplicity, all these segments together will hereafter be referred to by the generic term STIDI [the Spanish acronym for 'technological and research, development and innovation services']. In 2006, STIDI services accounted for 18.2% of the technology services market in Spain (Annex VI). In that same year, Technology Centres billed €432 million, signifying a 6% share of that market.

Out of the market addressed by Technology Centres, the market segments relating to testing, commissioned research and development and information services performed best in terms of gross value-added as a proportion of business volume (cf table in chapter 2.1.2) . This fact suggests that Technology Centres' positioning in the technology services market is appropriate, insofar as their activities focus on the three segments carrying the highest relative value-added.

[21] Of these, about 10,800 companies (50%) were also partners or associates, meaning that the remaining 50% accounted for 'pure clients'.

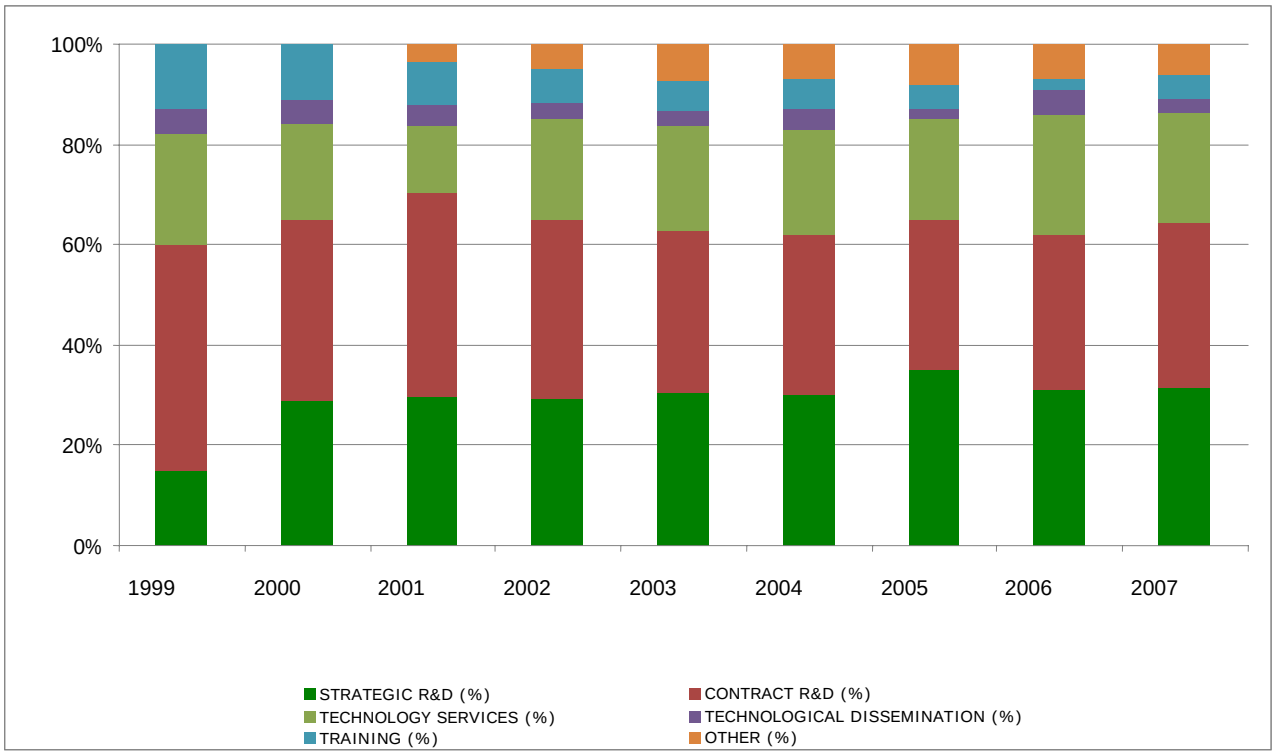
As suppliers of technology services to enterprises, Technology Centres' activities follow a rational pattern, in that they combine their foundational objects of public service with the optimisation of their income statements. Their main goal is to achieve a wide-ranging and diverse customer base. This explains why they increasingly look beyond their original geographical setting and their specific focus on SMEs in order to optimise their use of installed capabilities and to widen their range of sources of income.

Technology Centres have made a significant contribution to reinvigorate their immediate territorial environs. This is revealed by an analysis of their origins and their functional and geographical fields of action, as described in chapter 2. From a strategic standpoint, however, their objective should be to cater to a broader and faster-moving nationwide market in technology services to enterprises, stimulated by public policy.

The development and trends in Centres' portfolio of services: technology generation versus technology services

The composition of Technology Centres' portfolio of services has evolved over time in step with the entrepreneurial and social demands of their host communities, as disclosed by the shift in the proportions of income from each type of activity.

Graph 10: Shares of revenue by activity type at TCs



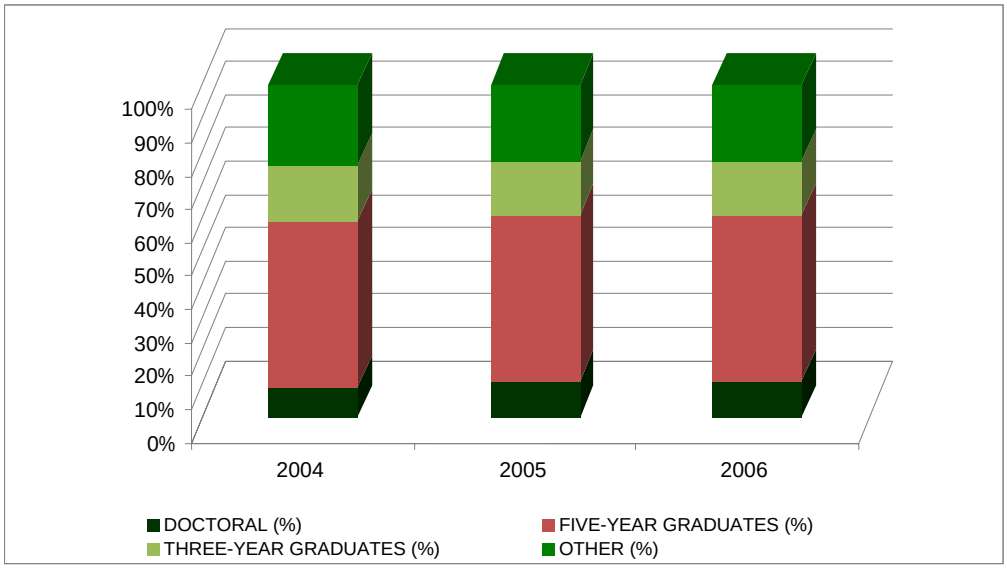
Source: Prepared by the authors on the basis of FEDIT data.

As shown above, Technology Centres' main source of income is research and development, whether strategic[22] or under contract from companies. Among the latter projects:

- Project complexity and technological ambition have both risen. The growth in strategic research and development activities has enabled Technology Centres to undertake higher-risk lines of research to generate knowledge intended to be of use to enterprises in the medium and/or long term.
- The proportion of revenue coming from commissioned research and development has held steady in relative terms, although annual absolute revenue has increased. Some activities have declined in relative importance, such as training and dissemination, giving way to the emergence of other technology services, such as the conduct of standardised tests and strategic research and development activities.

The following graph shows that the past few years have seen a widespread rise in the number of Technology Centres' employees. The proportion of employees holding doctoral qualifications has increased in step with the rise in the technological ambition of Technology Centres' internal research and development, as mentioned above.

Graph 11: Staffing of Technology Centres



Source: Prepared by the authors on the basis of FEDIT data.

According to FEDIT data, in 2006 research and development activities represented 62% of Technology Centres' revenues, distributed 50:50 between strategic projects and projects under contract. As much as half of Centres' research activity, therefore, is intended to maintain and augment their capabilities (in-house

[22] Internal or in-house research and development, regarded as strategic or in the public interest for the ambit (industrial sector, geographical area, etc) in which the Technology Centre operates.

research and development and knowledge generation); the other half is provided as a service to enterprises in the form of commissioned research and development.

In 2006, 31% of Centres' revenues came from the provision of technology services such as consultancy, testing, prototypes and services relating to obtaining and managing information of interest to client companies. Dissemination activities accounted for 5% of revenue, while the remaining 2% was accounted for by training.

Although only a short time series of four years is available -- so that no trend can be affirmed with certainty -- the data do seem to suggest that Centres' rising income from in-house research and development, chiefly as a result of involvement in government-sponsored knowledge generation programmes, has been offset by a decline in revenue from services, with commissioned research and development and the dissemination-training pairing holding steady.

The Technology Centres' willingness to undertake knowledge generation might suggest that their traditional role as transfer agents should be reconsidered. Based on their scientific and research capabilities, Technology Centres should be able to take part in government programmes at a higher level.

If the possible trend mentioned above is confirmed, Technology Centres can be seen as evolving into knowledge generators rather than remaining as mere transferors of knowledge. The absolute value of commissioned research and development revenue has risen over the reference period, but its relative weight in Centres' aggregate revenue has stabilised; this may indicate that very few or no additional enterprises ask for this service. The figures would thus reflect rotation in the customer base rather than growth.

The Technology Centres' market orientation could itself be made the object of government incentives as a means to facilitate the access of SMEs to the technology services market. The objectives pursued here would be to raise the visibility of Centres with respect to SMEs and to bring Centres' supply of services in alignment with SMEs. It would fall to the Technology Centres themselves, moreover, to increase their own commercial positioning efforts by undertaking more intensive promotion of their services to enterprises.

Cooperation versus competition of Technology Centres with enterprises, universities and public research bodies

Given the structure of supply on the market in technology services, as described above, and given the way that the Centres' portfolio of services has evolved, it seems that the potential market for universities, public research bodies, Technology Centres and advanced service providers is one and the same. There is therefore a potential for relations of both cooperation and competition among these actors, through their operating in the same market segment or through their taking part as beneficiaries or implementers of government incentives and programmes.

The argument is plausible that higher competition arises among suppliers of knowledge services, but a similar argument applies to the opportunities for cooperation in the form of networks, alliances and public-private partnerships.

In step with the rise of enterprises seeking technology services, and as a function of the direction taken by government bodies' knowledge transfer incentive policies, cooperation may emerge among universities, public research bodies, Technology Centres and enterprises to 'go to the market of entrepreneurial needs' in the three fields embraced by knowledge transfer policy:

- Training of qualified human resources,
- entrepreneurial initiative (in its twofold aspects of increased business investment in internal research and development and creation of new technology-based enterprises),
- and enlargement and improvement of the functioning of the technology services market.

The market segment that sees the highest intensity of competition and cooperation among universities, public research bodies and Technology Centres as supply-side actors is the market in research under contract. In 2006, the Spanish market in commissioned research was worth €1.5 billion, or €3.5 billion if one counts the value of related technological innovation services. As shown in the following table, this further product is provided by all actors on the supply side:

Table 4: Involvement of various agents in research and development under contract

R&D contractor	Amount in 2006 (€ mn)	%
Miscellaneous[23]	855.7	55.6
Universities, OTRIs	428.0	27.8
Technology Centres	134.8	8.8
Public research bodies	119.2	7.8
Total	1537.7	100.0

Source: *Technology Centres, FEDIT annual report 2006; Universities, OTRI 2006 network report; public research bodies, INE R&D survey 2006; Total, INE R&D survey 2006*

In this segment, competition is at its most intense in the arena of national government subsidy award processes: it is very rare for different actors to come together to propose a combined response to enterprises' needs.

Technology Centres could operate as technology generators mainly on schemes of cooperation or public-private partnership, and as promoters of knowledge-intensive enterprises.

[23] Rest of actors: Advanced service companies, other enterprises.

4.2.2. Financial support measures for Technology Centres: The PROFIT programme for Centres (2000-2007). Other measures aimed at Technology Centres

PROFIT programme for Technology Centres

The incentives under successive National Research and Development Plans for Technology Centres through the PROFIT scheme since 2000 are a reaction to the role of the Centres as providers of services to enterprises.[24]

Technology Centres have been able to access all programmes under the National Plans as promoters, partners or users; in addition, they have benefited from lines of support specifically designed for them. The PROFIT scheme has thus allocated resources with a view to encouraging the supply of services to enterprises from Technology Centres, cooperation among Centres, viability studies for new entities (CREA program) and expansion of capabilities at existing Centres.

The allocation of resources to Technology Centres from the national government has sought to make up for the shortfall in scientific and technical public assets and to counteract the pressures selecting against SMEs, such as information asymmetries in the technology services market. As indicated above, such information asymmetries are often a reflection of the intangible nature of some of the services provided and of their uncertain outcome, as in the case of research and development under contract; an enterprise may fail to perceive the true value of the service and thus be unwilling to pay a price in consonance with that value. From 2000 to 2007, the initial focus of the PROFIT scheme was maintained despite changes of government and officeholders. The main goal has been to fund an increase in the technological capacity of Technology Centres as a means to widen the supply of services to enterprises.

Implementation of the Programme

Throughout the period under evaluation, the class of potential beneficiaries of the PROFIT scheme has not remained invariable. Originally, the only potential beneficiaries were the Centres themselves; but in the 2001 subsidy award process the scope of potential benefits was widened to enterprises and non-profit entities. In 2004, the PROFIT scheme was again restricted to Centres -- with the additional requirement that they be registered with the ministry of education and science. In 2005 the former regime was reinstated, and the participation of public research bodies was made subject to restrictions. There appears to have been a lack of clarity as to who was to be a beneficiary under the programme, and some doubt as to how properly to delimit access to the awards.

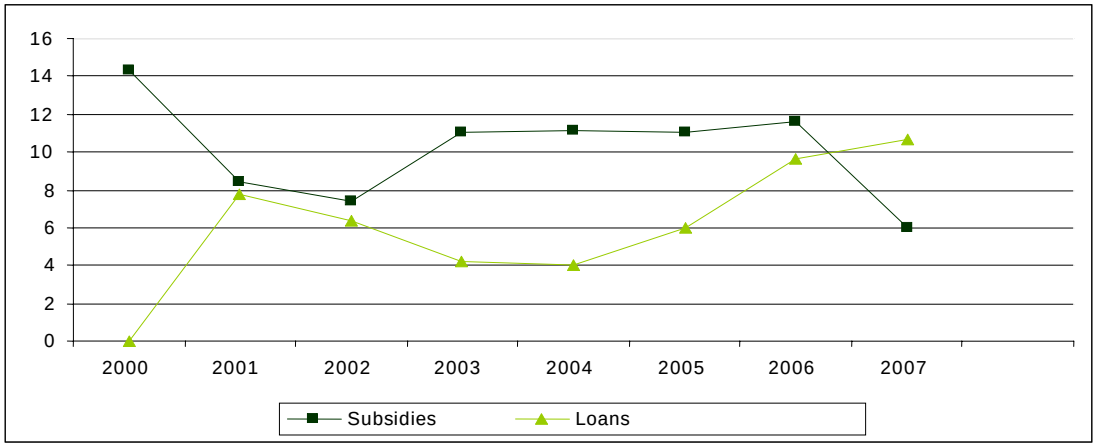
Examination of the subsidy award processes and their terms and conditions reveals difficulty in determining the compatibility of different sources of government support for one and the same action: the compatibility of the PROFIT scheme with other government subsidies. Potential beneficiaries may not have been given a

[24] A compendium of the incentives available to the Technology Centres is set out at: http://www.ipyme.org/IPYME/es-ES/CentrosTecnologicos

sufficiently clear criterion as to whether a given action was eligible for funding by one or the other of the two available financial modes: subsidies or interest-free loans. As an exception, the 2005 process set a ceiling on the cost of infrastructure (€200,000); above that ceiling, a project could only receive support in the form of a loan.

