Research and Technology Organisations in the Evolving European Research Area

- A Status Report with Policy Recommendations -

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Research and Technology Organisations (RTOs) in the Evolving European Research Area (ERA)

In December 2005 EURAB, the European Commission's high-level Research Advisory Board, published its report on *Research and Technology Organisations and ERA*. This influential EURAB paper underlined the key role which RTOs play in Europe's research and innovation systems and the important potential contribution which they have to make to the evolving European Research Area.

EURAB emphasised too, however, that present policies are often ill-adapted to the needs of RTOs and hence fail to properly leverage their role in the construction of ERA. This is perhaps at least partly because RTOs are a diverse and constantly evolving category and, for that reason, are sometimes ill-perceived by policy makers: "not universities, not enterprises".

The present document is a sequel to the EURAB report. Its purpose is to illustrate more fully the distinctive role of RTOs in modern research and innovation systems, to show through statistical analysis their powerful engagement in strategic European research initiatives, notably the European Framework Programme for Research and Technological Development, and to offer in conclusion some policy recommendations.

The paper is in five parts:

I. **The Role of RTOs: Definition, Evolution, Mission**
II. **RTO Governance: Responsibility, Independence, Funding**
III. **Recent RTO Developments in Europe**
IV. **RTOs as Key Players in the European Framework Programme for Research and Technological Development**
V. Conclusions and Recommendations

*The basic idea underpinning the ERA is that the issues and challenges of the future cannot be met without much greater '**integration**' of Europe's research efforts and capacities. The objective is to move into a new stage by introducing a coherent and concerted approach at Union level from which genuine joint strategies can be developed. Without this political will, Europe is condemned to increasing marginalisation in a global world economy. With the ERA, on the other hand, Europe gives itself the resources with which to fully exploit its exceptional potential and to become – in the words of the Lisbon European Summit of March 2000 – 'the world's most competitive and dynamic economy'.*

European Commission ERA website

I. The Role of RTOs: Definition, Evolution, Mission

What is an RTO?

EARTO, the European trade association representing RTOs, defines them as organisations *"which as their predominant activity provide research and development, technology and innovation services to enterprises, governments and other clients …"*. This definition distinguishes RTOs from universities, the predominant activity of which is education, and from enterprises, the predominant activity of which is the production and sale of goods and services.

The EARTO definition has been challenged because it "*also includes fully privately owned for-profit contract research organisations*"[1]. The observation is correct, as is in part the attendant comment that "*though their activities may be similar, the governance structure of such companies and hence the driving forces for change are very different*".

A recent study of RTOs used this definition: *"RTOs are organisations with significant core government funding (25% or greater) which supply services to firms individually or collectively in support of scientific and technological innovation and which devote much of their capability (50% or more of their labour) to remaining integrated with the science base"*[2]*.*

For present purposes – thinking about the future of RTOs in the evolving European Research (and Innovation) Area – we prefer the relatively loose EARTO definition, which best captures the diversity of governance structures and activity profiles of RTOs as they have evolved over time, in particular since the mid-20th century.

Many of Europe's largest RTOs would have been characterised 50 years ago as "national public laboratories": their budgets came predominantly from government and their mission was largely scientific. Three or four decades later, beginning in the 1980's or so, many RTOs now styled themselves as "Contract Research Organisations", reflecting a growing proportion of research and especially development work for firms and a consequently rising share of commercial contract income. Some others reduced their laboratory R&D services in favour of technical consultancy and business-solution delivery.

What does the future hold? In another three or four decades, perhaps, RTOs may have "mutated" yet again. VTT's recent strategic re-orientation, for example, reflects a paradigm shift from technology-push to innovation-pull: identify emerging market opportunities and societal needs and orient technology development and service offerings accordingly[3].

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[1] *The Future of RTOs in the European Research Area*, Jos Leijten, TNO, Delft, December 2005.

[2] *"Birds were Dinosaurs Once: the Diversity of Evolution of Research and Technology Organisations",* CENTRIM, University of Brighton, 2001

[3] In the USA, innovation pull is apparent in most federally funded R&D. A diversity of organisations – including universities, federally funded research and development centres and commercial organisations – respond to carefully chosen state-of-the-art operational challenges facing the state.

The Aho Report[4] has correctly emphasised the ability of organisations – enterprises, universities, RTOs – to react and adapt, and to reconfigure ways of working together, as one essential requirement for an "Innovative Europe". Europe's RTOs have proven themselves willing and able to change. They will continue to adapt in the future. Quite possibly, different RTOs working in different contexts will evolve in different ways in the coming decades.

A relatively open definition of RTOs, like the EARTO definition, therefore seems wise when thinking about the current state of RTOs and their possible future development in the context of a similarly evolving European Research (and Innovation) Area.

The Rationale for RTOs

Why do RTOs exist at all? What do they do that, for example, universities and enterprises do not do?

The EURAB report on "*RTOs and ERA*", while acknowledging the diversity of the RTO sector, affirms that *"there is a clear, basic rationale for RTOs: it is to perform essential functions [in national research and innovation systems] that other R&D players (enterprises and universities) cannot reliably be expected to perform in sufficient quantity and quality, and with sufficient reliability, stability and accountability. Thus, in a general sense, RTOs are a response to perceived actual or potential market or systemic failures".*[5]

In order to explore further the rationale for and role of RTOs, a brief historical overview is helpful.

The Origins: (Re-)Building National Industry, Big Science

The origin of practically every RTO lies in a decision by [national] government that a new kind of R&D institution was needed, created directly by government or by other organisations (e.g. enterprise associations) sanctioned by government. Thus RTOs were founded in response to specific socio-economic needs.

