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EUROPEAN RESEARCH ADVISORY BOARD
FINAL REPORT

RESEARCH AND TECHNOLOGY ORGANISATIONS (RTOS) AND ERA

December 2005

SUMMARY AND RECOMMENDATIONS

Summary

Effective research and innovation systems require an effective mix of institutions with complementary competences, resources and skills.

R&D in Europe involves three main types of institutional actor: enterprises, higher education institutions (universities, etc) and RTOs (Research and Technology Organisations). They complement one another and all contribute importantly to ERA .

Research and Technology Organizations (RTOs) are distinctive, mission-oriented R&D organisations which perform key functions in European innovation systems and which exhibit characteristic strengths.

RTOs account for about 40% of publicly funded R&D in the EU and for about 14% of all R&D.

RTOs could contribute more to ERA if European policy were better adapted to realising their potential.

Industry-linked RTOs can help boost private R&D investment in Europe (EURAB WG5) and can be powerful catalysts of regional research and innovation (EURAB WG3).

Recommendations

EURAB makes the following recommendations:

1. Action should be taken to raise the profile of RTOs so that policy makers are more aware of their role and of their important contribution, actual and potential, to ERA.

   Specifically, two policy conferences should be organised.

   i. A conference to illustrate the distinctive role of RTOs in European R&D and their contribution to ERA. In order to attract the necessary policy attention, it is recommended to organise this conference as an EU Presidency event.

   ii. A conference to promote closer cooperation between RTOs and universities - indispensable in a world characterised by increasingly “open innovation”, the explosion of knowledge, and rising demand for well-trained scientists and engineers.

2. ERA policies, programmes and instruments must take greater account of the potential of RTOs to contribute to the realisation of ERA. A full ERA policy review relative to RTOs is required.

   Improvements to consider include the adaptation of existing and envisaged instruments in order to take better account of RTOs as holistic, mission-oriented organisations. For example:

   - the present ERA-NET scheme could be adapted, or a similar scheme introduced, such that the definition of "research activities" addresses RTOs as whole organisations and hence permits their participation.

   - the new infrastructures programme proposed for FP7 could be defined so as to encompass mission-oriented RTOs as whole organisations.

   Such adaptations to ERA instruments would facilitate more effective mission-oriented networking and coordination among RTOs in Europe.

3. RTO visibility must be raised inside the European Commission also. DG Research should establish an "RTO Observatory". The Observatory would monitor the development of the RTO community in order to help ensure proper comprehension for policy purposes of RTOs' distinctive role.

4. RTOs perform missions in the public interest, and are at least partially funded through public resources. They are thus responsible to government. But they require sufficient operational independence. This is essential for their effective and efficient operation, for the impartiality of the research and advice which they provide, and for their ability to adapt rapidly and smoothly to changing conditions and opportunities in their research fields and operating environments.

   The most suitable governance model for RTOs may be what might be termed an "arms-length" or "agency" model, combining clearly defined long-term missions with medium-term (e.g. five to seven years) rolling programmes and budgets. Such an arrangement can effectively balance the public responsibility of RTOs and their sufficient managerial independence. It remains the responsibility of the relevant shareholders/stakeholders to set, and to adjust when necessary, the RTO's mission.

REPORT

The Issues Addressed

The key questions underlying the present report are:

- What is the distinctive role of RTOs in European innovation systems?
- How do RTOs contribute to ERA and how appropriate are present policies, programmes and instruments for supporting RTOs' contribution to the realisation of ERA?

The Distinctive Role of RTOs

Research and Development in Europe involves three main types of institutional actor: enterprises, higher education institutions (universities, etc) and RTOs (Research and Technology Organisations). They complement one another and collaborate closely.

EARTO (The European Association of Research and Technology Organisations) defines RTOs 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 RTO sector is large. It accounts for about 14% of total R&D expenditure (GERD) and for about 40% of total government expenditure on R&D (GOVERD) in EU-15 (and probably more in EU-25). It is heterogeneous in organisation: public research centres, private non-profit associations, arms-length managed agencies … are just some common models. It is variable in the functions which individual RTOs perform: basic research, applied research, policy support, big infrastructures, certification … It is continually evolving: privatisation of public laboratories, joint ventures with universities, growing commercialisation of services to industry …

Despite this diversity, there is a clear, basic rationale for RTOs: it is to perform some of the essential functions of national or European research systems that they are better fit to perform than other R&D players (enterprises and universities) in terms of quantity and quality, reliability, stability and accountability. Thus, in a general sense, RTOs are a response to perceived actual or potential market or systemic failures. This rationale for RTOs is further discussed in Appendix A.

That there is so much diversity from one country to another in the organisational forms of RTOs and in the functions which they perform reflects, by and large, historical contingency and politico-cultural preferences. It does not contradict the essential reason for their existence.