Loan terms have become more favourable for borrowers (in 2005 the grace period was lengthened from 2 to 3 years and the repayment period from 7 to 10 or 15 years), but the budgetary funds available for lending have been difficult to place, given beneficiaries' preference for subsidies. In practice, from 2000 to 2007, 67.6% of aid was granted in the form of subsidies, and 32.4% as refundable loans.

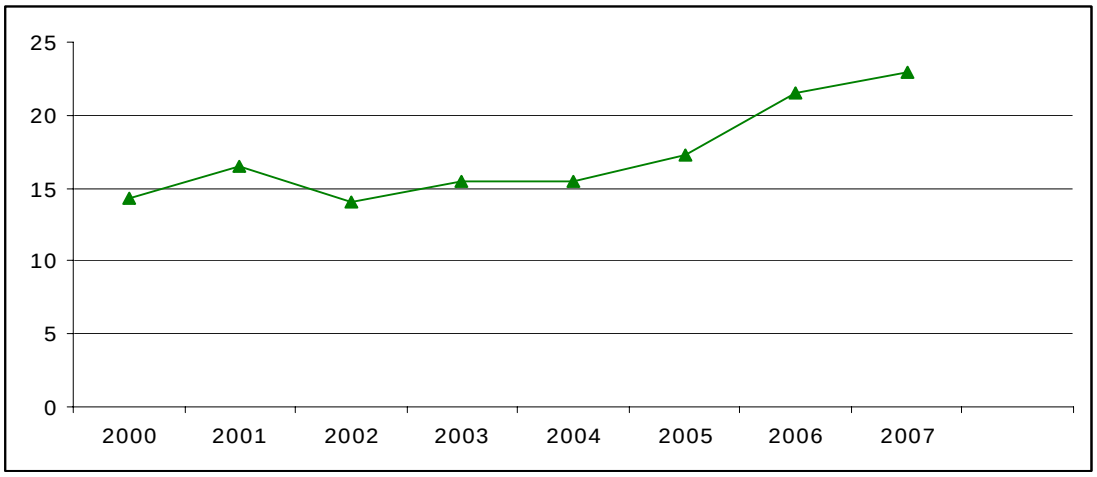
Graph 12: Aid under the PROFIT-Centres programme, by nature



A further difficulty has been a fluctuating criterion as to whether two-year projects ought to be eligible for funding, or whether aid should be limited to the current year: this, too, may have faced applicants with greater uncertainty. This must be viewed in relation to the requirements for access to government support under the PROFIT scheme, particularly as regards early collection of subsidies and, in certain cases, the need to provide a guarantee. These requirements have been superadded to the administrative procedure of management, mandatory records and other steps that intervene between an applicant's reading the terms of the award process in BOE, the Spanish national government gazette, and the final use of the funds for the planned action. In this regard, the procedures for the award of aid under the National Plan should be simplified as far as practicable.

The national government' s cumulative budgetary allocation for the period 2000 to 2007 to the PROFIT scheme was €150.4 million (67% of subsidies and 33% as refundable loans).

Graph 13: Amounts awarded as aid under the PROFIT-Centres programme



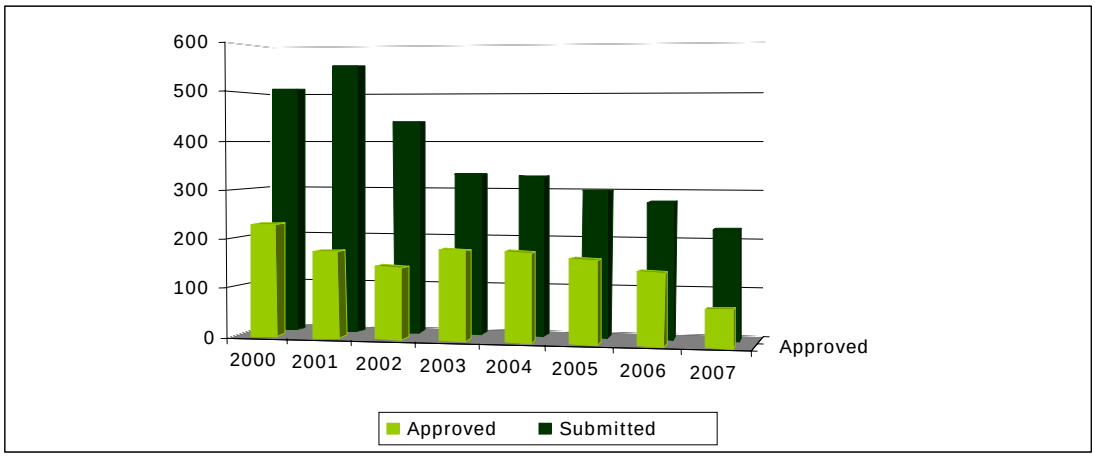
As a rule, these funds have been used in support of individual or partnership projects promoted by Technology Centres, usually in cooperation with enterprises. In relative terms, funds granted by the national government have accounted for a quarter of Technology Centres' income from all government sources, and 11% of their total revenue. This fact gives an idea of the limited significance of national government policy for Technology Centres, at least in quantitative terms. This state of affairs calls for reinforcing the synergies among these interventions, and, more broadly, between national government policy regarding Technology Centres and the policies of the devolved regions. The aim here would be to avoid duplication and overlap and to prevent clashes of objectives, by encouraging joint programmes, for example.

Throughout its execution, the PROFIT scheme has been subject to the financial monitoring inherent to the laws and regulations on the management of subsidies and loans. However, like the rest of programmes under the National Research and Development Plans, it has not been subject to any systematic mechanism of follow-up of outcomes and impacts. This is an area for improvement with a view to the implementation of the 2008-2011 National Plan. The Ingenio 2010 programme under axis 4 of the NPR recognised this need and established a new integrated system of follow-up and evaluation (SISE).

As to the outcomes of the programme, given that the actions funded by the PROFIT scheme had budgets of up to €1 million and that infrastructure costs of up to €200,000 were eligible for funding, the programme results indicators set out in Annex VII can be regarded as acceptable:

- 43% of proposals succeeded.
- 57% of the maximum possible aid was achieved if the funds were to be allocated to infrastructure, with a minimum 11.5% for any successful proposal.
- Average aid was €441,100 for the 'average technology centre' submitting a proposal for the maximum allowed budget.
- On average, 44% of the budget applied for was finally awarded.

Graph 14: Applications for aid under the PROFIT-Centres programme



Source: Prepared by the authors.

As revealed by the above graph, the number of successful applications declined from 2004 onwards; that downward trend became steeper in 2007. Given that, as shown in graph 12, the budget appropriations to subsidies had in fact risen over the period, one explanation might be that the average funding for each successful application was higher than in other years. This would fit in with some of the changes detected in project features over the course of the various annual award processes, as described in chapter 2:

- From 2006 onwards priority was given to projects carrying higher technological risk.
- In 2005 projects involving cooperation among Centres were encouraged (partnership projects).

Application success rate	43.90%
Average subsidy award	€78.100
Average loan value	€44.900
Total average aid	€115.400
Unit aid per TC	€441.100

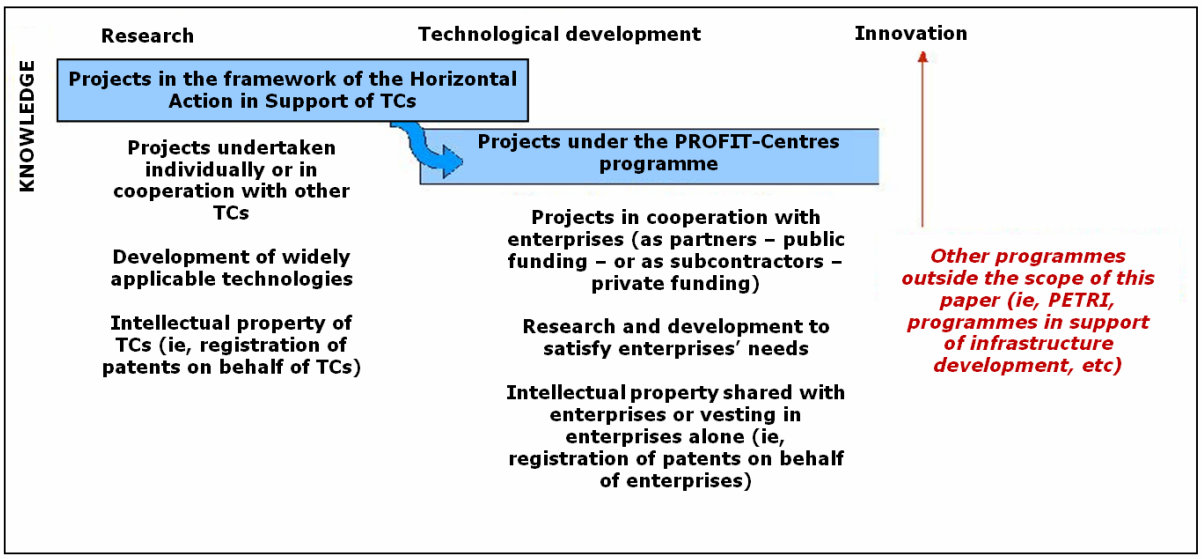
Programme effectiveness

As a general rule, Technology Centres have used the Horizontal Action for the purposes of their internal or strategic research and development, in order to generate new knowledge that would enable them to keep competitive in the innovation market and provide better services to enterprises. They have used this programme to support those of their research projects that lay furthest from the market (pre-competitive research or industrial research) so as to generate knowledge that would serve as the seeding-ground for future research and development projects commissioned by enterprises, or undertaken in partnership with them, hitherto conducted in the framework of the PROFIT scheme for enterprises. It was accordingly the PROFIT scheme for enterprises that Centres used as the national government's main instrument to transfer the results of Centres' research and development to enterprises, by conducting applied research

projects and development and demonstration projects. Against that background, the projects completed under the auspices of the Horizontal Action in Support of Centres were mostly individual efforts. Where cooperation was present, it was carried on with other Technology Centres. Cooperation between Centres and enterprises was carried on under the PROFIT scheme for enterprises.

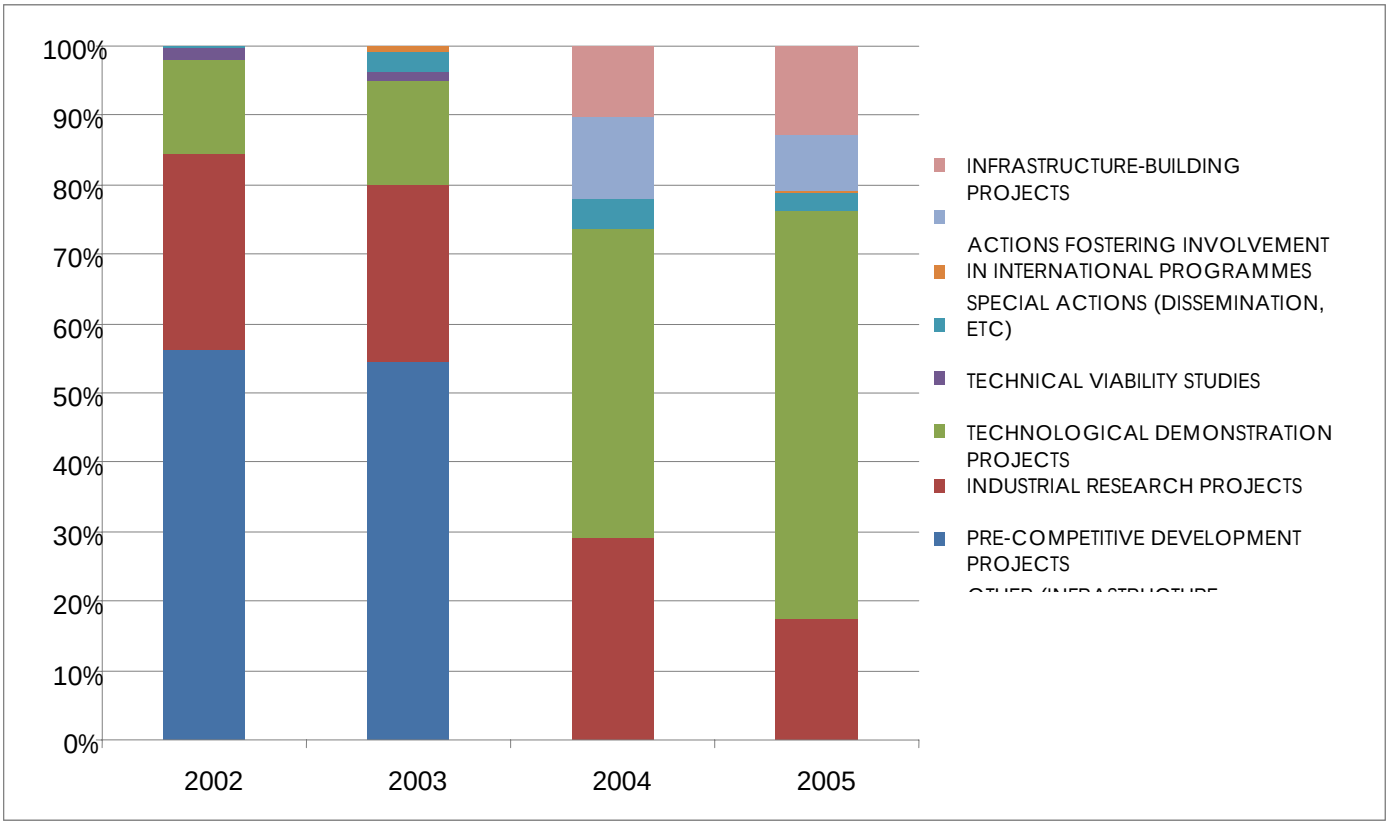
Here, Technology Centres could become involved in two different ways:

1. As participants in cooperation projects with enterprises, receiving aid in proportion to the eligible part of their participation. The Centre would use this option as an intermediate solution between the Horizontal Action and acting as a subcontractor to an enterprise if the Centre had some strategic interest in the results of the project and in holding intellectual property rights over them.
2. As as a subcontractor to an enterprise, to provide a development service in a project in which the Centre had no strategic interest.



Leaving aside the changes to the amount of aid and a number of shifts in application assessment criteria, financial support has been accorded systematically to actions such as: pilot experiences, viability studies, technological demonstration projects, certain infrastructure, dissemination actions, technological cooperation among enterprises and among Centres, and support for the presence of SMEs in international programmes (the priority being the EU Framework Programme).