Many RTOs were founded shortly before or shortly after the Second World War. The new science-based industries of the Second Industrial Revolution, and the military technologies developed and deployed in the war, had demonstrated the power of science and technology as a driver of economic, social and geo-political development. At that time, the universities were generally recognised as places of teaching and of predominantly theoretical research. The new breed of RTOs was needed to adapt and channel this scientific knowledge to the needs of society and the economy:

- to contribute to the strategic development of national industry – and to "economic rebuilding" after the 1939-45 war – through research and development, norms and standards, testing and certification, technology diffusion and dissemination, and

[4] *Creating an Innovative Europe*, European Communities, January, 2006

[5] This argument is further developed in an appendix to the EURAB report: *Research and Technology Organisations (RTOs) and ERA*, DG Research, European Commission, 2005.

- to host and maintain critical infrastructures ("large facilities"), often as part of "big science" initiatives, e.g. nuclear energy, large-scale experimental computing.

An Expanding RTO Agenda: Public-Interest Research

In the 1970s and later, further public-interest research issues were added to the RTO agenda, e.g. public health, environmental protection, sustainable development. More recently still, preoccupation with the consequences of technology has given rise to technology assessment and precautionary research as new functions for many RTOs, and the requirements of "evidence-based" policymaking are bringing still further new tasks. RTOs are particularly well-equipped to assume these various functions because they combine scientific competence, technological understanding, practical orientation, market knowledge and independence of political and commercial interests.

The Knowledge Explosion Meets the Corporate Lab: The Rise of R&D Outsourcing

Large and growing public investments in education and research during the 1960s and 1970s, coupled with the advent of new, powerful information-processing technologies, further fuelled an explosion of knowledge which seriously challenged the ability of individual enterprises to sustain their knowledge base in-house. Corporate R&D, once a "sacred cow", became subject to cost-benefit analysis.

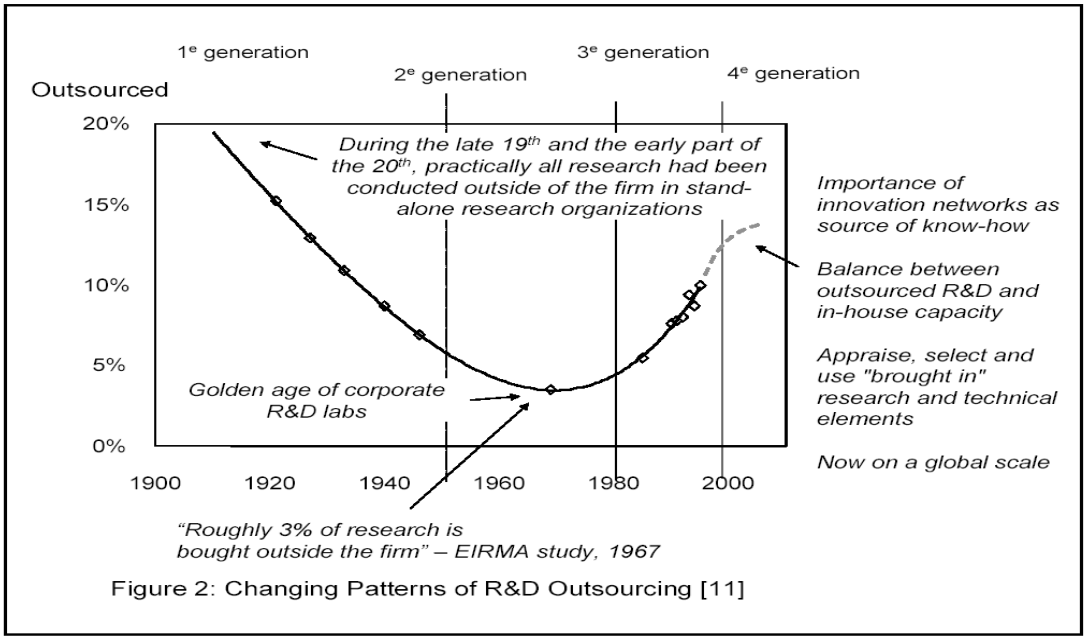

Figure 2: Changing Patterns of R&D Outsourcing [11]

Responsible Partnering, European Commission, January 2005, p. 3

As the diagramme shows, more and more firms began to contract out more and more research. Recent estimates suggest that some 10% of business R&D is outsourced[6]. The trend continues today under the heading

[6] *Creating an Innovative Europe*, European Communities, January, 2006, p. 16.

"Open Innovation"[7] and related initiatives to promote "responsible partnering"[8]. RTOs are key partners of enterprises in these new scenarios.

Contracting out R&D gives companies and governments access to a wider range of expertise, and competition favours stronger suppliers. The contracts which governments place with RTOs, especially for longer-term research, are often a vital source of capability generation.

Knowledge: The Strategic Resource in Modern Economies

Successful modern economies are knowledge-based economies. They are fast-moving economies, with and within increasingly open and global markets. The competitive pressures on firms grow accordingly, and so too do the risks of investing in research for the new knowledge needed to improve competitive position … A vicious but also virtuous circle.

Economists are broadly agreed that enterprises, left to their own devices, tend to under-invest in R&D. One reason is the high risk associated with many leading-edge investments. Another is the uncertainty of being able to sufficiently appropriate the results of a successful investment. For SMEs, the risks tend to be magnified further: often they lack the necessary technical competence; often the costs are simply unaffordable. As risk and uncertainty rise, so too does the probability of under-investment in the production of knowledge. This re-affirms, in changed form, a historically key function of RTOs: to contribute to the development of [national] industry through strategic high-risk, long-term scientific research and technology development.

The form has changed, however. The industries are not the same, and indeed service activities now predominant. New technologies have emerged, and in multidisciplinary combinations. What were once mostly government-funded national public labs are now semi-commercial contract research organisations. The linear pipe-line model of innovation is dead, if ever it really existed.