In view of the diversity in the RTO sector, it is not helpful to try to characterise the sector in terms of the public vs. private nature of the organisations concerned or of the commercial vs. non-profit character of their operations. Most useful is to identify the

functions which RTOs typically perform and to understand the corresponding rationale(s).

The Working Group identified the typical functions of RTOs shown in the attached table.

TYPICAL FUNCTIONS OF RTOS

	FUNCTION	EXAMPLES OF ACTIVITIES	RATIONALE(S) FOR RTO ROLE
A	Fundamental/ strategic research	• Fundamental research in particular in areas considered to be of strategic importance, e.g. defence/security, nuclear energy, public health. • Long-term studies	• Improbability that enterprises or universities would undertake the work in sufficient breadth/depth, inter-disciplinarity, with sufficient continuity. • Need to combine basic and applied work and to ensure "knowledge integration", i.e. marrying knowledge from own and other sources (cf mission orientation of RTOs). • Scale of the investment required for critical mass (people, facilities, etc.). • Security (in strategic or sensitive areas). • Specialised training and skills (perhaps a benefit rather than a rationale).
B	Technological support to economic development	• Contract research services to industry • Long-range technological research[1] • Technology "extension" • Support for SMEs	• Compensate market imperfections related to cost and risk • Accelerate and broaden technology diffusion.
C	Supporting public policy	• Fundamental and precautionary research, e.g. environmental policy, public health, food safety, sustainable development • *Ex-ante* policy design and impact analysis • *Ex-post* surveillance and monitoring of the implementation of policy, e.g. pollution, seismic survey • Expertise	• Impartiality (including the need to separate monitoring and control functions from advocacy functions) • Requirement for resource-/time-intensive expertise (i.e. more than occasional or one-off expertise) • Responsibility and accountability
D	Technical norms, standards	• Pre-normative research • Implementation monitoring, e.g. metrology • Certification (and certification of certifiers)	• Impartiality • Security based on independence
E	Constructing, operating and maintaining key facilities	• Big infrastructure (e.g. accelerators, research reactors, botanical gardens, large computing facilities). • Large, unique, dangerous etc. collections.	• Cost beyond the resources of other players • Security and safety (physical concentration, accountable management)

[1] i.e. speculative development of technologies which it is hoped will prove to be of major practical significance in the longer term (e.g. ten-year time horizon).

		• Large, long-term data collections	

Trends and Perspectives in RTO Development

A SWOT *(Strengths, Weaknesses, Opportunities, Threats)* analysis of the longer-term position of RTOs (+/- 10 year perspective) in Europe is a helpful tool for better understanding the potential contribution of RTOs in an evolving ERA. A summary table of the results of such an analysis is presented in Appendix C. The present section highlights key conclusions.

- A characteristic feature of RTOs is that they are mostly mission-oriented. This implies a certain continuity of activity over time (since missions are usually long-term, even "permanent"). It tends to imply, also, a certain polyvalence, because achievement of the mission typically requires the "bundling" of various otherwise distinct competences and activities, e.g. R&D, information dissemination, training, condition monitoring and impact evaluation, etc.

- An RTO's mission defines the objects of its research; it says nothing about the nature of the research. It is characteristic of many RTOs that they pursue both basic (or fundamental) as well as applied research. RTOs undertake basic research in order to understand phenomena and so to develop knowledge and technologies needed to complete their service offering in order to be able to fulfil their mission. Their applied research may be short-term (e.g. contract research for immediate application) or long-term (e.g. strategic research aimed at developing technologies with hoped-for significant practical application in several years time). Such mixed research portfolios pose specific management challenges and call for financing arrangements which balance both short- and long-term perspectives and diverse income streams from public, private and co-financed sources.

- Mission-oriented research demands sufficient minimum critical mass. The necessary minimum critical mass is tending to rise in many areas as a consequence of the explosion of knowledge, rising "technicity", the costs of essential equipment and infrastructures, etc. There may therefore be an opportunity for RTOs in different countries with similar missions to pool activities and resources.

- A typical function of RTOs is to provide unique facilities such as large-scale infrastructures, rare-specimen collections, longitudinal data series, etc. The costs of construction and maintenance of many such large-scale infrastructures continue to rise, which severely strains limited resources. There may therefore be an opportunity to "share" them more fully, e.g. by partnering with other institutions, by making them more fully available to wider communities of users, etc.

- "Open Innovation" requires improved knowledge flows between enterprises, RTOs, and universities. No one RTO can produce or absorb all mission-relevant knowledge. There may therefore be an opportunity to encourage greater staff mobility to and from RTOs. Also, there may be an opportunity for RTOs to increase their training of young scientists and engineers which later transfer to the university or industry sectors.

- RTOs in their relations with government require sufficient independence in order to be able to respond efficiently to new challenges and opportunities in their mission scope and operating environment.