Graph 15: Change in types of project funded

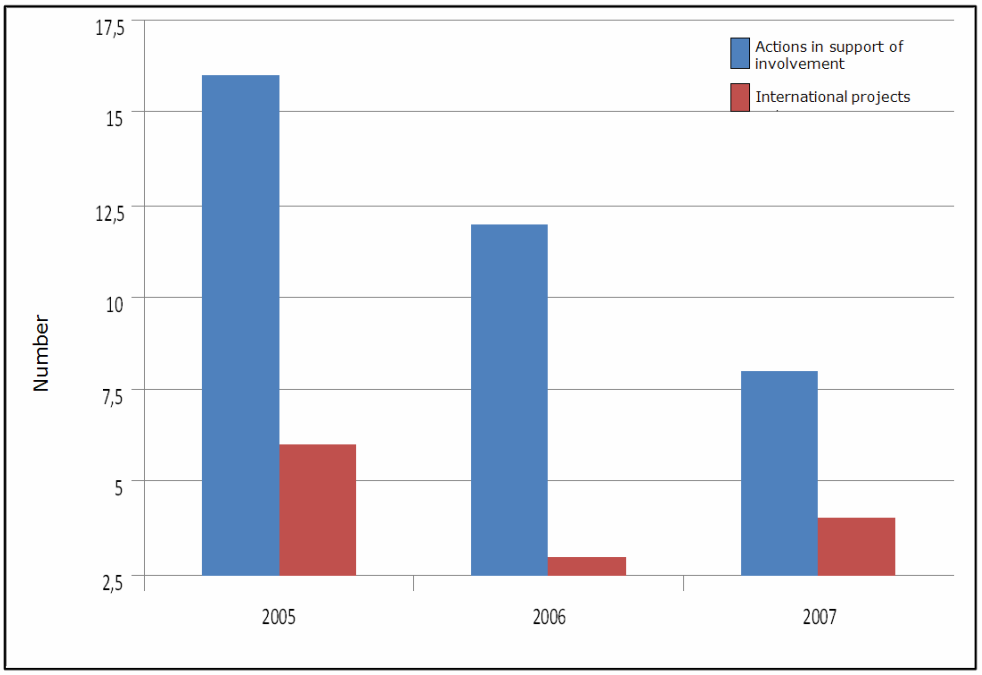


Source: Prepared by the authors based on research and development annual reports. From 2005 onwards, these disclosures are no longer made in R&D annual reports, nor have these details been ascertainable using other sources.

The funding of projects of this kind operates in support of some of the programme's objectives, such as bolstering the research and development units of Centres providing services to enterprises.

Another objective was to support the involvement of Technology Centres and SMEs in international programmes. Itemised data for all actions in support of involvement in international programmes and projects as strictly defined are available only for the period 2005 to 2007, when this particular objective became a high priority of the programme. The historic data are shown in the following graph, showing that actions in support of involvement outnumbered international projects, which generally took the form of Eureka and Iberokea projects.

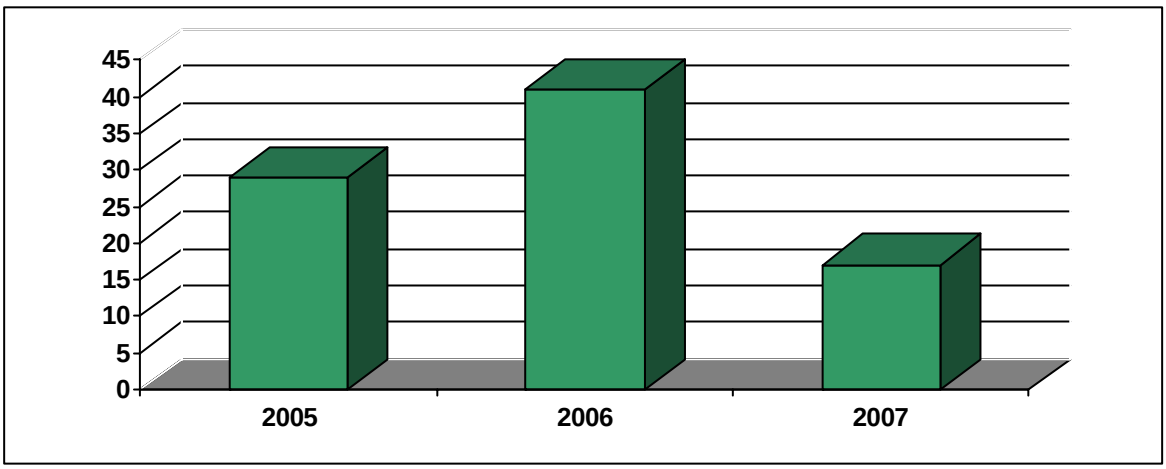
Graph 16: Types of international activity funded by the Horizontal Action in Support of Technology Centres



These projects are generally undertaken by a single Technology Centre. It can accordingly be said that the Horizontal Action in Support of Technology Centres has made no special contribution to the involvement of SMEs in international programmes. Involvement by Centres, however, has been encouraged partly by these actions.

In the 2005 award process, a new priority objective of the Horizontal Action was introduced: to promote cooperation among Technology Centres so as to rationalise the use of existing resources and achieve the critical mass required to undertake certain technological development projects. From 2005 to 2007, a great many projects were conducted collaboratively, as revealed by the following graph. Most such cooperative projects were carried out by two or more Technology Centres. Involvement in these collaborative projects by enterprises and/or associations was in evidence only to a limited extent.

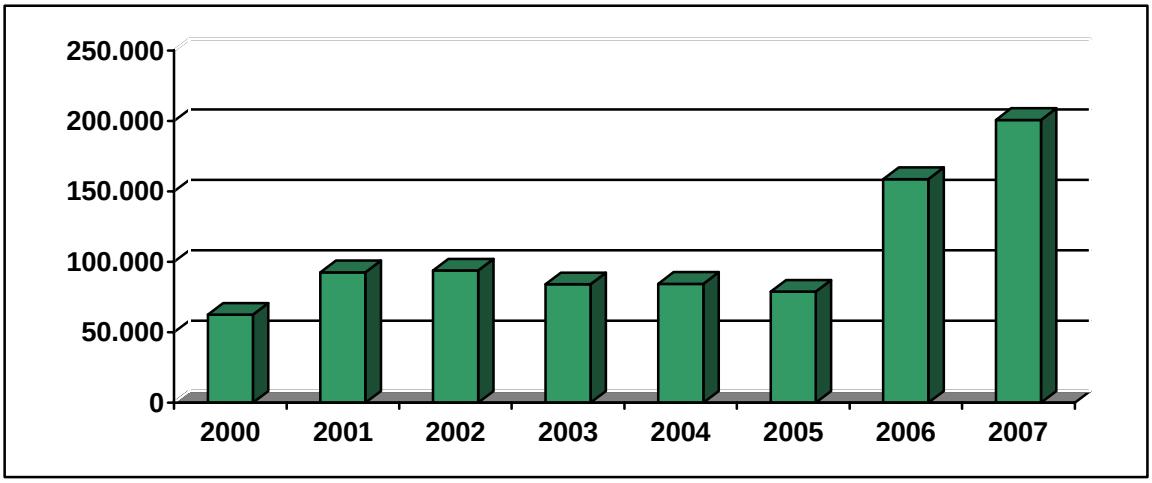
Graph 17: Number of collaborative projects attracting funds over the various annual award processes of the Horizontal Action in Support of Technology Centres (prepared by the authors)



Source: Prepared by the authors.

The development of the size of the PROFIT-funded projects, represented in the following graph, may disclose whether the priority given to support projects carrying higher technological risk and complexity (as first attempted in the 2006 award process) had any effect.

Graph 18: Change in size of projects attracting funds over the various annual award processes of the Horizontal Action in Support of Technology Centres (prepared by the authors)



The sharp increase in the average size of projects funded in 2006 and 2007 may reflect higher technical complexity. In these years, what is more, many of the subsidised projects exceeded one year in duration, which would be consistent with greater size and complexity.

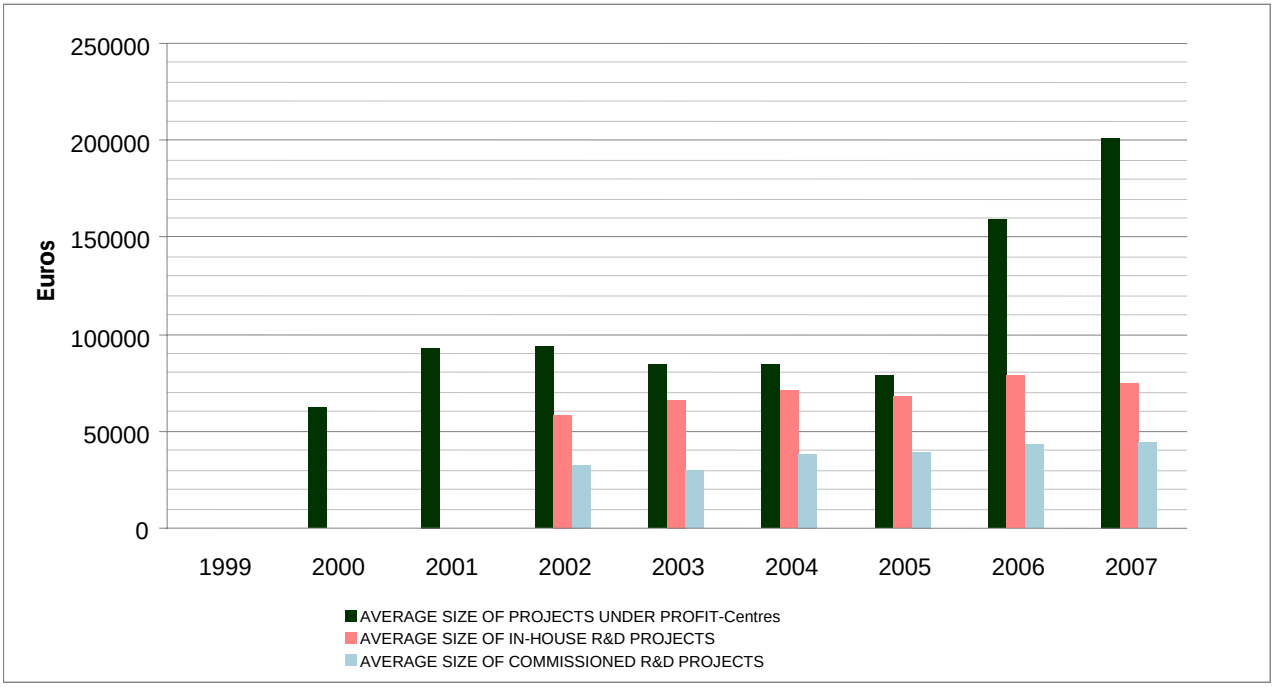
One of the main purposes of this evaluation is to ascertain the extent to which the Horizontal Action in Support of Technology Centres of the PROFIT programme has enhanced the Centres' technological capability, and whether any improvement has been made to the effectiveness of technology transfer to enterprises.

The indicators that best represent increased technological capability at Technology Centres are:

- The size of the projects that they undertake. As an entity acquires higher technological capability, it is able to address technically more ambitious projects.
- The development of Centres' portfolio of services, as discussed above. The increased relative significance of Centres' research and development activity (as against, for example, technology services and training) also suggests enhanced technological capability.
- The number of patents registered by Technology Centres, and their citation indexes, as a means to gauge the quantity and quality of the research and development performed and of the Centres' ability to transfer technology.
- The development of Centres' staffing, particularly as regards number of researchers.
- The volume of investment in infrastructure as a strategy to establish a sustainable competitive edge in technological capability.

The following graph shows the history of the average size of Technology Centres' strategic and commissioned research and development projects as compared to the average size of the projects funded by the Horizontal Action in Support of Technology Centres.

Graph 19: Change in size of projects conducted by Technology Centres



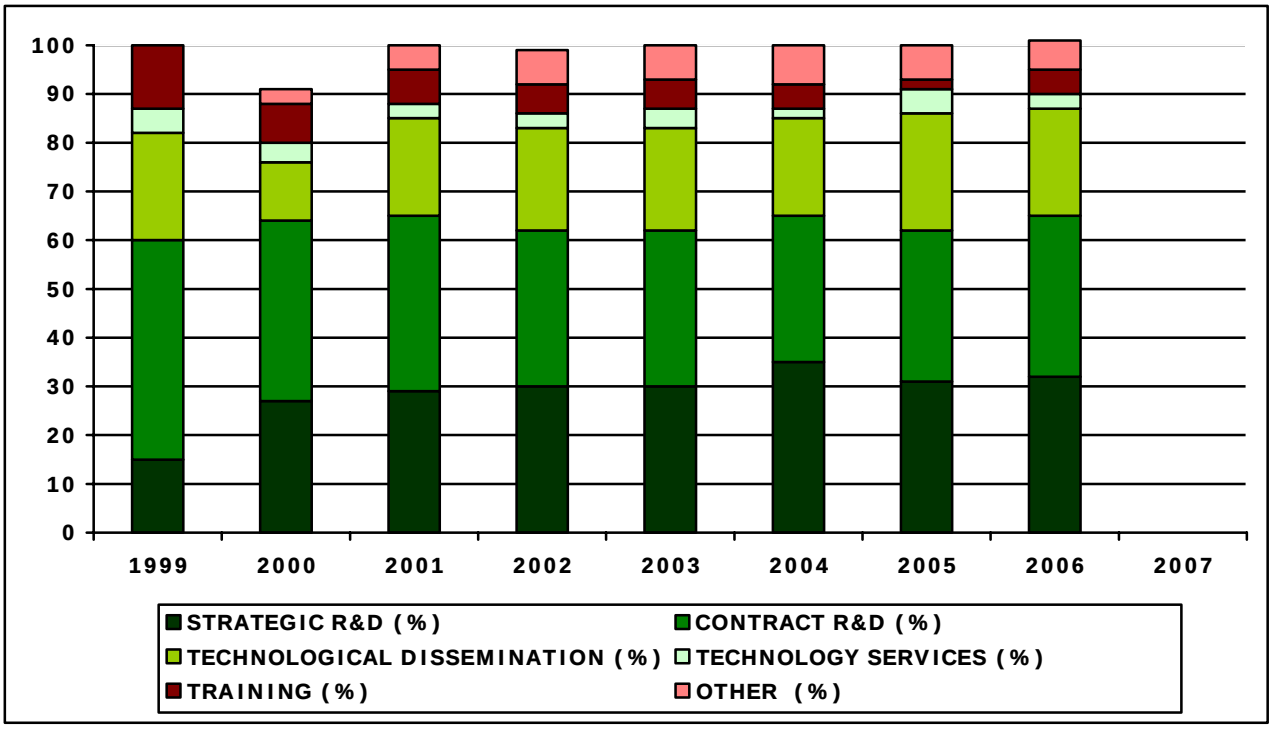
As shown, both the strategic research and development projects undertaken by Centres on their own initiative and projects commissioned by enterprises underwent

considerable growth in average size. The larger size of projects under contract is indicative of the higher complexity of entrepreneurial demand.

The size of projects covered by the Horizontal Action in Support of Technology Centres -- on average somewhat larger than Centres' typical projects -- remained practically constant in the early years of the programme but increased considerably in the final years. The widening of the scope of eligibility for subsidies to multi-year projects probably had a direct influence on the emergence of increasingly ambitious proposals, as pointed out above. The fact that projects were often conducted by more than one Technology Centre also accounts for these projects' above-average size.

Looking at the weighting of Centres' portfolio of services, research and development activities represented over 60% of the total.