RTOs and Universities: Complementarity, not Competition

Some observers have noted the growing role of universities, especially in parts of northern and western Europe, in undertaking contract research work for industry, and have pointed also to the growth of "Knowledge-Intensive Business Services" (KIBS), which has led to speculation that RTOs may be a declining species. Such discussion often misses the essential point that RTOs, universities, KIBs … and others – whatever the incidental similarities – are fundamentally different: they have different core objectives, capabilities, and skill sets.

TECHNOPOLIS has succinctly stated the difference between RTOS and universities in its recent report about RTOs in Sweden[9]: *"In contrast to the universities, institutes use much more structured and quasi-industrial approaches, with disciplined project management, quality control, business information systems and strong cost monitoring and control, milestones*

[7] Henry William Chesbrough, *Open Innovation: The New Imperative for Creating and Profiting from Technology*, Harvard Business School Press, 2003

[8] http://www.responsible-partnering.org/

[9] TECHNOPOLIS, *The Role of Industrial Research Institutes in the National Innovation System: A report to VINNOVA*, December 2006

and stage gating. Their researchers are on average older than those at universities … and more experienced. They tend to have experience of manufacturing and understand how to scale up new techniques to a point where they are industrially useful. They are often equipped with specialised test and measurement equipment and sometimes pilot plant not readily available elsewhere. They have routines for the confidential treatment of proprietary knowledge, so that it does not leak into the research literature or other parts of the public domain. Crucially, providing research and technical services to industry tends to be core business for an institute, whereas for universities these are peripheral activities that may even conflict with allocating resources to the two core missions of teaching and research".

Those who would argue that universities can do everything that RTOs do would be well advised to read carefully the just cited TECHNOPOLIS report, which analyses the government policy in Sweden over the past 50 years which considered that universities should function as "research institutes for the whole of society" and which resulted in a policy of benign neglect for Swedish RTOs, forcing them for existential reasons to abandon their original function of higher-risk, longer-term strategic research in favour of short-run, commercial service contracts. There is growing acceptance in Sweden today that this policy has failed and that the RTO sector must be re-invigorated, as we shall see shortly.

But such images of universities displacing RTOs, or universities competing with RTOs, are unhelpful, not to say dysfunctional. "Open Innovation" is a reality: the imperative is to recognise the complementary interests and skills of universities, RTOs and enterprises, and to find productive ways in which they can work together[10].

RTOs do not compete with universities; RTOs partner with universities:

- Fraunhofer's many *An-Institute* with universities in Germany…
- TNO's participation in Technological Top Institutes with universities and enterprises in the Netherlands…
- Sintef's organic links with the Norwegian Institute of Technology…
- CEA's 62 joint research facilities with universities and other research organisations in France …
- QinetiQ's University Partnering programme in the United Kingdom and worldwide connections with academia …

The skills of RTOs and universities are complementary, their relationships synergistic, mutually beneficial, long-term.

[10] A soon to be released study of RTO impact on the British economy – commissioned by the United Kingdom Association of Independent Research and Technology Organisations – is expected to show that there is strong recognition among industry of the distinction between academic research and the 'problem solution' work which RTOs provide, with 80% of companies surveyed strongly agreeing that they could not have achieved the same results working in-house or with a university and 60% of respondents agreeing with the statement that the work they had undertaken with RTOs had given them access to networks that they would not have found otherwise.

Today's RTOs: *Plus ça change* ...

The world has changed much over the last half century and RTOs have changed with it. Yet the fundamental rationale for RTOs' existence remains, and the essence of their mission too.

RTOs undertake research and development and provide related technology services in the public interest. Whilst a principal activity is to perform client-specific projects, in doing so they deliver value from their knowledge base into the economy and society. It is a common feature of RTOs that they generate innovation from research funded by government through a range of mechanisms.

RTOs support public policy (and, increasingly, pre-policy debate) through research and state-of-the-art advice as well as through condition monitoring and technical service work (assaying, certification, norms and standards). Their independence and neutrality are critical pre-conditions for performing these functions.

RTOs underpin economic competitiveness by undertaking long-range strategic research and development on promising new product, process and service technologies, working closely with enterprises, universities, government agencies and others in varying modes of cooperation: single-client contract research, multi-client collaborative research, whole-sector collective research …

Fundamentally, and succinctly, RTOs are in the business of enabling customers in the economy and public domain to extract value from science and technology.

From these basic missions of RTOs important corollaries follow: a certain institutional stability over time, independent operational management, and reasonably predictable funding.

II. The Governance of RTOs: Responsibility, Independence, Funding

RTOs are Independent Organizations

In view of the characteristic public-interest functions of RTOs, they typically have legal forms which preclude the predominance of individual self-interested parties. Some RTOs, although few, are owned directly by government. Some have government, directly or indirectly, as the principal shareholder or stakeholder. Others are established as foundations or non-profit associations, with a large number of "associates" such as to preclude any single majority interest.

Where there is concentrated ownership of RTOs – typically when government is the owner or predominant shareholder – it is important that the

relationship between "owner" and "owned" should provide for "strategic responsibility with operational independence". In such cases, government *qua* owner has the responsibility to ensure that the RTO's mission remains pertinent and that adequate resources are made available to it. Thereafter, however, RTO management must be allowed day-to-day operational independence in order to ensure the neutrality necessary for its public-service mission.

Most RTOs are non-profit organizations

It is again a reflection of RTOs' characteristic public-interest functions that most, although not all[11], are non-profit organizations. This is true of approximately 80% of EARTO members.

Non-profit does not mean *Income* ≤ *Expenditure* but rather that any surplus of income over expenditure is retained in the organization and is employed in accordance with the RTO's core mission. In other words, any surplus is not distributed to third-party owners, shareholders or other beneficiaries.

Reliable Funding, Diversified According to Mission(s)

Most RTOs have several distinct missions. This is especially true of the larger "national" RTOs which play an important "infrastructural" role in their respective country: these RTOs typically combine, for example, advice to government, public laboratory services (e.g. assaying, norms and standards), condition surveillance (e.g. environmental monitoring), facilities hosting as well as strategic research and contract R&D for enterprises.