- RTOs play an important role in supporting economic development and competitiveness (cf EURAB WG5), including at regional level (cf EURAB WG3). Their role as providers of contract research services to industry is significant and growing.

- RTOs are an “impartial” source of policy expertise and advice, and they contribute to evidence-based policy making, which is growing.

- The most appropriate governance model for a mission-oriented RTO may be what might be termed an “arms-length” or “agency” model:
  - Goal: mission-focussed, long-term perspective.
  - Means: arms-length contractual relationship with government specifying the broad parameters of the mission and the corresponding budgets, in an at least medium-term (e.g. five to seven years) perspective and on a rolling basis.

RTOs’ Contribution to ERA

The ERA policy initiative, successfully implemented, will raise the efficiency and effectiveness of European research.

RTOs play an important role in European research. As noted earlier, they account for about 14% of total R&D expenditure (GERD) and for about 40% of total government expenditure on R&D (GOVERD) in EU-15 (and probably more in EU-25)[2].

Current European policy frequently fails to take specific account of the distinctive role of RTOs. The Commission’s reassessment of the Lisbon strategy (COM 2005 24), for example, makes frequent references to universities but says nothing specific about RTOs

A rather similar conclusion emerges from an analysis of the specific instruments put in place to encourage and facilitate the restructuring of ERA, at the three levels of policies, programmes and projects.

Policies	“Open Method of Coordination”
Programmes	Articles 169 and 171, ERA-NET
Projects	FP6 instruments: NoEs, IPs

Mission-oriented research does not fit comfortably into any of these boxes: a mission is generally less than a policy but more than a programme or a project. Of course, RTOs can and do participate in Framework programme activities - but very often less completely than they would if instruments were better attuned to their circumstances.

For example, at the level of **projects** RTOs are important players in collaborative research. Precise statistics are not available but estimates suggest that they probably constitute more than two-thirds of the research performers in the CRAFT and Collective Research schemes for SMEs. This reflects, of course, their relevance to the practical needs of SMEs. It reflects also, however, the fact that within the FP SME-specific schemes their services as research performers are fully remunerated. By contrast, RTOs wishing to undertake longer-term strategic research using the IP or STREP instruments are often frustrated by the 50% funding rate, for industrial co-funding is almost impossible to raise for high-risk long-term research, while RTOs’ disposable core funding is frequently inadequate to cover the balance.

[2] These figures relate to government intramural spending on R&D and hence do not refer to all RTOs. The true figures for RTOs in their entirety could be nearer 20% and 50% respectively. One of the roles of the proposed RTO Observatory could be to obtain better data.

NoEs and IPs are clearly intended as structuring instruments. Their relevance as such for mission-oritented RTOs is limited, however. IPs are thematic (and individual IP Calls for Proposals may be quite tightly focussed), whereas the missions of RTOs are generally broader. Thus RTOs may be able to fit parts of their missions to IPs, but IPs rarely fit well to their missions.

NoEs can be focussed more broadly than IPs, but they provide support only for concertation: there is no direct support to facilitate practical coordination and the often considerable effort necessary for planning and implementing the restructuring and integration of activities. As NoEs are required to promote European integration, there is sometimes a tension with RTOs' strategic orientation: should they aim to integrate with other players as a whole or should they transfer a subset of their activity to a European integrated system?

At the level of **programmes**, the ERA-NET sub-programme is helpful for some RTOs but is of limited relevance for others. The essential difficulty here is that "programmes"[3] in the restrictive ERA-NET sense of the term rarely correspond to the "missions" of RTOs. The mission of an RTO may comprise or relate to all or part of one or more government programmes, or a mixture of (public) programmes and other activities which, while not "programmes" in the sense of ERA-NET, are nevertheless essential to its overall mission. Of course, (large) RTOs can accommodate ERA-NETs as a subset of their activities. But the ERA-NET scheme does not address RTOs as whole organisations and hence provides no substantial opportunity for facilitating their European rapprochement and co-operation.

Article 169 might provide a framework and opportunity for bringing together the activities of similar RTOs from several Member States. But the road to an Article 169 arrangement is long and difficult. A substantial amount of groundwork must first be accomplished for which no suitable supporting European instruments yet exist.

FP7 is intended to include a further new structuring instrument for infrastructures. It may offer opportunities for RTOs which include infrastructure management among their activities to undertake joint initiatives with other players in order to rationalise the purchase, maintenance and operation of and access to large-scale facilities. This new FP instrument would relate to only a specific segment of RTO activity.

Currently, RTOs are unable to contribute as fully as they might to the realisation of ERA. Their contribution can be significantly raised by adapting ERA policy instruments accordingly. A better fit between ERA instruments and the mission orientation of RTOs would facilitate more European mission-oriented networking among RTOs.

[3] ERA-NET uses the term "research activities" in order not to avoid too restrictive a focus; nevertheless, the target is essentially what is normally understood by the term "public programmes".