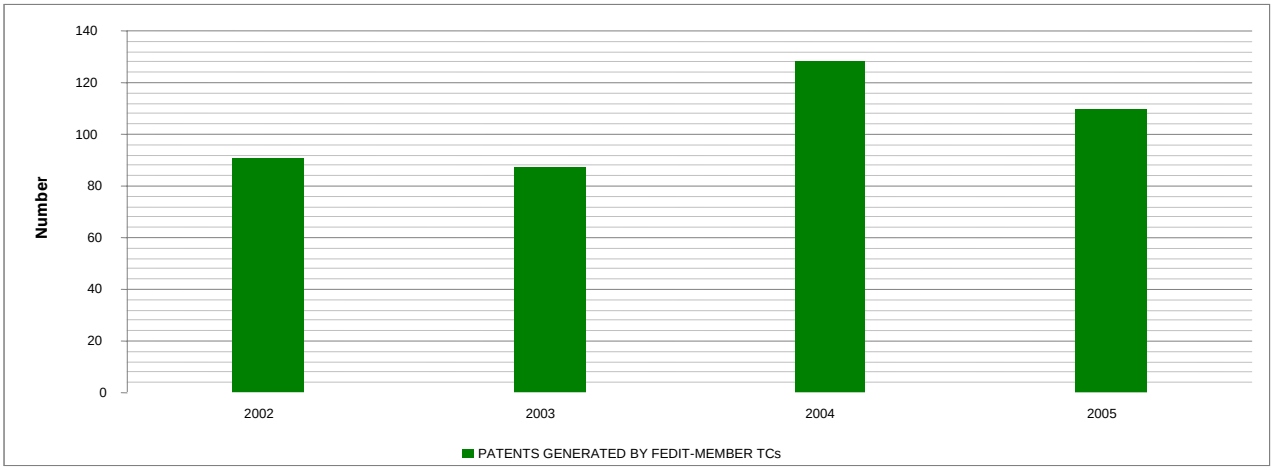
Graph 20: Development of TCs' portfolio of services



Finally, the following graph shows the history of the number of patents generated by Technology Centres within FEDIT in recent years. Only data from 2004 onwards are available; it is therefore difficult to identify the overall trend of Technology Centres' output of patents. It nonetheless appears that the past few years have seen a considerable rise in patent registrations. 2006 was the year in which the most patents were filed; this was also the year of the highest volume of aid awarded under the Horizontal Action in Support of Technology Centres.

The number of citations of these patents in the various patent systems would serve as a useful indicator to evaluate the importance of patents, but specific data relating to Technology Centres have not been found.

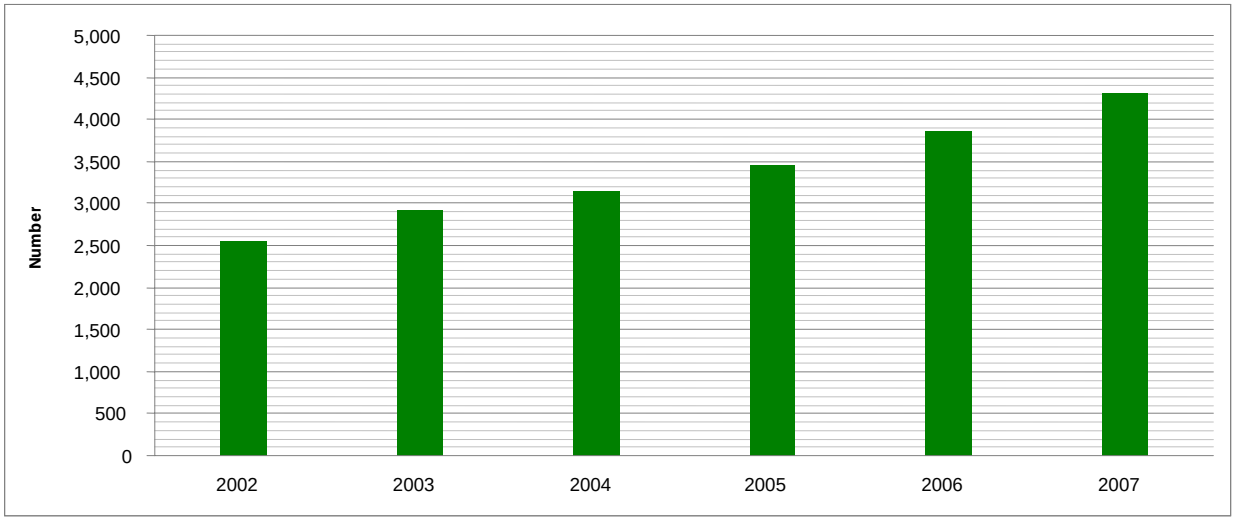
Graph 21: Change in number of patents generated by TCs within FEDIT (prepared by the authors)



Source: FEDIT. Prepared by the authors.

The features of Technology Centres' staff can also be a telling sign of their capabilities. In principle, the greater the number of researchers, the higher the technological capability. The following graph reveals a sharply rising trend; again, this points to the Centres' consolidation as institutions of increasing technological capacity.

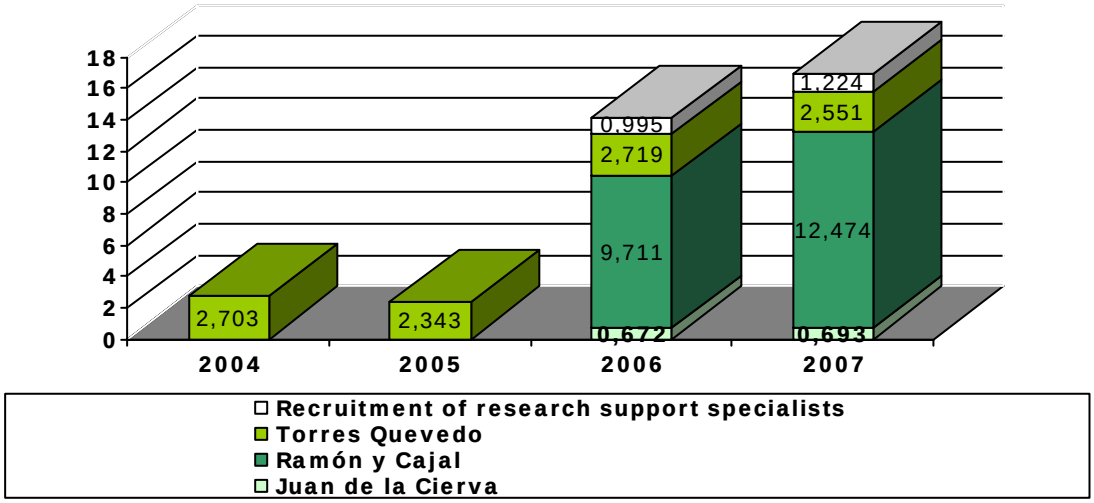
Graph 22: Change in number of researchers on TC staff



Source: Prepared by the authors on the basis of FEDIT data.

This rise in the number of staff researchers may not be a direct outturn of the PROFIT programme; it may reflect some of the programmes in support of Centres geared to capacity-building, such as the Torres Quevedo programme.

Graph 23: Aid awarded to TCs in the framework of various programmes for knowledge creation and capacity-building (human resources)



Source: Prepared by the authors on the basis of SICE (MICINN) data. No data available for 2004 and 2005 except for the Torres Quevedo programme. Figures in millions of euro.

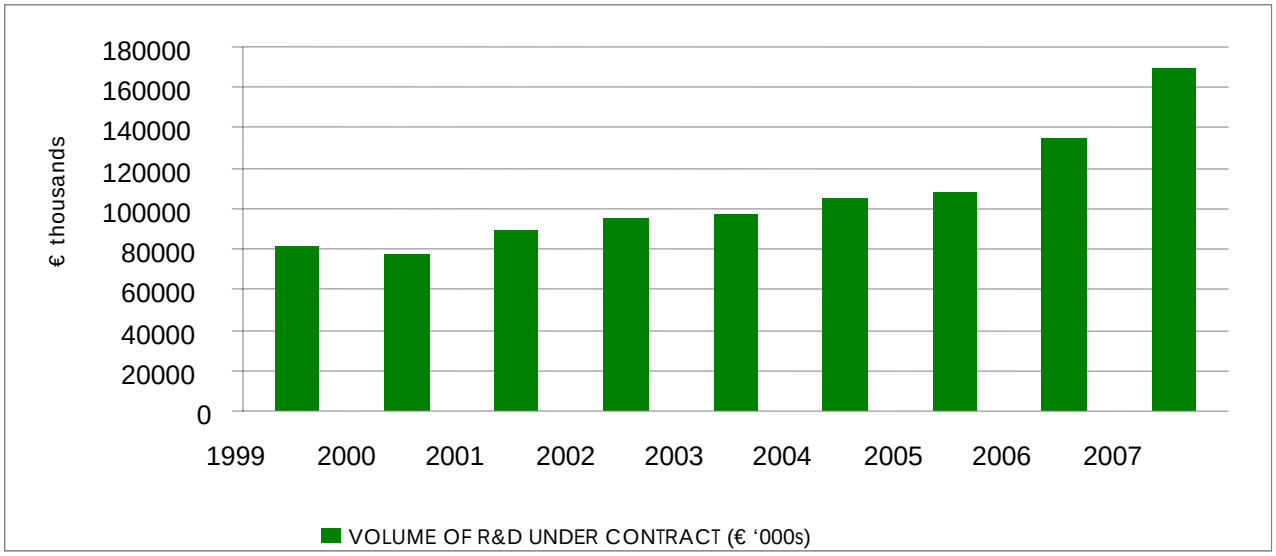
Another indicator of the technological capability of a Technology Centre is its volume of investment in infrastructure. However, the small number of infrastructure projects funded by the Horizontal Action in Support of Technology Centres and some of the interviews conducted with Technology Centres have disclosed that this programme does not provide significant support in this respect. Interviewed Centres identified the FEDER infrastructure programme (now set to disappear) and the programme of infrastructure subsidies aimed at technology parks (for Centres located in Parks) as their two principal sources of income for these purposes.

The efficiency of Technology Centres as transferors of technology to enterprises is difficult to measure.

Information gathered on visits to some of the leading Centres at the national level reveals that Centres are beset with difficulties when transferring knowledge. The Horizontal Action in Support of Technology Centres has made no significant contribution to removing such difficulties. Respondents have pointed to a need for programmes directed to the structure underlying this stage of the process.

The volume of research and development under contract can be regarded as an indicator of the relationship between Technology Centres and client enterprises. The trend revealed by the following graph displays a clear increase in Centres' income from this source.

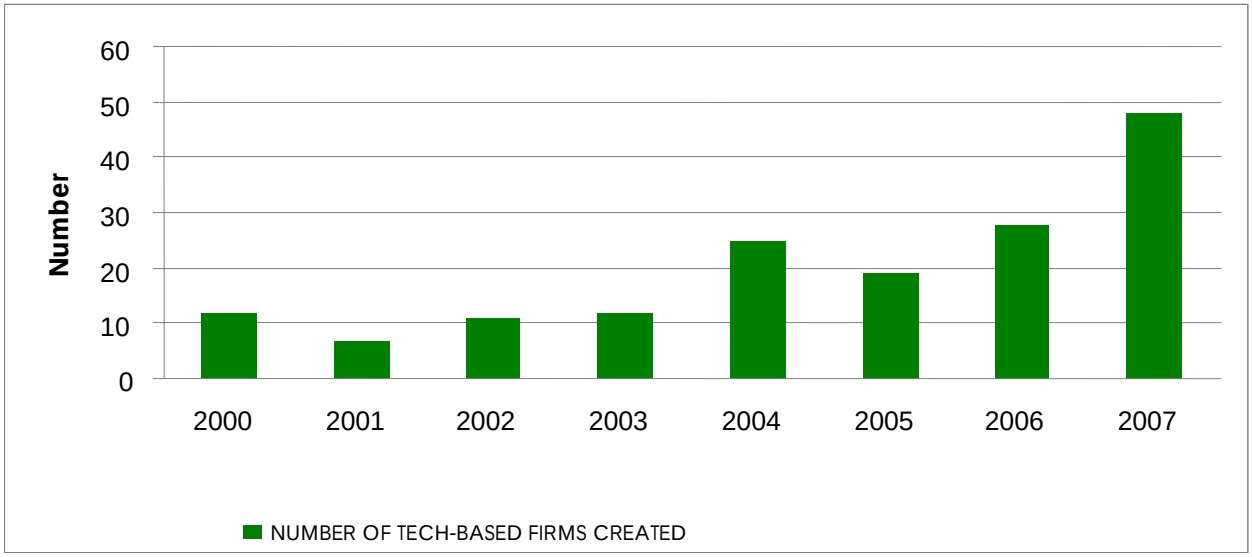
Graph 24: Change in volume of revenue from projects commissioned by enterprises



Source: Prepared by the authors on the basis of FEDIT data.

The number of technology-based enterprises started up as a result of Centres' research and development activities also provides a useful measure of the effectiveness of technology transfer between Centres and enterprises. The following graph shows the history of the number of technology-based companies started up by Technology Centres within FEDIT in recent years.

Graph 25: Change in number of technology-based enterprises created by TCs

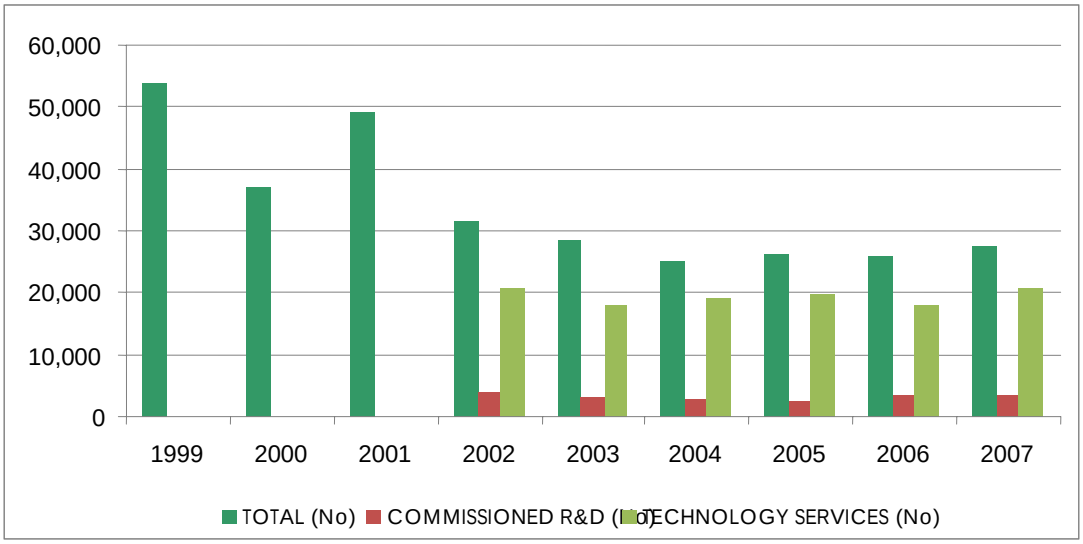


Source: Prepared by the authors on the basis of FEDIT data.

The sharp rise in the number of technology-based companies formed annually shows that, although this transfer phase can still be improved, clear progress has been made with respect to the state of affairs prior to the reference period.

The historic data on the number of a Centre's client enterprises also gives an idea of how technology transfer has developed between them. The following graph reveals that the number of client enterprises of FEDIT member Centres has declined over the term of effect of the PROFIT programme. However, this may merely indicate that a mature Centre cultivates a circle of loyal clients, which, though fewer in number, contract for engagements of increasing size.

Graph 26: Change in number of client enterprises



Source: Prepared by the authors on the basis of FEDIT data.