Different missions have different time horizons. Strategic research programmes, for example, may extend over many years and require a decade or more of programmed work to reach full fruition. By contrast, contract R&D assignments for enterprises may last just weeks or months. Hosting of big infrastructure facilities tends to be very long-term as does the hosting of special collections (which often involve longitudinal data series). Surveillance work, too, is typically long-term. Different time horizons imply different budgetary arrangements: long-term work requires long-term budgets.

The different missions of RTOs benefit different target groups differently. Some services are rendered to government, some to citizen groups, others to groups of enterprises or to single firms. Where there is significant individual benefit to the recipient of a service, it is reasonable that the beneficiary should pay a fair price for the service received: thus contract R&D for

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[11] For example, one of Europe's largest RTOs, QinetiQ, is a United Kingdom stock-exchange quoted company and thus has substantial private shareholder funding. A particular reason for choosing such a form of privatisation was to give QinetiQ greater freedom to operate as a "solution provider" to customers in the public and private sectors, for example freedom to exploit technology by creating companies, as well as to buy and sell other technology businesses, and to do so also outside of the United Kingdom. Despite its private capital and commercial freedoms, QinetiQ remains subject to public-interest constraints: the United Kingdom government holds a "golden share" in the company and a special compliance regime has been implemented to ensure that no conflict of interest arises between QinetiQ's roles in providing consultancy advice, on the one hand, and supplying technology, on the other. QinetiQ is another example of how the world of RTOs in Europe is evolving.

enterprises is an important category of service through which RTOs earn commercial income. Different services for different groups tend to result in RTOs having several income streams.

The following table reproduces data from the most recent EARTO survey of its members' income streams (n = 98). Because there is great variation among individual RTOs, averages would be misleading and have not been calculated. Instead, the three columns show the income streams of three selected individual RTOs which are broadly representative of different types of RTO:
A = a "national" RTO, multidisciplinary, several thousand employees
B = a sectorally focused RTO, around 100 employees
C = a small, technologically specialized RTO, less than 100 employees

Most small to medium RTOs in Europe approximate more to Type B than to Type C.

There are several important messages in the data. First, **core funding** is a small – but critically important – part of RTO income. It accounts for up to a third of RTO income[12].

Second, most of this core funding is **conditional**, i.e. it is given for the fulfilment of specific tasks or objectives. Thus the sometimes voiced objection that RTOs receive large amounts of public funding "with no strings attached" is a misconception. **Unconditional** core funding is the exception and for many RTOs has been further reduced in recent years in favour of conditional funding.

Third, and a corollary to the first point, most **RTO funding is competitive** in origin, deriving in the main from private contract income and public competitive R&D programmes.

[12] Note that in the case of "C", the 21% of revenue derived from subscription income is in effect core funding: it provides critical resources for funding in-house strategic research and competence development, without which the RTO would not be viable. The RTO is question is a relative rarity and has probably been successful because it is: (i) technology- rather than sectorally focussed and (ii) totally free to operate internationally, both of which factors considerably increase its potential client base.

RTO Sources of Income: Three Illustrative Cases

Data from an EARTO Survey of its Members' Income
The data relate to 98 individual RTOs in EU-15

	A	B	C
PUBLIC CORE FUNDING: CASH, UNCONDITIONAL *Institutional funding given as **basic support**, i.e. not given for the performance of a particular project or for the supply of a particular service, and which may be spent by the RTO as it wishes.*	**14.0**		
PUBLIC CORE FUNDING: CASH, CONDITIONAL *Institutional funding given as **basic support** but earmarked for a particular general purpose, e.g. equipment purchase/maintenance, strategic research, personnel development. Includes public service income e.g. standards development, environmental monitoring.*	**16.0**	**7.0**	
PUBLIC COMPETITIVE R&D *Funding for R&D work from public sources, won under competition with other RTOs, universities, public laboratories, firms etc., e.g. funding from Research Councils, government ministries, European programmes.*	**29.0**	**50.0**	**10.0**
OTHER PUBLIC INCOME *Any other income from public sources not covered by the categories above.*			
SUBSCRIPTION INCOME: MANDATORY (PUBLIC) *Subscriptions received from firms, trade associations or other organisations which are obliged by law to support RTOs through payment of a corresponding tax, parafiscal tax, impost, levy, etc.*			
SUBSCRIPTION INCOME: VOLUNTARY (PRIVATE) *Some RTOs offer membership to firms, often providing a standard set of membership services in exchange for an annual membership fee.*		**4.0**	**21.0**
PRIVATE CONTRACT INCOME *Income from companies and other clients, at home or abroad, for contracted work of all kinds, e.g. R&D, technical consulting, testing, training etc.*	**41.0**	**35.0**	**69.0**
OTHER INCOME *Includes "in-kind" income, e.g. RTOs which have free or subsidised access to university facilities.*		**3.0**	
TOTAL	**100**	**100**	**100**

Legend:

A = a large "national" RTO, multidisciplinary, several thousand employees

B = a medium-sized, sectorally focused RTO, greater than 100 employees

C = a small, technologically specialized RTO, less than 100 employees

The Importance of Long Term Strategic Funding

Funding to sustain research which generates new capability is critical for the continued effectiveness of RTOs and can be achieved by a variety of mechanisms which are often used together in varying proportions.

Core funding, granted conditionally or unconditionally, provides critical resources for, in particular:

- strategic high-risk research of medium- to long-term duration;
- in-house competence development, and
- the acquisition and maintenance of large-scale facilities and specialised equipment

The larger "national RTOs", like Type A in the table, tend to receive 30% or more of their funding as core funding. About another third comes from public competitive funding sources, and a final third from contract income. This roughly **$^1/_3 : ^1/_3 : ^1/_3$** split may serve as an approximate benchmark for RTOs with a leading "national" vocation.