APPENDIX A

Background Material on the Role and Importance of RTOs

Research and Development in Europe involves three main types of institutional actor: enterprises, universities (more broadly, higher education institutions) and RTOs (Research and Technology Organisations). In the definition employed by the European RTO trade association, EARTO[4], RTOs are 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, which produce goods and services.

In a simplistic characterisation, universities do basic or fundamental research and enterprises do applied research, *inter alia* using the results of basic research. Reality is not at all so simple, of course, but let us imagine for a moment such a world. Many dysfunctionalities would arise.

The Origins: Market and Systemic Failures

Economists broadly agree that enterprises, left to their own devices, will tend to under-invest in R&D: one reason are the high risks associated with certain investments; another is the uncertainty of being able to sufficiently appropriate the results of the investment. SMEs tend to under-invest in R&D for lack of technical competence, because of the high risks of innovation, and for want of financial resources. These are examples of **market failures** or imperfections, which lead to collectively sub-optimal R&D outcomes. There are others.

There are in addition higher-order **systemic failures** and imperfections. We demand today, for example, high standards of food safety, occupational health, and environmental protection. We need, too, widely accepted technical standards in the interests of efficiency and safety. Enterprises cannot necessarily be relied upon to ensure or respect such standards without regulation and/or incentives by government. In order to be able to act effectively, governments need precautionary and pre-normative research, impartial surveillance, and more.

One essential rationale for RTOs is the perceived need by government to pre-empt or counter such market and systemic failures. Many RTOs have been established or facilitated by governments to perform tasks that enterprises and universities, left to their own devices, most probably cannot or will not perform in sufficient quantity and/or quality, and with sufficient reliability, stability and accountability.

The Shifting Boundaries between Enterprises, RTOs and Universities

The RTO sector is large, ubiquitous, but also heterogeneous and therefore often ill-perceived. For example, RTOs in different places but with similar functions may reveal quite different legal forms and financing mechanisms. Also, some functions that in one place are performed by RTOs may in

[4] European Association of Research and Technology Organisations: www.earto.org

another place be done by a university[5]. Indeed, one of the trends of recent years is the shifting and overlapping boundaries between enterprises, RTOs and universities[6].

RTOs were generally created directly by government - or by publicly sanctioned collectivities (e.g. industrial branch organisations)[7] - and had, at the time of their creation, a clearly public profile: a publicly ordained (collective) mission paid for with public (collective) funds.

Today, the profile of many of these RTOs is less uniquely public. Many fulfil one or more public mandates, and receive corresponding public funding, but at the same time also provide services commercially to enterprises. Indeed, some RTOs are required to sell services commercially as part of their public mandate[8]. RTOs are no longer a perfectly homogeneous category, if ever they were, and many can no longer be neatly and unambiguously classified as "public". They have evolved into mixed-economy institutions.

The university and enterprise sectors are changing, also, however. Universities in many countries have been encouraged by government in the past decade or so to engage increasingly with industry[9]: they perform contract research, create spin-off companies, license out technology, and accept industrial sponsorship. In the enterprise sector, services now account for the major share of total economic activity in Europe and among them is a growing proportion of what are sometimes termed "Knowledge Intensive Business Services (KIBS)", which include firms providing research and other technology services to enterprises – services that may also be provided by RTOs and universities.

The Changing Space for RTOs (and other players)

At least part of the explanation for the shifting boundaries between enterprises, RTOs and universities is that during the past half century or so the role of government has changed as the tools of governance available to it have evolved. The traditional, rather blunt instruments of modern government – parliamentary legislation, executive orders - have been joined by increasingly sophisticated incentive, regulatory and other management tools. Financial and fiscal incentives have developed since the 1960s into widely employed instruments which governments use to influence the behaviour of firms (and others) at the margin. Regulatory and other management tools have evolved, too, and have become more and more sophisticated. The point for the present discussion is this: governments dispose today of a much richer array of tools – "sticks"

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[5] For example Functions B (Technological support to economic development) or C (Supporting public policy) in the earlier table. The other functions, however, are less easily performed outside of RTOs.

[6] The three exhibits attached in Appendix D try to capture something of this evolving diversity in graphical terms.

[7] The French Centres Techniques Industriels are an example of this type of RTO. The originators and owners of most of them are the firms in the respective branch of industry, the overall system being facilitates by the government, which provided for a parafiscal tax to be levied on the firms and its proceeds to be used for funding the CTI. This was also the model in the UK 'Industrial Research Associations), pre-Thatcher. Similar but different branch-based arrangements are found in Germany (AIF model), Greece, Italy, Portugal and Spain. TNO, the leading Dutch RTO, began life as a branch-focussed technology organisation.