An analysis of the outcomes of the Horizontal Action in Support of Technology Centres under the PROFIT programme leads to the conclusion that most collaborative projects are conducted by more than one Technology Centre but without any participating enterprise being present. Collaborative projects involving enterprises are very few.

Other measures

InnoEuropa

The InnoEuropa programme was begun in 2007 in the framework of the launch of the Ingenio 2010 scheme.

In the 2007 InnoEuropa aid process, the funds appropriated to non-refundable subsidies totalled €3,700,000 (€2,500,000 for 2007 and €1,200,000 for 2008). The decisions on this aid process, published 27 November 2007, exhibited 97% execution of the allocated budget, such that the subsidies awarded in 2007 totalled €3,670,000.

This aid was distributed to 23 Technology Centres registered as CITs (21 of which were also members of FEDIT). Of these beneficiaries, the entities ROBOTIKER, LEITAT and LEIA won the largest awards, attracting 26% of all aid executed.

The number of projects supported by the programme matched the number of Centres attracting awards. (Each Centre was backed for the development of an

individual project.) These were chiefly strategic action plans deployed by the respective Centres to promote their own involvement in the Seventh European Framework Programme; the subsidies therefore operated in furtherance of both the first and second of the InnoEuropa objectives. Some of the strategic action plans also contemplated support for entrepreneurial involvement in the Seventh Framework Programme, this being the third objective of InnoEuropa.

Support for Technology Centres through partnership projects

Support for Technology Centres in the form of backing for partnership projects began in 2007 under an individual PROFIT subsidy award process, as described in earlier sections.

In the period 2007 to 2009, the funds budgeted for aid totalled €11,562,123 in subsidies and €11,828,578 in loans. Of these totals, in 2007 an amount of €5,027,010 was appropriated to subsidies and €5,142,860 was allocated to loans.

28 applications were filed, all being in respect of projects the duration of which exceeded one year, as required by the terms of the award process; a total of 66 Technology Centres were involved. In the aggregate, these projects required a budget of €96,682,034, requested fully in the form of subsidies.

The decisions on this aid award process, published 25 January 2008, entertained six of the 28 candidate projects; 25 Centres attracted aid under the programme. The total budget for all projects thus approved was €25,215,010, of which the programme funded €5,027,010 in the form of subsidies.

These results show that the budgetary execution of the funds allocated to aid in the form of subsidies attained to a level of 100%. No aid was applied for in the form of loans; accordingly, no loans were granted.

Among the successful projects, those proposed by the Technology Centres TEKNIKER and CEIT attracted about 40% of all subsidies awarded. Most projects concerned the development of new products.

Interviews with some of Centres reaping the greatest success in attracting PROFIT programme funds suggest that the restrictions imposed on the composition of partnerships have given rise to considerable difficulty, and may have been the cause of the small number of applications elicited by this award process.

4.2.3. Regulatory measures affecting Technology Centres

The Community Framework for State Aid to Research, Development and Innovation and the Technology Centres

As regards research and development under contract, the purpose of government intervention is to assure compliance with the Community Framework for State Aid to Research and Development, so as to minimise the distorting effects that government aid may have on price formation.

It is therefore important to determine the status that Technology Centres have or may have for the purposes of the Community Framework, given the implications

for the design of the government incentives directed to them and for the requirements of access to certain aid programmes. Government aid received by a Technology Centre that might help it to fund the services it subsequently provides to enterprises in the technology services market is not treated as State aid within the meaning of Article 87 of the EC Treaty if:

- The Technology Centre passes on to its clients the full costs of development or invoices the service at market prices.
- The results of the research are disseminated without generating intellectual property rights for the client (the enterprise) or, once generated, such rights are assigned to the Technology Centre or the enterprise pays the market price for them.

As stated earlier, Technology Centres qualify as 'research bodies'. This means they are eligible for government aid for their knowledge-generation activities. This is why it has become a priority in the past two years for Technology Centres to adapt their accounting systems so as clearly to separate 'economic' activities from 'non-economic' activities.

Patents policy

In line with the patents policy implemented across the European Community[25] and internationally,[26] Spanish patents policy seeks to streamline and lower the cost of the process in order to encourage increased use of patents as a tool facilitating the transfer of knowledge and its further development.

The main measures introduced in Spain include:

- Streamlining of administrative procedures, shorter timeframes and online registration processing. Spanish legislation has introduced the 'unexamined' form of patent so as to shorten the registration processing period. Today, the average period required to take out a patent in Spain is 22 to 23 months. This is still above the target period of 18 months, but less than the 45 to 50 months of the European patent, where the reasonable duration of the registration processing period is adjudged to be 30 months.
- Raising the technological standard required for a patent to be admissible.

[25] In the European ambit, the main challenge is to improve the Community patent, and to create a common procedure for patent protection, in line with the Communication of the Commission to the European Parliament and the Council: Improving the system of patents in Europe, 2007.

[26] Worldwide, the goal is the framing of a worldwide patent, in continuity with international treaties on the protection of intellectual property, based on the Patent Cooperation Treaty signed in Washington in 1970. As in Europe, synergies are also being promoted among patent offices at the world scale through the development of the concept of utilisation. The aim is that the work done by a patents office in the process of registering a patent can be validly used, wholly or in part, when the same invention is to be patented in another country.

- As regards incentives to patenting:

  - Patents under licence attract a 50% subsidy of the maintenance fee over the lifetime of the licence.
  - Partial subsidies of the costs of patenting in other countries.
  - Exemption from patent fees for universities and certain enterprises.
  - The deferral or modification of maintenance fees by up to 30 months, so as to lower the financial cost while the invention reaches economic maturity (PCT system).

The role and strategies of Technology Centres react to and contribute to patents policy in the following ways:

- By developing knowledge with a focus on innovations relevant to their sectors of activity and adapting to the needs of the industrial fabric to which they provide service.
- By seeking and developing technological vigilance services in cooperation with the Spanish patents and trademarks office (OEPM). 67% of Technology Centres reviewed in 2006 were providing such services.
- By seeking training for their staff as regards patent management (45% of Technology Centres reviewed in 2006).
- By according priority with reference to the aspects of the patent system most closely related to the business opportunities it offers: management, marketing and licensing, inter alia.

The CIT register of TCs

The register of innovation and Technology Centres (CIT)[27] is intended to create a mechanism that filters potential beneficiaries. By setting criteria for access to the register, it is hoped that applicants for subsidies will satisfy certain characteristics (in general, in relation to a range of capabilities). The question ought to be considered of whether a register such as this suitably fulfils the purpose of furthering the policy objectives of the specific programme or measure.

To be effective, this kind of register should have an effective, systematic and transparent mechanism for ongoing evaluation of the capabilities that justify privileged access to government aid programmes. In the absence of such a mechanism, the assumption appears to have been made that the characteristics of excellence evidenced by an entity to win registration will remain intact over time.

An alternative might be to establish quality accreditation procedures in accordance with accepted standards that could be required under the terms of research and development aid programmes. If implemented transparently, this formula would widen the scope of potential beneficiaries, encourage competition and the search for excellence, and safeguard fairness in access to aid by all actors in the system.

[27] This register under Royal Decree 2809/1996 was under the review at the time of writing this evaluation paper. The comments as to its existence are in any event applicable.

5. CONCLUSIONS AND RECOMMENDATIONS

A review of the national government policies in the period 2000 to 2007 concerning knowledge transfer to enterprises and, more specifically, concerning the market in technology services and the system of Technology Centres leads to a range of conclusions and recommendations the central purpose of which is to help improve the actions now in progress and those envisioned for the period 2008 to 2011, the timeframe for the new National Research and Development Plan. The measures most closely related to knowledge transfer to enterprises are described at the end of chapter 2.[28]

Strictly, there is no express and structured policy in Spain that faithfully conforms to the name 'technology transfer policy'. Instead, that term covers one group of measures, and, on the other hand, most policies in support of research and development are framed so as also to cater to the objective of 'contributing to technology transfer'.

These measures pursue three main axes of action: training qualified human resources; promoting business initiative in research, development and innovation; and the extension, bolstering and functional improvement of the technology services market, having regard to its decisive role.

Public incentives affect both the strategies and capabilities of Centres providing services and the actual and potential business users of such services. Technology Centres also promote business research and development initiatives by becoming involved in those programmes to one extent or another on the basis of their decisions as private actors. Public managers' design of the incentives for these activities will be decisive for such involvement to be effective.

[28] They include:
- Instrumental line 1 on human resources,
- Instrumental line 2 on collaborative research and development projects,
- Instrumental line 4 on scientific and technological infrastructure, Sub-programme for special scientific and technical installations (ICTS),
- Instrumental line 5 on use of knowledge and technology transfer: promotion of technology-based enterprises.
- Instrumental line 6 on system articulation: national programmes for public-private networks and cooperation. Programme of science and technology parks.

Recommendation 1

A policy to improve the system of technology transfer to enterprises must take the form of an integrated scheme in which all components function in a co-ordinated manner:

- *To promote the systematic functioning of the policies involved: training qualified human resources; fostering entrepreneurial initiatives in research and development; and transfer via the market in technology services (MTS).*
- *Suitably to design incentives so that they prove attractive to actors.*
- *To encourage actors to develop their own strategies (reinforcement of the supply side of the MTS).*
- *To encourage enterprises to respond proactively (stimulus to the demand side of the MTS).*

A systematic conception of the set of all government interventions directed towards improvement of the system of knowledge transfer to enterprises would make more rational use of existing capabilities (human capital, scientific and technical research and knowledge infrastructure) and available resources would come under a more efficient regime of allocation.

Recommendation 2

In the period of application of the National Scientific Research, Development and Innovation Plan 2008-2011, the scheme of incentives for technology transfer to enterprises deployed by the national government in coordination with the devolved regions should give priority to the mobility of qualified human resources to enterprises, the creation of new technology-intensive enterprises, augmentation of the technological profile of the economic fabric as a whole, and reinforcement of the market in technology services to which SMEs typically have recourse.

The scope of such interventions should include universities, technology transfer offices (OTRIs), public research bodies (OPIs), science and technology parks, advanced service providers and Technology Centres as actors within a single transfer system. The design of specific regulatory measures and forms of financial support should make better use of the supplementary role whereby such actors facilitate knowledge transfer to enterprises.

The achievement of a high technological profile is a necessary but not sufficient condition of raising competitiveness. There is also a need for technologically advanced end products and services on the most active markets. The development of markets that demand goods carrying new or improved technological content must keep abreast with the development of a system of knowledge transfer.

Technology is only inserted in the economic process when there is a realistic prospect of its doing well on the market and driving up business sales figures. If there is no market, there are no sales; in the absence of sales, there can be no product, no sustainable effort, and no technological demand. Such markets are widely diverse and function in very different ways. Some of them, however, offer

suitable opportunities for a number of ancillary policies, such as government purchases and involvement in international projects. The ENCYT strategy has pointed out that the sectors with the highest potential for immediate demand include those most closely involved in the investment efforts of the Spanish economy, such as infrastructure, transport, energy, environmental management, and water.

Recommendation 3

Policy for improvement of technology transfer to enterprises must be aided by policies intended to open up and foster new domestic and foreign markets, government purchases attending the major government expenditure plans, and entrepreneurial involvement in international projects (preferably in the European Union Framework Programme).

Over the past ten years, national government policy and resource allocation has been geared towards raising human and material capabilities: investment in research and development has increased threefold. But a lack of structure in efforts to support the transfer of knowledge thus generated has meant that existing market failures have not been entirely rectified, and enterprises may unnecessarily delay their adoption of the technological improvements already available in the system.

Recommendation 4

Increased use of the impact indicators under the National Plan 2008-2011 may make for a more accurate picture of the maturation of past investments, difficulties in the process, and, especially, the transformation of knowledge into goods and services that enterprises have been able successfully to launch on the market.

The design of such impact indicators should allow for monitoring the extent to which the innovative entrepreneurial base in the economy has broadened, and for measuring the gains in value-added as a proportion of GDP through technological extension and intensification.

Government support intended to correct market failures inherent to research and development activities and knowledge transfer is helping to enhance the capabilities and transferable knowledge available on the supply side of the technology services market and to raise demand from businesses, SMEs in particular.

To access technology and innovation, companies in general and SMEs in particular are chiefly reliant on the technology services market, research under contract and public-private partnerships. Accordingly, the National Plan 2008-2011 should do as much as possible to reinforce allocation of resources to these three areas.

Incentives should also be accorded to the dissemination and value-enhancement of knowledge so as to encourage companies to access technology services regularly and easily.

This requires activating technology service and distribution networks, which in turn calls for closer familiarity with such networks and their uses. Technology suppliers -- and Technology Centres in particular -- and regional development agencies (ADRs) play a key role in this process.

Knowledge services must attain to an effect of 'capillarity' in the economic fabric in order for the available incentives to be effective to increase technological cooperation and raise enterprises' demand for technology services.

The main market failure of the technology services market consists of an information asymmetry between the demand side -- enterprises are inadequately conversant with the available technological options -- and the technological offering of knowledge creators.

Companies are not always able to ascertain the extent to which offered technology might be of use to them in their innovation projects, nor do they always know how to access such technology or the cost involved in implementing it.

Recommendation 5

National government policy should encourage enterprises to improve their knowledge of existing technological resources by disseminating the technological profile of the actors generating such resources.

Another major opportunity to improve the system of knowledge transfer to Spanish companies is to reverse territorial inequalities in the provision of technological services, which tend to make demand lower than socially desirable. The localisation of technology service providers is a barrier to enterprises' wider access to such services.

Recommendation 6

National government policy should encourage business demand for technology services. Any company should be able promptly to locate the technology it needs to grasp a market opportunity. Any business should be able to access its technology provider regardless of their respective geographical locations within Spain.

To give the mechanism the agility it requires, a programme could be attempted of technology vouchers, that would gradually extend over a battery of standard technology services.

One of the key achievements to be expected of government programmes intended to promote knowledge transfer to enterprises -- whether deployed from national government or originating in partnerships between national and devolved regional authorities or public-private cooperation -- is an improved match between technology service supply and demand.

Recommendation 7

Regulatory and incentive measures must be taken to widen, reinforce and foster the competitive and transparent functioning of the Spanish market in technology services, in such a way as to remove barriers and information asymmetries and encourage the technology offering originating with any actor to be available throughout Spain, particularly in the case of partnership arrangements.

The role of Technology Centres in the improvement of the knowledge transfer system is a variable upon which government can act through suitable design of policy and its implementing measures and incentives.

Technology Centres are actors in the market in technology services to businesses; but they could supplement their offer of services by generating knowledge of their own, independently or in partnership with other agents.

In any event, Technology Centres and their services and possibilities should be better known to enterprises. Only if their services are distributed effectively to a greater number of businesses will the Technology Centres be making any substantial contribution to enhancing the knowledge transfer system in Spain.

At present, the role of the Technology Centres is significant insofar as they are the main suppliers of technology to SMEs, chiefly in the form of research under contract and technology vigilance and alert services; they also operate as agents for entrepreneurial and territorial development.

In future, the devolved regions will continue to play a major role in relation to Technology Centres, particularly as regards the creation of new Centres. In the light of the lines of action set out in ENCYT, there is likely to be increased cooperation between the national government and the devolved regions in building new technological capabilities and rationalising and streamlining use of existing capabilities.

These expectations spring from the execution of the CREA sub-programme of Technology Centre creation and consolidation, and of the National Programme of Scientific and Technological Infrastructure 2008-2011.