A higher proportion of income from competitive sources can be acceptable, provided there is reasonable certainty of follow-on contracts.

Core Funding Mechanisms

Two main mechanisms are used today for determining RTO core funding[13]. The most common is the **negotiated business plan:** the RTO and the government reach agreement on a multi-year programme of activities and the volume of public funding to be allocated to the RTO for the different activities. Much of the funding granted will typically be conditional.

A second, **performance-related mechanism** can be found in Germany and France[14]. These models base the value of core funding on an RTO's success in working with industry. They have the merit of:

- providing a relatively stable and predictable income stream, while
- giving a clear incentive to engage with industry, and thereby
- ensuring the practical relevance of the RTO's service offering

The level of funding awarded can be varied according to need. In the case of *Fraunhofer*, the level of core funding thus awarded amounts to approximately 30% of annual income.

In France, a similar mechanism is used to provide basic funding to accredited Contract Research Organisations (*SRC - Structures de Recherche Contractuelle*). Here, the calculation is related especially to the volume of contract work undertaken for SMEs. The funding level is rather lower than

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[13] A third funding mechanism which has been used in several European countries is based on a compulsory levy on enterprises, sometimes referred to as a "parafiscal tax" system. Such arrangements have been used in the United Kingdom and Belgium, for example, and one continues to exist in France for funding some of the sectoral *Centres Techniques Industriels*. However, even in France the arrangement seems to have fallen somewhat out of favour - being viewed as "another tax on industry" - so that in some sectors the tax has been replaced by a government grant and in others has been maintained only if so decided by a majority of the firms in the sector.

[14] A partly performance-related funding mechanism has been proposed for Swedish RTOs in the future.

in Germany, being worth of the order of 6% to 9% of a qualifying RTO's annual turnover. However, a recent evaluation of the French SRC scheme has concluded that while it is a considerable success the level of funding is too low, preventing the scheme from reaching its full potential, and should be substantially increased.

A further, performance-related core funding mechanism in France has recently been introduced with the launch of the first *Instituts Carnot*, which is intended to provide core funding of up to 35% of turnover and which is described in the following section.

III. Recent RTO Developments in Europe

There is much diversity within the RTO sector in Europe. This diversity reflects different origins and traditions of public policy and differently evolving national innovation systems. RTOs continue to evolve in symbiosis with universities, firms and other innovation actors.

During the latter part of the previous century, RTOs in some countries found themselves under pressure. Government policies of fiscal rigour cut public budgets, including RTO basic funding. An enlarged university sector – following the expansion of higher education in the 1960s and 1970s – suffered budgetary cuts, too, and was encouraged to make up the shortfall by seeking income from elsewhere. Thus universities and RTOs sometimes found themselves in competition for income from industry.

In the past two decades, the concept of *National Innovation Systems* has gradually taken root, and a more ordered approach to innovation policy is slowly emerging.

The national innovation systems approach "*stresses that the flows of technology and information among people, enterprises and institutions are key to the innovative process. Innovation and technology development are the result of a complex set of relationships among actors in the system, which includes enterprises, universities and … research institutes*"[15]. Thus the sum is greater than the parts, many complementary parts are needed, and the parts must work together well.

It is a consequence of such systemic thinking that governments in several countries have recently re-affirmed the importance of RTOs and the crucial role which they play in innovation systems. The following paragraphs highlight some recent striking developments of this kind.

Finland: Reaffirming the Strategic Role of a National RTO

In 2004, as a part of a broad evaluation of the structures of the public research system in Finland, the Science and Technology Policy Council of Finland initiated a review of VTT.

[15] OECD, *National Innovation Systems*, OECD Publications, Paris, 1997.

The review concluded that a low level of basic governmental funding had caused VTT to shift emphasis from long-term strategic research to more short-term commercial activities with a more customer-oriented and sponsor-dependent focus. This had reduced VTT's capability of risk-taking and expectations for technological breakthroughs. The situation challenged the fundamental arguments for the existence of a state-owned research institute, making VTT's role undoubtedly questionable in the long run.

Thus a major conclusion of the review was the need to increase the level of basic funding for VTT from a level of around 30% of turnover (in 2003) to a new level of around 40 to 50%.

The review also concluded that VTT should enhance its ability to implement innovation policy more actively and acknowledged that this would require additional investment, especially in raising competence and know-how, deepening systematic internationalization and broadening activities to cover all phases of the innovation process.

The Science and Technology Policy Council of Finland adopted a very positive attitude towards these recommendations, and there is now an agreed medium-term target of raising VTT's core funding by about 5% annually in order to reach approximately 40% of turnover by 2010.

Norway: Reinforcing the Innovation System and the Role of RTOs

Norway has been blessed in recent times with large revenues from North Sea oil and gas. It has long been known that such revenues are not sustainable, and there has been much political rhetoric about the need to build an innovation culture in Norway and an internationally competitive economy. There are perhaps now signs that actions are following words.

A 2004 report to the government[16] argued the need to increase public R&D investments in areas of strategic importance for Norway and that RTOs have an important role to play in this.

In a speech to the EARTO-EUROTECH meeting in Oslo in April 2006, the Secretary of State for Trade and Industry announced a first small increase in strategic funding for *Sintef*, in anticipation of the introduction of a new scheme of core funding for RTOs in Norway. This new scheme is intended to be performance-related, rewarding cooperation with universities and success in winning competitive contracts from private and public sources.

France: The Birth of a French Fraunhofer

The first *Instituts Carnot* were founded in 2006. They are not new institutions, but existing public R&D organisations with a proven record of successfully working with industry. The objective of the Carnot scheme is to further encourage this engagement with firms and to provide additional financial resources for building in-house competence and capacity as well as to professionalise the services offered. There is, therefore, an explicit recognition of the need to invest and to provide a solid basis of core funding in order to allow these RTOs to develop effectively.