[8] A good example is the Fraunhofer Gesellschaft in Germany. The funding model is that the government gives approximately €40 of matching finance for every €50 which Fraunhofer earns in the market. The rationale for this mixed public-private model is that the criterion of market success guarantees the practical relevance of the services offered by Fraunhofer. In France, the "abondement" – less generous than its German counterpart and related to services provided to SMEs - offered by ANVAR to RTOs there follows a similar logic.

[9] This is true of the United Kingdom, for example. As noted in footnote 7, the UK Industrial Research Associations lost their core funding in the Thatcher years. Subsequently, central government funding of universities has been cut back, and universities have been encouraged to seek other sources of funding and in particular to engage with industry ("third mission"). There has been a growth in contract work for industry, in industrial sponsorship, third-party licensing, etc.
It is also true of Sweden, where core funding of the "Industrial Institutes" has been cut back and universities have been expected to develop as the knowledge base of Swedish industry: a recent evaluation undertaken for VINNOVA undertaken to benchmark Swedish technology policy against other countries tends to the conclusion that this Swedish experiment has not worked as intended, in part at least because the incentives to university researchers still predominantly favour academic criteria.

and “carrots” - than previously with which to tackle potential market and systemic failure. The “Create-a-New-Organisation” option is less automatic than it once was.

Conclusions

The essential rationale for RTOs is to counter actual or potential market or systemic failures in respect of R&D and related technology activities.

Enterprises, RTOs and universities live in an evolving symbiosis. The role and importance of RTOs at any one point in time and place are conditioned to some extent by the roles of the other two, and reflect historical contingency and political choice.

The RTO sector exhibits much variation across time and space. This may also help to explain why ERA and European Union R&D policy have not yet taken full account of the contribution which RTOs can make to the achievement of their policy objectives.

APPENDIX B

Some Comparative Statistics

Material reproduced with grateful acknowledgement from Carlos Morais' Paper for EURAB1/WG2:
"Leveraging Research and Technology Organisations (RTOs) in the ERA Landscape"

A detailed study on RTOs is given in a comparative analysis of European research centres compiled by PREST on behalf of the "Eurolabs" project consortium (EC,2002). The data come from a data base with 769 European R&D organisations, quoted in EC, 2003 (p. 72/73 in the section *The evolution of Research Centres*). The following summarised data provide a snapshot of RTOs in the EU-15:

Types of Activity	
Basic Research	52%
Applied Research	92%
Development	80%
Certification/Standards	32%
Diffusion/Extension	67%
Provision of Facilities	33%

Predominant Skills Base	
Engineering and Technology	63%
Natural Sciences	58%
Agriculture, Medicine and Social Sciences	27%-32%
Humanities (languages, culture, societal issues)	10%

Predominant Linkages	
Industry	77%
EC	74%
National Authorities	89%
Regional Authorities	53%
University	74%

The share of the public sector research institutes expenditure in total R&D expenditure (GERD), available for the latest year comes from the same source - EC, 2003 (p. 67, 68).

RTOs expenditure / GERD	
Portugal	27.9%
Greece	21.7%
Italy	20.2%
France	17.8%
Netherlands	16.5%
Spain	15.5%
Denmark	15.2%
EU-15	**13.6%**
Germany	13.1%
UK	12.2%
Finland	10.6%
Japan	9.9%
US	7.5%
Austria	6.4%
Ireland	5.7%
Sweden	3.4%
Belgium	3.3%

The weight of the RTOs funding within in the government sector R&D expenditure (GOVERD) (i.e. the combined higher education, HERD and public laboratories expenditures) is given in the following table:

RTOs expenditure / GOVERD	
France	51.5%
Germany	45.8%
Denmark	42.8%
Portugal	42.8%
Japan	40.5%
EU-15	**40.1%**
US	35.6%
Ireland	21.9%
Austria	17.8%
Sweden	13.6%
Belgium	12.2%

The tables show the importance given to publicly driven institutions, taking into account the differences in the relative importance of government sector in each of the quoted countries. This is the reason why EC, 2003 states (p. 68) that "*among the EU countries' government laboratories in France, Germany, Denmark and Portugal play a substantial role in national innovation systems"*.

According to OECD, 2003, referring to OECD countries (1981 to 2000), the share, in GERD, between universities expenditure on R&D (HERD) and public laboratories (RTOs) expenditure,

presents, over these 20 years, a constant value of 17% for universities and a slightly decreased value for RTOs: 15% to 11%. One explanation to explain this variation being *the decline in defence-related research, much of which was undertaken in government laboratories* (OECD, 2003). Sweden, Hungary, Japan and Mexico are presented as exceptions to the above mentioned stabilised trends. EU-15's RTOs expenditure on R&D / GERD roughly coincides, at present, with OECD values, as shown above [4].

Funding for RTOs comes from several different sources, in particular: public core funding, competitive public grants, and business. The share of business funding from contract research is growing.