The specific support measures for Technology Centres and, more specifically, the PROFIT scheme for Technology Centres, are important for the growth and maturation of the Centres as actors in the Spanish science-technology-enterprise system. But there is a failure of alignment between the strategic objectives defined for Horizontal Action in Support of Technology Centres and the use that the Centres have made of the programme, namely, to fund their own research and development.

Hence the basic objectives defined for Horizontal Support Action for Technology Centres have only been fulfilled with regard to the creation and reinforcement of research and development units catering to industrial businesses, this being the strategic use that the Centres have chosen to make of the programme. Among the programme's supplementary objectives, cooperation has been encouraged among Centres in the form of partnership-driven projects. Priority has been given to

supporting those projects carrying the highest technological risk; accordingly, the average size and duration of executed projects have both increased.

The objective of raising Centres' involvement in international programmes has not been achieved to a significant extent. One of the main reasons for this in the final years of the programme may have been the existence of other programmes specifically designed for this purpose, such as InnoEuropa.

Most subsidised projects have been individual; almost none involved cooperation with enterprises. Such cooperation has more typically taken the form of market-oriented projects (applied research and development) submitted to the PROFIT programme for businesses.

Horizontal Support Action has helped enhance Centres' technological capability, as borne out by the performance of certain indicators, but it has had no material impact on their capacity as technology transfer actors. In this respect, any impact has originated with the Centres' involvement in projects subsidised by the PROFIT programme for enterprises, as partners or, more usually, as subcontractors. Interviews conducted with representatives of some of the more active Centres under these programmes show that the transfer stage is beset by difficulties. Some respondents saw the need for programmes aimed at improving the structural element underpinning this stage.

Recommendation 8

Incentives under national government policy should be designed so that Technology Centres, whether individually or in partnerships, are actively present at all stages of the route from knowledge generation to insertion of such knowledge in the market, as a result of the entrepreneurial processes of transformation and service provision.

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Anexo I. Metodología y herramientas utilizadas

1. Fase de recopilación de información y estudio

Herramientas

- **Análisis documental**

Durante esta fase se han identificado y han sido objeto de análisis los principales documentos disponibles en el ámbito de la evaluación propuesta.

- **Consultorías de apoyo.**

Mediante dos consultorías de apoyo, se ha desarrollado una parte del trabajo de campo. La primera de ellas, sirvió para caracterizar el mercado de la transferencia de servicios tecnológicos y de innovación en España, estudiar las relaciones de competencia y cooperación y las sinergias y antagonismos entre los agentes del sistema de transferencia.

La segunda consultoría llevó a cabo un análisis del programa PROFIT en su sección de Centros Tecnológicos, determinando qué aspectos relevantes pudieran considerarse en la ejecución del Plan Nacional de Investigación Científica, Desarrollo e Innovación Tecnológica 2008-2011.

2. Fase de análisis

Herramientas

- **Fichas descriptivas de las intervenciones públicas**

Para su mejor consideración se elaboró una ficha para cada intervención pública comprendida en el ámbito de evaluación. Todas ellas constituyen el Anexo IV.

- **Análisis D,A.F.O. preliminar de la situación de los Centros Tecnológicos en el Sistema de Transferencia**

No obstante las limitaciones que presenta esta herramienta de análisis para los sistemas dinámicos y complejos[29] -como es el caso de la transferencia de conocimiento desde los Centros Tecnológicos-, la literatura sí valora su utilidad como instrumento exploratorio. Por otra parte, su sencillez y claridad expositiva permitía resumir en él multitud de aspectos y referencias a agentes no comprendidos en la evaluación, pero que de forma implícita nunca debían dejar de considerarse. El cuadro resultante figura en el Anexo V.

[29] Al respecto, Vid. "Swatting SWOT" en http://www2,wmin.ac.uk/haberba/SwatWOT.htm

- **Entrevistas**

Se identificaron varias personas y organizaciones cuya consulta se consideró relevante para los fines de la evaluación.

Administraciones Públicas

- **Administración General del Estado**

o Oficina Económica del Presidente del Gobierno.

o Dirección General de Política Tecnológica (MICINN).

o Consejo Superior de investigaciones científicas (CSIC).

o Oficina de patentes y marcas (OPM-MITYC).

o Centro para el Desarrollo Tecnológico Industrial (CDTI).

o Dirección General de Política de la PYME (MITYC).

- **Comunidades Autónomas**

Entrevistas con varios representantes de las Consejerías responsables de la política de transferencia y apoyo a los Centros Tecnológicos.

- **Empresas usuarias o clientes de los Centros Tecnológicos**

Para contrastar casos de colaboración entre empresas y Centros.

Otros agentes participantes en el sistema de transferencia de tecnología

- Universidades y centros productores de conocimiento.
- Oficinas de transferencia de resultados (OTRI)
- Parques científicos y tecnológicos, a través de sus entidades gestoras.
- FEDIT-Centros Tecnológicos de España.
- REDIT-Red de Centros Tecnológicos de la Comunidad Valenciana.
- AIDIMA. Instituto Tecnológico del mueble, la Madera, el Embalaje y Afines.

- **Panel de expertos**

Se ha realizado un panel de expertos para analizar el funcionamiento del mercado de servicios tecnológicos y la posición con respecto a él de los Centros Tecnológicos. A ella asistieron representantes de los siguientes organismos: MICINN, Oficina Económica del Presidente del Gobierno. FEDIT, Agencia Vasca de Innovación

(INNOBASQUE), Agencia de Innovación y Desarrollo del Andalucía (IDEA), Universidad Rovira i Virgili, Universidad Carlos III, Instituto Madrileño de Desarrollo (IMADE), Confederación de la Pequeña y Mediana Empresa (CEPYME) y CSIC.

En la Mesa se desarrollaron tres debates: identificación de la naturaleza del problema, formas de mejorar el sistema de transferencia del conocimiento a las empresas en España y contribución de los Centros Tecnológicos a la mejora pretendida. Las aportaciones hechas por los expertos se han incorporado a este informe de evaluación en los apartados correspondientes de la fase de Análisis.

Para objetivar la opinión de la Mesa en torno a cuestiones concretas, se cuantificó mediante porcentajes la ponderación otorgada a:

Votación 1. Contribución de las políticas de formación de RRHH cualificados, fomento del *entrepreneurship* intensivo en tecnología y dinamización del mercado de servicios tecnológicos, a mejora del sistema de transferencia de tecnología a las empresas. Respectivamente, las ponderaciones medias de la Mesa fueron: 34,7%, 32,7% y 32,7%.

Votación 2. Para contribuir a la mejora del sistema de transferencia de tecnología a las empresas, los Centros Tecnológicos deben: generar más tecnología, aumentar su capacidad de transferencia, actuar más como promotores de empresas intensivas en tecnología o ser más activos como dinamizadores del entorno territorial. Las ponderaciones respectivas de la Mesa para cada opción, fueron: 22,9%, 30,4%, 21,3% y 25,4%.

Votación 3. Si los Centros Tecnológicos han de desarrollar más conocimiento y capacidad para transferirlo, deben hacerlo: desarrollando más capacidades propias o cooperando más con el resto de los agentes del lado de la oferta del sistema (universidades, OTRI, OPI, parques científicos y tecnológicos y empresas de servicios avanzados). Las ponderaciones que recibieron ambas opciones fueron de forma respectiva: 44,2% y 55,8%.

Anexo II. Síntesis de indicadores del sistema de transferencia de conocimiento en España[30]

1. Constatan el atraso significativo (posición relativa por debajo del 75% de cada indicador para EU25) en los siguientes aspectos:

- Gasto público en I+D como porcentaje del PIB (74%).
- Gasto empresarial en I+D como porcentaje del PIB (48%).
- Porcentaje de PYME innovadoras que trabajan en cooperación (49%).
- Porcentaje de las exportaciones en sectores intensivos en I+DT (31%).
- Porcentaje del empleo en actividades de alto contenido tecnológico (70%).
- Patentes europeas por millón de habitantes (22%).
- Patentes EEUU por millón de habitantes (15%).
- Patentes admitidas en Europa, EEUU y Japón (8%).

Estos datos ponen de relieve, de forma básica, el todavía insuficiente o bajo perfil innovador del sistema de ciencia-tecnología-empresa en España, que será necesario mejorar tanto en sus características estructurales, comerciales y de gestión; muy particularmente en lo que atañe a sus capacidades para aumentar el valor añadido de las exportaciones y para gestionar productos y servicios nuevos y mejorados.

2. La capacidad tecnológica y de innovación está desequilibrada desde el punto de vista de su localización sobre el territorio. Así:

De forma coherente con lo anterior, cabría promover con las Autoridades Comunitarias una reasignación de los Fondos Estructurales otorgados a España para el período 2007-2013, de forma que todas las Comunidades Autónomas anteriores pudieran ser objetivos de gasto en condiciones equivalentes a las denominadas 'de convergencia'. Este ajuste permitiría, además, mejorar la capacidad de absorción de los fondos comunitarios y, en definitiva, la asignación de recursos.

[30] Fuentes: European Innovation Scoreboard 2006: Strengths and Weaknesses Report (Comisión Europea, 2007), Encuesta sobre innovación tecnológica en las empresas. Año 2006 (INE), Estadística sobre actividades en I+D. Año 2006 (INE) y Clasificación Nacional de Actividades Económicas (CNAE).

3. Los servicios tecnológicos que configuran el mercado de transferencia de conocimiento están bien representados por agregados estadísticos, que facilitan su seguimiento y evaluación:

Actividades de I+D+i (CNAE 73)	Sobre ciencia naturales y técnicas (CNAE 731) Sobre ciencias sociales y humanidades (CNAE 732)
Actividades de información (CNAE 72)	Equipos (CNAE 721) Aplicaciones (CNAE 722) Proceso de datos (CNAE 723) Bases de datos (CNAE 724) Mantenimiento de equipo (CNAE 725) Actividades anexas (CNAE 726)
Otras actividades empresariales (CNAE 74)	Consulta y asesoramiento (CNAE 7414) Servicios de arquitectura (CNAE 74201) Servicios de ingeniería (CNAE 74202) Otros servicios técnicos (CNAE 74204) Ensayos y análisis (CNAE 74303)

Sin perjuicio de los sistemas de seguimiento y evaluación dispuestos por los gestores de los distintos programas, la información que de forma sistemática proporciona el INE, constituye una herramienta útil de apoyo a la gestión susceptible de ser utilizada en todo su potencial.

Encuesta europea de innovación (2006)

Indicador	UE	España	% España/UE
2.1. Gato público en I+D (% PIB)	0,7	0,5	78,5
2.2. Gasto empresarial en I+D (% PIB)	1,2	0,6	52,1
2.3. % Gasto I+D sectores intensivos	85,2	77,0	90,4
2.4. % Empresas receptoras de recursos públicos	9,0	9,0	100,0
3.1. % PYME innovadoras	21,8	18,4	84,4
3.2. % PYME innovadoras bajo formas cooperativas	9,1	5,7	62,6
4.1. % Empleados servicios tecnológicos	3,3	2,7	82,2
4.2. % Exportaciones sectores intensivos I+D	16,7	4,7	28,1
4.5. % Empleo sectores tecnológicos	6,5	4,5	69,4
5.1. Patentes EPO/millón de habitantes	128,0	30,8	24,1
5.2. Patentes USPTO/millón de habitantes	52,2	6,5	12,5
5.3. Patentes s/Tríada-millón de habitantes	20,8	2,7	13,0

Cuadro 1.Encuesta europea de innovación (2006)

Fuente: Elaboración propia a partir de la Encuesta Europea de Innovación (CE, 2007)

Estadística sobre actividades de I+D (INE, 2006):

- Gasto interno en I+D = 11.815 Meuros (1,20% PIB)

- Distribución territorial del gasto interno en I+D:

- Madrid, Cataluña, Andalucía y el País Vasco acumulan el 69,4% del gasto en I+D.
- Madrid, Cataluña, Andalucía, País Vasco y la Comunidad Valenciana acumulan el 77,1% del gasto en I+D.
- El rango de Gasto Interno en I+D en proporción al PIB en las CCAA es de: 1,98 a 0,80 (2,5 veces).

- La industria concentra el 52,2% del gasto y, las empresas de servicios el 44,5% del mismo.

Estadística sobre actividades de I+D, (INE 2006)

Cuadro 2. Gastos internos totales en I+D. Sector de ejecución y origen de los fondos
(En miles de Euros)

Ejecutado por	Importe	%
AAPP	1.970.824,0	16,7
ENSEÑANZA	3.265.739,0	27,6
EMPRESAS	6.557.529,0	55,5
IFSL	21.127,0	0,2
Total	11.815.219,0	100,0
	Importe	%
Origen en		
AAPP	5.020.049,0	42,5
ENSEÑANZA	466.075,0	3,9
EMPRESAS	5.561.629,0	47,1
IFSL	66.041,0	0,6
EXTRANJERO	701.425,0	5,9
Total	11.815.219,0	100,0

Fuente: Elaboración propia a partir de Estadística sobre actividades de I+D, (INE 2006)

Cuadro 3. Análisis de las diferencias

Agente	Variación	Variación en %
AAPP	-3.049.225,0	-25,8
ENSEÑANZA	2.799.664,0	23,7
EMPRESAS	995.900,0	8,4
IFSL	-44.914,0	-0,4
EXTRANJERO	-701.425,0	-5,9
Total	0,0	0,0

Origen	Diferencias	Aplicación	Diferencias
AAPP	3.049.225,0	ENSEÑANZA	2.799.664,0
IFSL	44.914,0	EMPRESAS	995.900,0
EXTRANJERO	701.425,0		
Total	3.795.564,0	Total	3.795.564,0

Fuente: Elaboración propia a partir de Estadística sobre actividades de I+D, (INE 2006)

Cuadro 4. Personal empleado en I+D
(equivalentes a jornada completa)

Ejecución por	Personal I+D	%	Investigadores	%
AAPP	34.588,0	18,3	20.063,0	17,3
ENSEÑANZA	70.950,0	37,5	55.443,0	47,9
EMPRESAS	82.869,0	43,9	39.936,0	34,5
IFSL	570,0	0,3	357,0	0,3
Total	188.977,0	100,0	115.799,0	100,0

Fuente: Elaboración propia a partir de Estadística sobre actividades de I+D, (INE 2006)

Encuesta sobre innovación tecnológica en las empresas (INE, 2006)

El Perfil innovador de las empresas en España

- Número total empresas innovadoras: 49.415 empresas (25,3% de las empresas industriales, construcción o servicios de 10 ó más asalariados)
- Sectorialmente la innovación se localiza en la industria: química y de fabricación de equipo electrónico y en los servicios de I+D y TIC.
- En el 11,8% de los casos, la innovación tuvo carácter cooperativo, con proveedores (51,6%), universidades (29,9%) y clientes (26,9%).
- El 25,1% del las empresas consideran que la innovación contribuye a incrementar la calidad de su oferta de bienes y servicios.
- El 20,7% de las empresas considera a la innovación relevante para aumentar su producción o prestación de servicios.