[16] Aris Kaloudis, Per M. Koch, *De næringsrettede instituttenes rolle i det fremtidige innovasjonssystemet*

The inspiration for the Carnot model is international, and especially the Fraunhofer Institutes in Germany. The French institutes, recruited selectively through competitive tendering, are intended to complement one another in their technology and service offerings, and to work together closely. The vision is for a family of some 40 institutes similar to the Fraunhofer family in Germany

20 Carnot Institutes were selected for the first wave, in 2006. A further 13 have been named in 2007.

The funding mechanism is performance-based, and again inspired largely by the Fraunhofer model. A two-part formula is employed, based on (i) the value of contracts with firms and (ii) a bonus for contracts with SMEs[17]. The maximum amount of annual funding is capped at 35% of turnover, and it is expected that the more successful Carnot Institutes will achieve core funding levels of some 30% of turnover.

Sweden: Reversing Years of RTO Neglect

Sweden has pursued since the middle of the last century a policy privileging the universities as the "knowledge base" of Swedish society and of the economy. A result has been the long-term neglect of the RTO sector (the "Industrial Institutes"), which had the very consequences feared in Finland: absence of risk-taking, concentration on routine technology services and short-run commercial contracts, neglect of strategic research.

VINNOVA, the Swedish government agency which manages R&D and innovation programmes in that country, has commissioned national and international evaluations with the aim of re-appraising Swedish R&D policy.

One of these evaluations, by Sverker Sörlin[18], has called for a "re-invigorated" RTO sector in Sweden. He concludes that the Swedish universities have not been able to provide the Swedish economy with what it needs. Sörlin argues that:

- RTOs focused on the needs of industry are vital in all innovation systems;
- a strong RTO sector will complement and support the work of the universities;
- globalization of R&D creates needs for a strong Swedish industrial research base, and also
- creates a growing international market for powerful RTOs.

Following Sörlin's report, an inter-ministerial working group was established to develop a plan of action, and the government has since announced that the institute sector must be strengthened and that the plan of action will be part of the research and innovation policy proposals for 2008.

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[17] SMEs are defined as independent firms with less than 2,000 employees.

[18] *En ny institutssektor: En analys av industrifirskningsinstitutens villkor och framtid i ett närings- och innovationspolitiskt perspektiv*, Royal Institute of Technology, Stockholm, 2006.
Another VINNOVA-commissioned evaluation, by TECHNOPOLIS, has benchmarked Swedish RTO policy against several other European countries and has similarly concluded the need for a radical change of course in order to re-instate a Swedish RTO sector capable of effectively supporting innovation capability in the industry and service sectors: *The Role of the Industrial Research Institutes in the National Innovation System: A report to VINNOVA*, December, 2006.

Spain: OECD Confirms Important Role of RTOs

In its 2007 Economic Survey of Spain, the OECD has confirmed the important role of the country's *Technology Centres* as an efficient demand-driven instrument for promoting innovation in the economy.

It is noteworthy that the corresponding paragraph in the OECD document is type-set such as to give the statement particular emphasis: ***"Promoting technology centres, which rely on demand by end-users, is a useful way of encouraging a culture of innovation while simultaneously limiting the risks of wastage."***[19]

A Counter-Case: The United Kingdom

In the 1930s and 1940s, the United Kingdom government encouraged the setting up of Research Associations to serve the needs of specific industrial sectors. Each was owned by the industry which it served and any profit made had to be re-invested in the organization. The original commitment was that government would match industry funding 50/50. In order to attract significant industrial funding, many Research Associations set themselves up as membership organizations, funded by members' subscriptions, and provided their services uniquely to their member companies. In total, about 100 Research Associations were formed.

Over the years, the level of funding by government declined and by the 1980s for many Research Associations represented around 20% of turnover. In the early 1990s an official review concluded that the public funding was too small to have a significant effect and government co-funding was subsequently cancelled.

The consequence was that some Industrial Research Associations were soon forced to close, while others continued but changed their business model, reducing their generic R&D activities in favour of more routine and commercially lucrative laboratory and technical consultancy services. The UK case illustrates that RTOs are not able to perform a strategic research function without a sufficient element of reliable core funding[20].

IV. RTOs are Key Players in the European Framework Programme for Research and Technological Development

The European Union Framework Programme for Research and Technological Development is the largest strategic R&D programme in Europe, and RTOs play a major role in its implementation.

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[19] OECD Policy Brief, Economic Survey of Spain 2007, OECD, Paris, January 2007

[20] One of the very few Industrial Research Associations which survived and which has maintained a significant strategic research programme is TWI (formerly The Welding Institute). This has been possible because TWI has succeeded in maintaining a voluntary fee-paying membership base (with some 3,500 members from 60 countries today) which generates approximately 20% of TWI's turnover and thus permits funding of a strategic research programme. This was perhaps only possible because TWI was technology-focused (welding, and later other joining technologies) which gave it a broader audience than other, sectorally focused Research Associations.

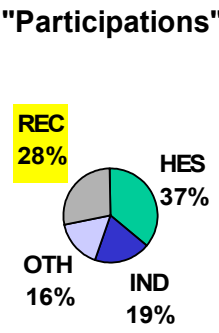
The following analysis uses official European Commission data for practically the whole of the Sixth Framework Programme (2002-2006). The data cover over 8,800 FP6 projects and almost €16 billion of FP6 funding[21].

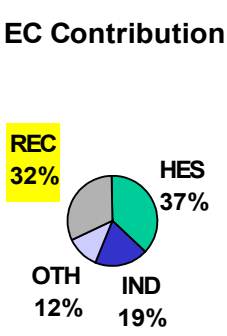
We have analyzed the participation of RTOs in general, and of EARTO members in particular, and have made comparisons with other types of participant, using the Commission's statistical categories:

- REC: Research Organisations, i.e. RTOs in a broad sense
- HES: Higher Education Institutions, i.e. universities, colleges, etc.
- IND: Enterprises in industry or services
- OTH: Other organizations, including government bodies, public agencies, etc.