GERD: Gross domestic Expenditure on R&D.
GOVERD: Government intramural Expenditure on R&D.
HERD: Higher education Expenditure on R&D.

APPENDIX C

SWOT Analysis : The Position of RTOs with (some) Public Funding in the Longer Term (e.g. +/- 10 years from now) in the European Research Area

Strengths

- Mission-oriented focus, which facilitates/requires:
  - inter-disciplinarity
  - critical mass
  - polyvalence (i.e. ability to cover/integrate many elements in the innovation chain, e.g. to combine research, consultancy, testing, dissemination, certification, training etc.)
  - knowledge integration (i.e. durably network in-house and externally the competence required for the mission)
- Unique facilities (infrastructures, large and long-term data collections, etc.)
- Impartiality, neutrality (including towards government, providing management arms-length)
- Reactivity/adaptability in principle to changing environment (in keeping with longer-term mission-oriented focus)
- Provision of high-level specialised training

Weaknesses

- Origins/objectives related to promoting national economic advantage, which can constrain European activities
- Public dependence can impair ability to react to changing demand and opportunities
- Civil service rules and mentality in some cases and consequent lack of flexibility.
- Multiple missions/tasks can overstretch management
- High cost of necessary investment and maintenance in relation to big facilities

Opportunities

- Rising demand for individual and collective security and safety (terrorism, environment, food) increases demand for precautionary research, impartial testing, monitoring services etc.
- Increasing use by governments of medium-term negotiated contracts with RTOs under which functions are agreed and corresponding funding negotiated: provides recurrent medium-term (e.g. five-seven year) stability.
- Competition and cost pressures on enterprises drive lean organisation: increased outsourcing of R&D
- Multi-facetted innovation processes (technology + business plans + management skills + investment capital, etc.) and networked National Innovation Systems provide an opportunity for RTOs as "integrators" or "spiders in the web".
- Industrial demand for young scientists and engineers with applied skills; young graduates and industry view RTOs as an attractive first employer of students
- Rising costs of acquisition and maintenance of sophisticated infrastructures and large-scale facilities provides opportunity for big RTOs to offer collective or shared-cost solutions to universities etc.
- Inability/unwillingness of higher education in certain countries to enter the growing contract R&D market
- Emerging/new markets, e.g. China, Russia
- Increasing demand for knowledge-based policy development
- Increasing importance of "science & society" issues