Cuadro 5. Distribución del gasto en actividades para la innovación tecnológica

Clase de gasto	%
I+D Interna	38,7
I+D externa	15,1
Equipo	31,6
Otro conocimiento	5,5
Formación	0,9
Comercialización	5,6
Diseño	2,6
Total	100,0

Total de gasto: 16.533 Meuros

Fuente: Elaboración propia a partir de Encuesta sobre innovación tecnológica en las empresas (INE, 2006)

Distribución territorial del gasto interno en innovación

- Madrid, Cataluña, País Vasco y Andalucía acumulan el 71,2% del gasto en innovación y el 58,7% de las empresas innovadoras (EI).
- Madrid, Cataluña, País Vasco, Andalucía, la Comunidad Valenciana y Galicia acumulan el 71,9% del gasto en innovación y el 74,9% de las (EI).
- Rango del porcentaje de empresas innovadoras en las CCAA: del 31,20% (Navarra) al 14,78% = 16,42% (2,1 veces).
- Sectores de media y alta tecnología. Volumen de negocio: 163.657 millones de euros (18% PIB).
- Sectores de alta tecnología. Volumen de negocio: 24.359 millones de euros (3,86% PIB).
- Sectores de alta tecnología. Ocupados: 1.399.300 personas (7,4% de la ocupación).
- Sectores de alta tecnología. Concentran el 64,4% del personal dedicado a I+D y el 68,5% de los investigadores.
- Madrid, Cataluña, País Vasco y Andalucía acumulan el 63,9% de los ocupados en los sectores de media-alta y alta tecnología.
- Madrid, Cataluña, País Vasco, Andalucía, Comunidad Valenciana y Galicia acumulan el 77,5% de ocupados sectores de media y alta tecnología.

Rango del porcentaje de ocupación en sectores intensivos en tecnología en las CCAA: del 12,33% (País Vasco) al 2,63% = 9,7% (4,7 veces).

Anexo III. Caracterización del mercado de servicios tecnológicos y de sus agentes

Estructura del mercado de servicios tecnológicos

El principal incentivo con que cuentan las empresas para innovar procede del mercado. En efecto, son las oportunidades que suscitan los clientes las que llevan a las empresas a mejorar su oferta de bienes y servicios, bien mejorando los actuales bien introduciendo otros nuevos, a fin de garantizar la rentabilidad de las inversiones y, en último extremo, su supervivencia en los mercados en que operan. Por tanto, la decisión empresarial de innovar (entendida en términos de inversión en capital tecnológico) debería obedecer a los mismos condicionantes y objetivos de rentabilidad que los que guían la inversión en el resto de inputs que conforman su función de producción (capital humano y capital financiero).

Esta idea de que el motor de la innovación es el mercado o de que son las expectativas de mercado las que mueven a las empresas a innovar, es clave para entender el sentido de los cambios estructurales que puedan darse en una economía y, lo que es tanto o más importante, a qué ritmo sucederán tales cambios. Sin la presión procedente del mercado actual o de la apertura de nuevos mercados, no cabe esperar ritmos elevados de innovación en las empresas y, consecuentemente, el tránsito estructural del conjunto de la economía será lento.

Como se ha indicado, una de las tesis de partida -y que esta evaluación busca validar- es la de que el mercado de transferencia de conocimiento a las empresas requiere, para su buen funcionamiento, de una estrecha colaboración entre los distintos agentes del sistema de innovación. Así pues, a la hora de valorar el diseño y puesta en práctica de la política pública de apoyo a la transferencia de tecnología, habrá que ver en qué medida se están aprovechando y potenciando, o no, las sinergias y ventajas comparativas de cada agente (universidades, OPI, Centros Tecnológicos y empresas de servicios avanzados).

Agentes del lado de la oferta

- Universidades

Su papel como agente de transferencia se vincula a la llamada ‘tercera misión’ entendida como transferencia del conocimiento a la sociedad, mediante distintos productos de contenido tecnológico e innovador.

- OTRI

Las OTRI son unidades, organismos públicos de investigación, universidades y entidades privadas sin fines de lucro, que poseyendo funciones de transferencia en materia de resultados de investigación y tecnología, han solicitado y obtenido su inscripción en el Registro regulado al efecto (la Orden de 16 de febrero de 1996, publicada en el BOE. de 23 de febrero, les otorgó carácter oficial con la creación de un Registro Oficial de OTRI en la Comisión Interministerial de Ciencia y Tecnología).

Estas oficinas nacieron a finales de 1988 en el marco del Plan Nacional de I+D como estructuras para fomentar y facilitar la cooperación en actividades de I+D entre investigadores de centros públicos y empresas, tanto en el marco nacional como en el europeo. Así, las OTRI son unidades de interfaz en el sistema ciencia-tecnología-empresa cuya misión fundamental consiste en dinamizar las relaciones entre los agentes del sistema. Para ello, identifican la existencia de necesidades tecnológicas en los sectores socioeconómicos, para favorecer después la transferencia de tecnología entre los sectores público y privado, contribuyendo a la aplicación y comercialización de los resultados de la I+D generada por universidades, Organismos Públicos de Investigación (OPI) y Centros Tecnológicos. El modo en el que llevan a cabo esta tarea implica intermediar la transferencia, comercializando los resultados de la investigación, así como gestionar contratos, patentes y proyectos.

La Red OTRI confiere estabilidad y continuidad a la función de transferencia del sistema español de innovación, al intermediar más del 65% de los resultados de investigación del país, a través de las 63 oficinas integradas en la red. En una primera etapa formaban parte de la red OTRI las universidades, los OPI y algunos Centros Tecnológicos. En 1996 la Red se amplió incorporando a otras unidades de interfaz, tales como las Fundaciones Universidad-Empresa (FUE), ciertas asociaciones empresariales y los Centros de Innovación y Tecnología (CIT).

- Centros públicos de investigación de Ministerio de Ciencia e Innovación (MICINN)

En la actualidad existen 19 Organismos Públicos de Investigación (OPI) agrupados en torno al Consejo Superior de Investigaciones Científicas (CSIC) y, en algunos casos, formando además parte de estructuras funcionales particulares, como es el caso de las Instalaciones Científicas y Técnicas Singulares. Éstas responden a la política de descentralizar la investigación y extender la ciencia por todo el país, como un mecanismo más de cohesión y dinamización de la economía de las CCAA donde se ubican estos complejos.

- Centros del Registro CIT

El Real Decreto 2609/1996 considera a las Centros de Innovación y Tecnología (CIT) a personas jurídicas, legalmente constituidas sin fines lucrativos, cuyo objeto estatutario es contribuir a la mejora de la competitividad empresarial, mediante el perfeccionamiento tecnológico y la innovación.

En el momento de redactarse este informe de evaluación, son cien las entidades inscritas en el Registro CIT.

- Centros Tecnológicos

Su descripción figura en el texto principal del informe.

- Laboratorios de homologación y ensayo.

Por su naturaleza cabe configurarlos como centros de servicios tecnológicos o de innovación, si bien en sí mismos no desarrollan actividades de I+D. De titularidad

pública o privada, en muchos casos forman partes de estructuras vinculadas a la generación de conocimiento y, en otros, su actividad está más próxima a la prestación de servicios integrados en viveros de empresas o estructuras de gestión de parques industriales o tecnológicos.

- Parques Científicos y Tecnológicos.

Son organizaciones que tienen por objeto contribuir al desarrollo territorial inmediato a su localización física, facilitando la dotación de servicios e instalaciones. En ocasiones se vinculan a ellos estructuras de desarrollo empresarial, del conocimiento o de fomento de la innovación. De esta manera, algunos de los 26 parques científicos y tecnológicos existentes en España, incluyen universidades, laboratorios, Centros Tecnológicos, centros de innovación y otras infraestructuras de apoyo que, junto con las empresas productoras de bienes y servicios, configuran una oferta susceptible de comercializarse de forma individual o a través de una plataforma común de mercado.

La existencia de flujos de conocimiento necesarios para configurar una oferta dirigida al consumidor final, se estimula a través de mecanismos de dinamización muy relacionados con la proximidad física entre los agentes; como es el caso de incubadoras de empresas y la promoción de *spin-off*.

- Centros de patentes.

El proceso de patente entraña, en sí mismo, un mecanismo de transferencia de conocimiento en la medida en que, a cambio de la protección otorgada a la invención ésta se hace pública, lo que posibilita a científicos y tecnólogos utilizar el nivel de conocimiento que aporta para, a partir de él, acometer nuevos desarrollos.

Cuando las patentes se licencian, esto es, su propietario cede el uso a un tercero en determinadas condiciones a cambio de un precio, sí puede hablarse de la existencia de un mercado, en el que la formación de los precios tendría lugar en condiciones de competencia. No obstante lo anterior, este mercado –en el que la confidencialidad es clave- no recoge la totalidad de los intercambios que tienen lugar en torno a las patentes y la tecnología. En primer lugar, por la existencia de secretos industriales que no son objeto de patente, por cuanto suponen una ventaja competitiva para su poseedor que aspira a mantener más allá del período de expiración de la invención patentada.

En segundo término, determinadas patentes son intercambiadas entre las empresas mediante fórmulas de cesión más próximas al trueque que al mercado y, como tercera posibilidad del uso de las patentes, está el empleo que pueda hacerse de las mismas para desarrollar estrategias de bloqueo de tecnologías útiles a competidores. En términos porcentuales, se estima que hasta un 80% de las patentes estarían “durmientes” o bloqueadas por unas u otras razones, siendo el restante 20% objeto de explotación comercial por su titular o mediante contratos de cesión.

El coste asociado al hecho de patentar no obstaculiza el empleo del sistema de patentes, siendo sus costes principales los derivados de hacer valer los derechos (*enforcement*) o, dicho en otras palabras, los costes de transacción que se derivan de los litigios a que da lugar la defensa legal de los derechos exclusivos inherentes a la

patente. En efecto, ante la existencia de plagios, copias o fraudes, los procesos judiciales que ocasiona defender las invenciones constituyen auténticas barreras disuasorias para que los poseedores del conocimiento consideren patentarlo o, de forma alternativa, proceder a su explotación como secreto industrial.

Por otra parte, el carácter estratégico de la tecnología encubre siquiera de forma parcial a oferentes y demandantes, que no siempre utilizan la patente como soporte del conocimiento. Con carácter aproximado, apenas el 50% de la tecnología utilizada en el mundo estaría soportada por patentes, siendo el restante 50% explotada bajo la modalidad de secreto.

- Centros de innovación, plataformas tecnológicas y otras entidades de investigación

Son entes de muy diversa naturaleza, de carácter público o privado, que por lo general están vinculadas al territorio y sus necesidades, como principio orientador de la gama de servicios que prestan o actividades que realizan.

En otros casos es la asociación de diversos entes en torno a fundaciones, estructuras tipo *cluster* o plataformas, la que tiene como finalidad abordar temporalmente desarrollos tecnológicos de interés común.

Productos intercambiados

Son productos susceptibles de intercambio en el mercado de transferencia de conocimiento:

- Los que pertenecen al dominio de la Propiedad Industrial, tales como: patentes, modelos de utilidad y licencias.
- Los procedentes del dominio de la Propiedad Intelectual, como el software.
- Los servicios de vigilancia y alerta tecnológica.
- Servicios de apoyo tales como homologaciones, pruebas y ensayos.
- Servicios de comercialización, de gestión de resultados de la investigación y demás servicios de apoyo.
- La investigación bajo contrato.
- La colaboración entre empresas y organismos de investigación.
- La gestión de capital-riesgo en sus modalidades de capital-semilla y de arranque.
- Los servicios de infraestructura proporcionados por incubadoras, viveros de empresas y centros de innovación.

- El intercambio de profesionales cualificados, la movilidad de investigadores y de *spin-off*.

- Determinadas actividades de formación hacia las empresas.

- La creación y gestión de empresas de base tecnológica, su capitalización inicial y cobertura de gastos fijos o de estructura en sus primeros años de vida.

También se consideran productos de transferencia de conocimiento compatibles con la legislación comunitaria de Ayuda de Estado:

- Los proyectos y estudios de viabilidad, cuando el beneficiario es una PYME y el importe de la ayuda es menor de 7,5 millones de euros por proyecto, incluyendo la ayuda al estudio de viabilidad.

- Las ayudas a los costes de los derechos de propiedad industrial para las PYME.

- Las ayudas a empresas jóvenes e innovadoras.

- Las ayudas para servicios de asesoramiento y apoyo a la innovación.

- La financiación de gastos inherentes a la presencia de personal altamente cualificado en determinado tipo de empresas (por lo general las de mayor intensidad tecnológica).

De manera condicionada, también pueden ser compatibles con la legislación comunitaria de Ayuda de Estado:

- Los proyectos y estudios de viabilidad técnica y ayudas a los costes de los derechos de propiedad industrial, para no PYME.

- Las ayudas a la innovación en materia de procesos y organización de servicios.

- Las ayudas a estructuras *cluster* innovadoras.

En otros casos, por ciertos servicios de carácter *no económico* la legislación comunitaria permite recibir ayudas públicas de hasta el 100% de su coste, entre ellos están:

- Los de educación para lograr más y mejor personal cualificado.

- La realización de I+D independiente, incluida la I+D colaborativa, para mejorar los conocimientos.

- La difusión de los resultados de la investigación.

- Las actividades internas de los organismos de investigación y sus filiales o actividades conjuntas entre organismos de investigación para la concesión de licencias, creación de empresas y otras formas de gestión del conocimientos que no tenga como destino directo el mercado.

Agentes de lado de la demanda

- Las PYME. Corresponden a esta categoría las empresas de menos de 250 empleados, según la Recomendación 2003/261/CE de la Comisión, de 6 de mayo de 2003.

La diferenciación de estas unidades económicas del resto de las empresas, es procedente en virtud de la mayor flexibilidad que la normativa comunitaria sobre ayudas estatales permite para ellas. En el ámbito de las PYME cabe destacarse la tipología de las denominadas "PYME de base tecnológica", caracterizadas por una presencia en el mercado inferior a 10 años, la significativa ocupación de su capital humano en actividades de I+D e innovación (igual o superior a un tercio de la plantilla) y inversión alta y persistente en gastos de I+D (del orden del 15% del total en al menos 3 años consecutivos).

- Empresas no PYME.

Agrupadas bajo modalidades consorciadas tales como Uniones Temporales de Empresas o Agrupaciones de Interés Económico, que lleven a cabo proyectos conjuntos.

- Estructuras de *clusters* innovadores.

Integradas por empresas independientes junto a centros de investigación o formativos, que actúan en sectores y regiones concretos y cuyo objetivo es estimular actividades innovadoras de carácter cooperativo, en particular las de transferencia de conocimiento.

Anexo IV. Análisis D.A.F.O. preliminar de la situación de los Centros Tecnológicos en el Sistema de Transferencia de Conocimiento

Debilidades

- Su regulación como entidades sin fines de lucro limita la prestación de servicios tecnológicos en régimen de mercado.
- En una perspectiva de mercado, el registro administrativo previo de los Centros Tecnológicos para acceder a la financiación pública, no parece aportar garantías suficientes sobre la calidad de los servicios prestados y podría tener carácter discriminatorio para los centros no inscritos.
- Su carácter de entidades sin fines de lucro, limita la presencia en ellas del capital-riesgo y otros posibles socios financieros.
- Desarrollo insuficiente de su papel colaborador con OPIS y otros agentes en la transferencia de resultados de investigación hacia las empresas; en particular de su capacidad para gestionar proyectos.
- Necesidad de adoptar por cada centro un enfoque estratégico de mercado: liderazgo en costes, modelo de diferenciación o de alta segmentación.
- Necesidad de definir una cartera eficiente de productos y servicios que permita a cada centro desarrollar una estrategia orientada al mercado.
- Necesidad de definir un *mix* financiero de origen público-privado sostenible y coherente con la estrategia definida como factible por cada centro.