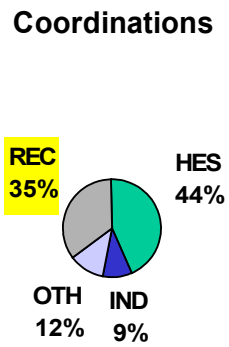
RTOs are Key Players in the Framework Programme

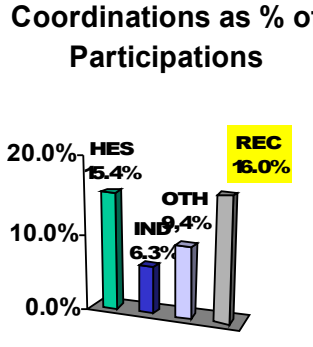
RTOs account for 28% of FP6 participations and receive 32% of FP6 funding. They are the second biggest participant category after higher education institutions





RTOs and higher education institutions provide about 80% of FP6 project coordinators: RTOs account for 35% of all project coordinations and they have the highest propensity to coordinate FP6 projects (right-hand diagramme).



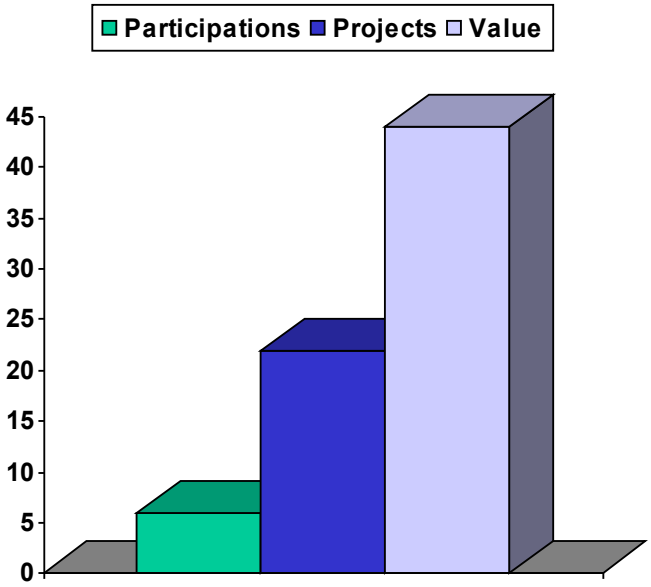


[21] The data are an extract from the FP6 contracts database. They include all FP6 contracts signed up to May, 2007. The unit of record is the individual "participation", i.e. an organisation which participates in 9 projects records 9 "participations". Prior to making our analysis, we cleaned the data by attributing, as far as possible, category codes to non-coded entries. We also aggregated the data to the level of the individual participant in order to be able to make certain comparisons. Additionally, we identified EARTO members among the "REC" participants in order to analyze their participation in FP6.

The Participation of EARTO Members in FP6

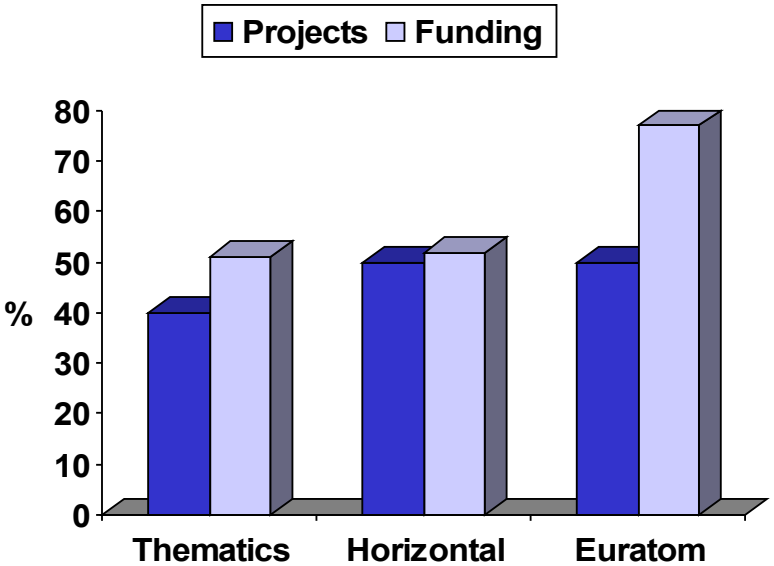
EARTO members are especially active in FP6. While they represent just 4.5% of all FP6 participations, they are involved in 22% of FP6 projects and those projects receive 44% of all FP6 funding.

EARTO members have an especially high propensity to coordinate FP6 projects, leading 27% of the projects in which they participate.



EARTO Members Coordinate 50% of EU Funding in Key Areas

EARTO members are strongly engaged in many areas of FP6. In the thematic priorities, EARTO members coordinate 9.3% of the projects, which receive 51% of the funding.