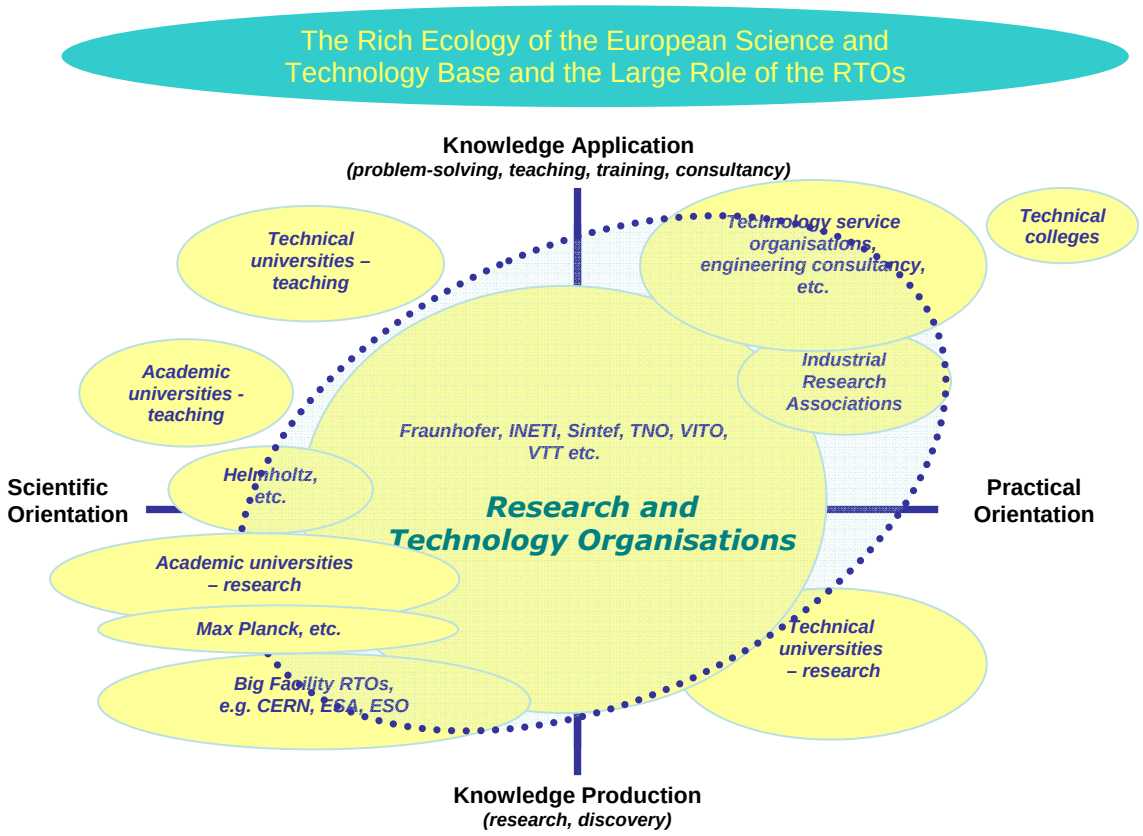
Threats

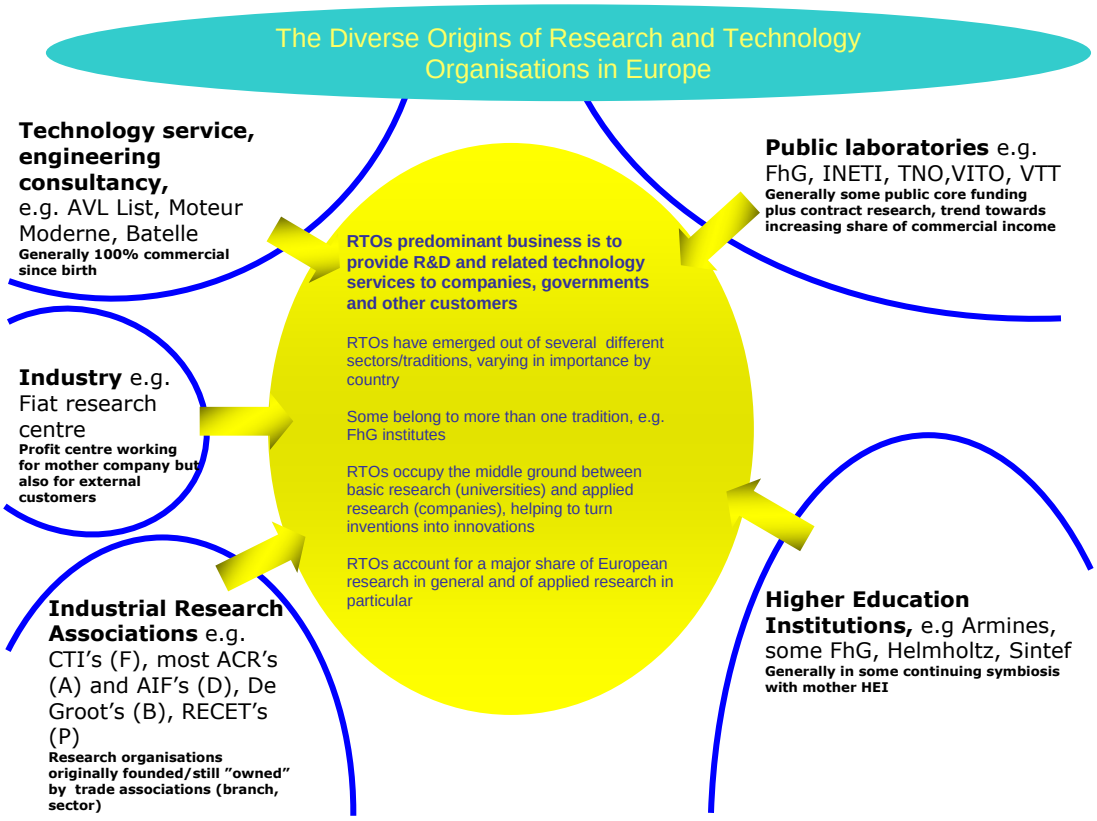
- Public budgetary stringency and consequent reductions in essential RTO core funding
- Widening belief among governments of the advantages of privatisation (including risk of organisational change without proper analysis)
- Increased reliance of governments on incentive and regulatory tools to influence the behaviour of private R&D and technology players in preference to funding of RTOs
- Government perception of RTOs' mission being to promote national economic advantage prevents RTOs from exploiting opportunities in other EU member States and in other regions of the world:
    - Governments sometimes oblige their RTOs to work only nationally
    - Governments may defend national markets by seeking to prevent foreign RTOs from them
- "Playing field" not always level for all players
- EU competition rules (e.g. State Aid Framework for R&D) must be consistent with public mission function and "business model" of RTOs