Amenazas

Lado de la demanda

- La todavía escasa implicación de las empresas en el proceso de innovación: perfil tecnológico y competitivo bajos e internacionalización escasa (insuficiente presión de mercado).
- Consecuencia de lo anterior: los servicios ofertados por los centros no se perciben como necesarios y las empresas no están dispuestas a pagar por ellos (problema de suficiencia y estructura financieras).

Lado de la oferta

- Aumento previsible de la competencia derivada de la transferencia directa de conocimiento a las empresas desde universidades (*tercera función*) y OPIS nacionales. Eventuales asimetrías competitivas.
- Deficiente caracterización de la oferta de servicios tecnológicos a las empresas: agentes que los prestan, tipología de servicios y coste de los mismos. Posible inexistencia de mercado o, en su caso, funcionamiento defectuoso (presencia de fallos).
- Amenazas derivadas de la globalización e internacionalización de la tecnología: aumento de la competencia desde entidades foráneas.
- Capacidades instaladas excedentarias, cargas de trabajo bajas y elevados costes de oportunidad de las inversiones en infraestructura y equipo.

Fortalezas

- Mayor conocimiento que otros agentes de las necesidades del sector o sectores industriales con los que se relacionan. Desarrollo de posibles enfoques de segmentación o nicho.
- Existencia de experiencia organizativa acumulada en cuadros, directivos y procedimientos de gestión frente a otros agentes.
- Percepción como iconos tecnológicos locales, portadores de prestigio institucional y susceptibles, por tanto, de recibir apoyo político y económico de las autoridades. Poder de *lobby*.

Oportunidades

Lado de la demanda

- Las que ofrezca un entorno empresarial dinámico que demande sus servicios (orientación al mercado).
- Mayor presencia en el segmento del mercado configurado por PYME.
- Las derivadas de la implantación de las empresas españolas en el exterior y la venta de tecnología a países emergentes; en particular la India y China.

Lado de la oferta

- Barreras de entrada altas en ausencia de apoyo institucional.

Abril de 2008.

Anexo V. Estimación de la dimensión del mercado de servicios tecnológicos en España

1. Estructura de los costes

1.1. A partir de la Estadística sobre Actividades de I+D (INE, 2006)

Gasto interno en I+D = 11.815 Meuros, que equivale al 1,20 % (PIB)
Producto interior bruto (Meuros) en 2006. Contabilidad Nacional:982.303,0

Cuadro 1. Distribución del gasto en I+D por rama de actividad

Destino del gasto	%	Meuros
Servicios de I+D	17,74	2.096,0
P. Farmacéuticos	9,24	1.091,7
Equipos transporte	8,10	957,0
Servicios empresas	6,87	811,7
Informática	6,81	804,6
Comunicaciones	5,36	633,3
Maquinaria	4,63	547,0
Otras ramas	41,25	4.873,7
Total	100,00	11.815,0

Fuente: Elaboración propia a partir de Estadística sobre actividades de I+D, (INE 2006)

1.2. A partir de la Encuesta sobre Innovación Tecnológica en las Empresas (INE, 2006)

Cuadro 2. Distribución del gasto en actividades para la innovación tecnológica
Gasto total: 16.396 Meuros = 1,67% (PIB)

Clase de gasto	%
I+D Interna	38,7
I+D externa	15,1
Equipo	31,6
Otro conocimiento	5,5
Formación	0,9
Comercialización	5,6
Diseño	2,6
Total	100,0

Fuente: Elaboración propia a partir de Encuesta sobre innovación tecnológica en las empresas (INE, 2006)

2. Estimación del volumen de negocio y valor añadido bruto por segmentos (2005)

Se realiza considerando los siguientes agregados de actividades económicas del INE: CNAE; 721, 722, 73, 742, 743; año 2005 (en Meuros)

Cuadro 3. Estimación del volumen de negocio y valor añadido bruto por segmentos (2005)

Actividad	CNAE	VN*	VAB*	% VN*	% VAB*	Relación VAB/VN*
Consultoría en equipos y programas informáticos	721 y 722	14.792,7	6.703,1	37,0	34,2	0,45
Información, tratamiento y bases de datos	723 y 724	2.239,0	1.211,4	5,6	6,2	0,54
Servicios vinculados a la producción	725 y 728	1.192,5	552,7	3,0	2,8	0,46
Investigación y desarrollo	73	1.178,3	789,0	2,9	4,0	0,67
Servicios de arquitectura e ingeniería	742	17.919,3	8.681,3	44,8	44,3	0,48
Ensayos, análisis, formación y asesoramiento	743	2.685,8	1.671,9	6,7	8,5	0,62
Total		40.007,6	19.609,4	100,0	100,0	0,49

* Volumen de negocio (VN), Valor Añadido Bruto (VAB)
Fuente: Elaboración propia en base a las actividades económicas del INE

Tamaño del mercado = Volumen de negocio: 40.007,6 Meuros (2005)
VAB sobre el PIB = 2,2% (PIB)
PIB (2005) = 908.792 Meuros

3. Resultados del mercado de bienes y servicios tecnológicos 2003-2005 (meuros)

Cuadro 4. Resultados del mercado de bienes y servicios tecnológicos (2003-1005) (Meuros)

	2003			2004			2005		
Actividad	VN	VAB	VAB/VN	VN	VAB	VAB/VN	VN	VAB	VAB/VN
Consultoría en equipos y programas informáticos	13.309,4	6124,3	0,46	14.183,8	6.430,3	0,45	14.792,7	6.703,1	0,45
Información, tratamiento y bases de datos	1.884,5	970,0	0,51	1.982,1	1.030,0	0,52	2.239,0	1.211,4	0,54
Servicios vinculados a la producción	1.057,6	521,0	0,49	1.099,8	522,2	0,47	1.192,4	552,7	0,46
Investigación y desarrollo	1.040,2	680,0	0,65	1.036,4	736,3	0,71	1.178,3	789,0	0,67
Servicios de arquitectura e ingeniería	13.329,4	6.787,9	0,51	14.760,9	7.581,6	0,51	17.919,3	8.681,2	0,48
Ensayos, análisis, formación y asesoramiento	2.036,5	1.264,0	0,62	2.511,5	1.521,7	0,61	2.685,8	1.671,9	0,62
Total	32.657,6	16.347,2	0,50	35.574,5	17.822,1	0,50	40.007,5	19.609,3	0,49

Fuente: Elaboración propia.

Anexo VI. Análisis del programa PROFIT-Centros Tecnológicos 2000-2007

Cuadro 1. Indicadores de Gestión (millones de euros)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
ACCIÓN PROFIT-Centros Tecnológicos										
Subvenciones	14,3	8,4	7,4	11,0	11,1	11,0	11,6	6,0	9,0	89,8
Préstamos rembolsables	0,0	7,8	6,4	4,2	4,0	6,0	9,6	10,7	0,0	48,7
PROYECTOS CONSORCIADOS										
Subvenciones		0,3	0,3	0,3	0,3	0,3	0,3	6,3	3,8	11,9
Préstamos rembolsables								6,2	3,6	9,8
Total	14,3	16,5	14,1	15,5	15,4	17,3	21,5	23,0	12,8	150,4
Distribución porcentual										100,0
% de Subvenciones										67,6
% de Préstamos rembolsables										32,4
Número de propuestas										
Presentadas	511	559	441	331	327	300	277	224		2.970,0
Aprobadas	230	176	147	182	180	168	145	75		1303,0
Número de Centros Tecnológicos beneficiarios	61	56	52			55	62	55		341,0

Fuente: Elaboración propia a partir de datos de ¿?. En 2008 se considera sólo el primer semestre??

Cuadro 2. Indicadores de resultados

Índice aprobación de propuestas	43,90%
Propuestas aprobadas	
Subvención media	78,1 miles de euros
Préstamo medio	44,9 miles de euros
Ayuda total media	115,4 miles de euros
Ayuda unitaria por Centro	441,1 miles de euros

Fuente: Elaboración propia a partir de datos de ¿?

	1999	2000	2001	2002	2003	2004	2005	2006	2007
INDICADORES DE CAPACIDAD TECNOLÓGICA									
CTS (FEDIT)									
TAMAÑO PROYECTOS ABORDADOS									
TAMAÑO MEDIO PROYECTOS PROFIT AH apoyo a CENTROS		62.522	92.557	93.810	84.069	84.383	78.899	158.761	200.789
TAMAÑO MEDIO PROYECTOS I+D PROPIA				58.734	66.259	70.682	67.666	78.776	75.107
TAMAÑO MEDIO PROYECTOS I+D CONTRATADA				32.354	30.146	38.635	39.230	43.422	44.371
EVOLUCIÓN ACTIVIDADES DESARROLLADAS (% IMPORTANCIA DE CADA TIPO)									
I+D ESTRATÉGICA (%)	15	29	27	29	30	30	35	31	32
I+D CONTRATADA (%)	45	36	37	36	32	32	30	31	33
SERVICIOS TECNOLÓGICOS (%)	22	19	12	20	21	21	20	24	22
DIFUSIÓN TECNOLÓGICA (%)	5	5	4	3	3	4	2	5	3
FORMACIÓN (%)	13	11	8	7	6	6	5	2	5
OTROS (%)	0	0	3	5	7	7	8	7	6
EVOLUCIÓN TIPOS DE PROYECTOS FINANCIADOS POR PROFIT (DE CTS) Nº									
PROYECTOS DE INVESTIGACIÓN INDUSTRIAL				22	23	60	101		
ESTUDIOS DE VIABILIDAD TÉCNICA				2	9	5	8		
PROYECTOS DE DESARROLLO PRECOMPETITIVO				74	77	41	38		
PROYECTOS DE DEMOSTRACIÓN TECNOLÓGICA				3	3				
OTROS (PROYECTOS DE EQUIPAMIENTO DE INFRAESTRUCTURAS, ETC.)				46	70				
ACCIONES ESPECIALES (DIFUSIÓN, ETC.)				9	3		2		
ACTUACIONES FAVORECEDORAS DE PARTICIPACIÓN EN PROGRAMAS INTERNACIONALES						16	16		
PROYECTOS DE INVESTIGACIÓN SOCIO-ECONOMICA						0			
PROYECTOS DE EQUIPAMIENTO DE INFRAESTRUCTURAS						1	5		
EVOLUCIÓN TIPOS DE PROYECTOS FINANCIADOS POR PROFIT (DE CTS) (Volumen de ayuda en Euros)									
PROYECTOS DE INVESTIGACIÓN INDUSTRIAL				1.897.400	2.283.700	3.985.900	7395500		
ESTUDIOS DE VIABILIDAD TÉCNICA				26.500	396.700	391.500	319.600		
PROYECTOS DE DESARROLLO PRECOMPETITIVO				3.873.000	3.907.800	2.590.600	2.213.500		
PROYECTOS DE DEMOSTRACIÓN TECNOLÓGICA				227.000	237.700				
OTROS (PROYECTOS DE EQUIPAMIENTO DE INFRAESTRUCTURAS, ETC.)				7.766.000	8.371.600				
ACCIONES ESPECIALES (DIFUSIÓN, ETC.)					150.200		47.100		

ACTUACIONES FAVORECEDORAS DE PARTICIPACIÓN EN PROGRAMAS INTERNACIONALES						1.054.800	1.024.300		
PROYECTOS DE INVESTIGACIÓN SOCIO-ECONOMICA						0			
PROYECTOS DE EQUIPAMIENTO DE INFRAESTRUCTURAS						914.100	1.605.400		
EVOLUCIÓN TIPOS DE PROYECTOS FINANCIADOS POR PROFIT (DE CTS) (Volumen de ayuda en Euros/PROYECTO)									
PROYECTOS DE INVESTIGACIÓN INDUSTRIAL				86.245	99.291	66.432	73.223		
ESTUDIOS DE VIABILIDAD TÉCNICA				13.250	44.078	78.300	39.950		
PROYECTOS DE DESARROLLO PRECOMPETITIVO				52.338	50.751	63.185	58.250		
PROYECTOS DE DEMOSTRACIÓN TECNOLÓGICA				75.667	79.233				
OTROS (PROYECTOS DE EQUIPAMIENTO DE INFRAESTRUCTURAS, ETC.)				168.826	119.594				
ACCIONES ESPECIALES (DIFUSIÓN, ETC.)					50.067		23.550		
ACTUACIONES FAVORECEDORAS DE PARTICIPACIÓN EN PROGRAMAS INTERNACIONALES						65.925	64.019		
PROYECTOS DE INVESTIGACIÓN SOCIO-ECONOMICA									
PROYECTOS DE EQUIPAMIENTO DE INFRAESTRUCTURAS						914.100	321.080		
PATENTES GENERADAS POR LOS CTS DE FEDIT						91	87	128	110
CITACIONES PATENTES									
INVERSIONES EN INFRAESTRUCTURAS									
Nº INVESTIGADORES (DOCTORES Y TITULADOS SUPERIORES)				2.558	2.916	3.151	3.459	3.855	4.313
Nº PROYECTOS PROFIT DE carácter INTERNACIONAL				14	27	16	22	15	12
ESPAÑA									
PATENTES									
SOLICITADAS EN ESPAÑA VIA NACIONAL (RESIDENTES)	2438	2.709	2.523	2.763	2.804	2.864	3.027	3.098	3.244
CONCEDIDAS EN ESPAÑA VIA NACIONAL (RESIDENTES)	1794	1.667	1.699	1.056	1.599	1.642	2.319	1.895	2.317
CITACION PATENTES									
INDICADORES DE CAPACIDAD CIENTÍFICA									
CTS (FEDIT)									
Nº PUBLICACIONES									
Nº CITACIONES DE PUBLICACIONES									
PUBLICACIONES EN SCI									
% DEL TOTAL MUNDIAL									

Nº CITACIONES DE PUBLICACIONES ESPAÑA									
Nº PUBLICACIONES	25.109	24.988	26.349	28.521	29.945	32.772	35.191	36.840	
Nº CITACIONES DE PUBLICACIONES									
%publicaciones DEL TOTAL MUNDIAL	2,57%	2,53%	2,69%	2,76%	2,77%	2,93%	2,97%		
INDICADORES DE TRANSFERENCIA DE TECNOLOGÍA									
VOLUMEN DE I+D BAJO CONTRATO (miles Euros)	81450	76.824	89.170	95.283	96.679	105.319	107.332	134.827	169.230
Nº TRABAJADORES QUE MIGRAN DE Cts A EMPRESA									
Nº EMPRESASA DE BASE TECNOLOGICA CREADAS		12	7	11	12	25	19	28	48
Nº EMPRESAS DE BASE TECNOLOGICA DISEÑADAS				131					
LICENCIAS DE PATENTES CTS									
Nº EMPRESAS CLIENTES									
CTS (FEDIT)	53700	37.163	49.254	30.412	28.307	24.900	26.178	25.886	27.555
CTS (PÚBLICOS)									
Nº PROYECTOS EN COOPERACIÓN							29	41	17
Nº MEDIO DE EMPRESAS PARTICIPANTES POR PROYECTO EN COOPERACIÓN									
% PROYECTOS EN COOPERACIÓN DE carácter INTERNACIONAL									

Fuente??