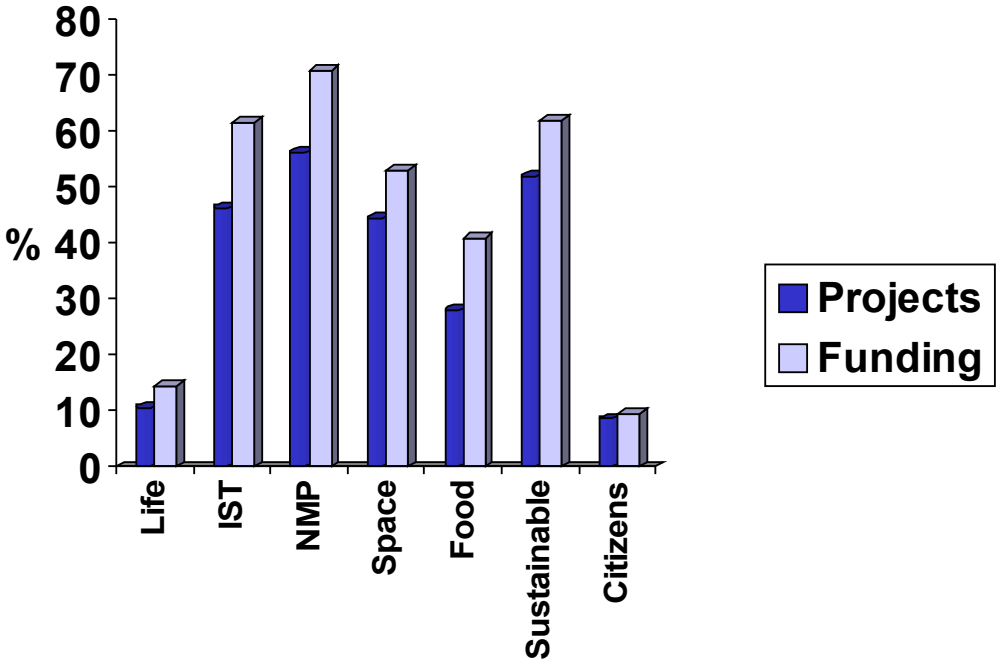


They are strongly engaged, too, in the "horizontal actions", particularly those targeting SMEs. Here they coordinate 16.6% of projects, which receive 52% of EU funding.

In Euratom actions, EARTO members coordinate 20.5% of projects, which receive 77% of the EU funding.

EARTO Members and the Thematic Priorities

RTOs have a key role in supporting economic development and this is reflected in EARTO members' participation in FP6.



EARTO members are especially active in the Thematic Priority areas of Information Society Technologies (IST), Nanotechnologies, Materials and Processes (NMP), Sustainable Development, Space and Food.

In most of these areas they are involved in half or more of all FP6 projects – the figures are slightly lower for the Food priority – which receive between 50% and 70% of the EU funding.

V. Conclusions and Recommendations

This paper has complemented the EURAB report on *Research and Technology Organisations and ERA* with additional arguments and evidence which underline the key role that RTOs play in modern research and innovation systems, working with enterprises, governments, universities and others to support socio-economic development and public policy.

As the current "Green Paper" debate on the future development of the European Research Area proceeds, to be followed in 2009/2010 by the mid-term review of FP7, policy makers at all levels must fully recognise the role of RTOs, actual and potential, in the evolving European research and innovation system.

RTOs have distinctive business models and funding regimes which EU and national policies must respect when conceiving policies, programmes and instruments. RTOs have neither the substantial basic funding of universities nor the opportunity of future income from new-product sales which allows enterprises to fund their R&D investment. EARTO had long argued that the 50% funding mechanism of earlier Framework Programmes was not sufficient support for RTOs' long-range strategic research programmes (for which industrial co-funding is typically scarce). FP7's 75% funding for research by non-profit research organisations is a necessary and welcome improvement. We estimate that it will apply to approximately 80% of EARTO members, and we shall be carefully monitoring how it is implemented in practice. **But a significant minority of RTOs remains excluded from the new, higher rates of funding and a solution must be found.**

This paper has shown that as national innovation systems evolve, **the need for RTOs – acting in complement and in concert with universities, industry and others – is increasingly better understood by governments**, resulting in new RTO initiatives being launched in some countries and in past policy errors being questioned and corrected in others. Other countries can learn from these experiences. Indeed, governments have a key role to play in shaping the innovation system – at national, regional and European level. Government is the architect and the arbiter: complementing resources where necessary, (re-)assigning roles where needed.

The earlier EURAB paper recommended the creation of a "European RTO Observatory" as a useful policy innovation to ensure that RTOs, with their distinctive characteristics, are fully recognised by decision makers as critically important R&D players. **We repeat that recommendation and propose that this "RTO Observatory" be provided by the DG Research ERA-WATCH initiative.**

More must be done to support innovation through public funding. The Aho report has prompted renewed discussion about the need to **strengthen public procurement in Europe and to use it to drive innovation**. RTOs fully support this approach and can be counted on to participate actively.

RTOs in general, and EARTO members in particular, play a major role in the implementation of the European Union Framework Programme for Research and Technological Development. **The Framework Programme was originally launched to strengthen the bases of European industry and competitiveness, and it has developed into a key funding instrument of application-oriented R&D in Europe. It is important to maintain this orientation and to expand the programme.** The Lisbon objectives will not be achieved by rhetoric alone; we need the policy measures and financial incentives to leverage industrial R&D spending, with RTOs playing a critical supporting role.

The introduction of the European Research Council (ERC), with the remit to fund excellent "frontier research", in the Seventh Framework Programme is a welcome innovation. **RTOs look forward to ERC funding for excellent application-oriented frontier research.**

EARTO has given its full support to the proposed European Institute of Innovation and Technology (EIT), which we believe can become a further valuable instrument serving to strengthen European competitiveness and social development. The EIT should complement the ERC's "excellence" with "relevance". It should complement, too, with longer-term strategic research the industry-led efforts of Technology Platforms and Joint Technology Initiatives. **RTOs anticipate playing a key role in the governance of the EIT as well as in the conception and implementation of its programmes.**

The EIT can also be expected to provide further stimulus for RTOs to operate outside of their national boundaries. This consideration applies especially to those RTOs in receipt of [national] public core funding, who often find themselves challenged by [national] decision makers whenever they engage in major projects with foreign partners. The result is frequently what can be termed "national lock-in" – discouragement of working with non-national partners – which is generally short-sighted and often results in sub-optimal outcomes. European initiatives like the Framework Programme, and now the EIT, help to counter this lock-in effect, but there is a continuing need to educate national decision makers about the many positive benefits of transnational engagement. **The European Commission should consider further measures to counter national lock-in, such as an incentive scheme which would provide a bonus on cross-border research contracts between accredited research organisations and enterprises**.

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