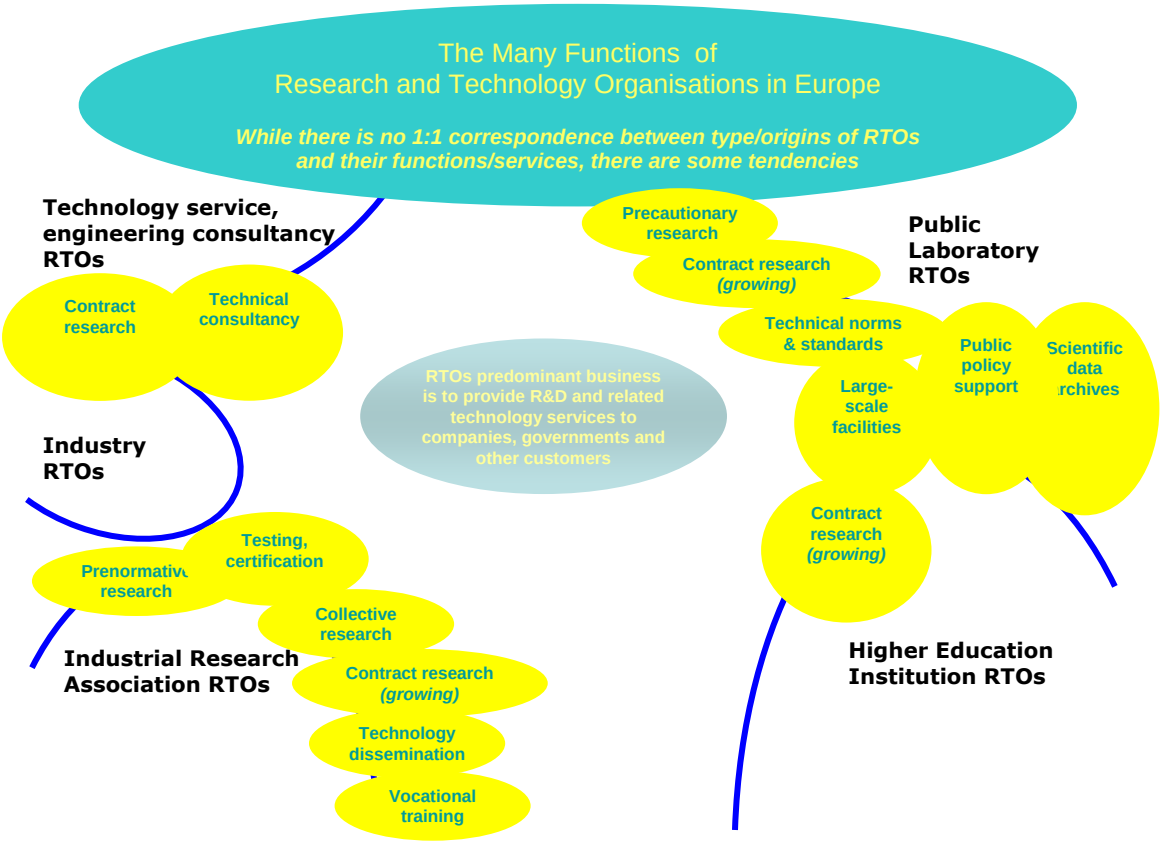
APPENDIX D

Exhibits

The following three exhibits illustrate very approximately the positioning of RTOs in the R&D landscape, their origins and their functions.




The Diverse Origins of Research and Technology Organisations in Europe
Technology service, engineering consultancy, e.g. AVL List, Moteur Moderne, Batelle
Generally 100% commercial since birth
Public laboratories e.g. FhG, INETI, TNO,VITO, VTT
Generally some public core funding plus contract research, trend towards increasing share of commercial income
RTOs predominant business is to provide R&D and related technology services to companies, governments and other customers
RTOs have emerged out of several different sectors/traditions, varying in importance by country
Some belong to more than one tradition, e.g. FhG institutes
RTOs occupy the middle ground between basic research (universities) and applied research (companies), helping to turn inventions into innovations
RTOs account for a major share of European research in general and of applied research in particular
Industry e.g. Fiat research centre
Profit centre working for mother company but also for external customers
Industrial Research Associations e.g. CTI's (F), most ACR's (A) and AIF's (D), De Groot's (B), RECET's (P)
Research organisations originally founded/still "owned" by trade associations (branch, sector)
Higher Education Institutions, e.g Armines, some FhG, Helmholtz, Sintef
Generally in some continuing symbiosis with mother HEI


The Many Functions of
Research and Technology Organisations in Europe
While there is no 1:1 correspondence between type/origins of RTOs and their functions/services, there are some tendencies
Technology service, engineering consultancy RTOs
Contract research
Technical consultancy
Industry RTOs
Prenormativ research
Testing, certification
Collective research
Contract research (growing)
Technology dissemination
Vocational training
Industrial Research Association RTOs
RTOs predominant business is to provide R&D and related technology services to companies, governments and other customers
Precautionary research
Contract research (growing)
Public Laboratory RTOs
Technical norms & standards
Large-scale facilities
Public policy support
Scientific data rchives
Contract research (growing)
Higher Education Institution RTOs

APPENDIX E

The Members of the Working Group

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