



ERAWATCH Country Report 2008

An assessment of research system and policies

Cyprus

Lena Tsipouri, Dariya Roubliova and Maria Kolomitsini



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**Joint Research Centre
Directorate-General for Research**

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Executive Summary

Research-related policies aimed at increasing investment in knowledge and strengthening the innovation capacity of the EU economy are at the heart of the Lisbon Strategy. The strategy reflects this in guideline No. 7 of the Integrated Guidelines for Growth and Jobs; the guideline aims to increase and improve investment in research and development, in particular in the private sector. The report aims at supporting the mutual learning process and the monitoring of Member States efforts. The main objective is to characterise and assess the performance of the national research system of Cyprus and related policies in a structured manner that is comparable across countries. In order to do so, the system analysis focuses on key processes relevant for system performance. Four policy-relevant domains of the research system are distinguished, namely resource mobilisation, knowledge demand, knowledge production and knowledge circulation. This report is based on a synthesis of information from the ERAWATCH Research Inventory and other important available information sources.

The research system of Cyprus was developed in the last decade; the negotiations with and then the accession to the EU were the driving force behind changes. The first university was created in the mid '90s and a Technical University started operating only in the previous academic year. The HEIs and research laboratories are now producing research results in a broad range of sectors but the business community is not yet mobilised. It lacks research interest, capabilities and demand for new results. But, at least, the country performs better in terms of internationalisation: it has a deeply rooted commitment to the ERA, a good track record in the participation to the Framework Programme and two broader ambitious projects in cooperation with US prestigious universities. Recent policy orientation envisages an opening up to the non-European Eastern Mediterranean countries, which started to show up with the Cyprus-Egypt bilateral research cooperation.

The Planning Bureau put more emphasis on research both in terms of budget allocation and resources at policy level last year. In this context the Research Promotion Foundation (RPF), the most important executive agency for research policy implementation, made an effort to create a bundle of activities (DESMI) to better streamline its support schemes, make them more visible and more transparent and most importantly try to increase the scope of support to the business community. Despite these efforts and an additional endeavour from the side of the Cypriot Chamber of Commerce and Industry to launch pilots for RTDI policy, intramural research, university-industry cooperation and the exploitation of research results are still significantly underdeveloped.

The most striking weaknesses are the reluctance of the business sector to invest in research and the RTDI governance structure, which is reluctant to select research priorities allowing for funds to be very thinly spread. In addition, the Ministry of Commerce, Industry and Tourism has other priorities and earmarks very limited resources to R&D. Important steps were made towards improving the overall governance with a Ministerial Council decision at the end of 2007: new interministerial structures are foreseen and a new Council that will take responsibility for a systematic consultation and priority setting. Until now the RPF was playing a positive role but was limited to R&D support without an explicit mandate to address

technology and innovation. A new agency, created through its merger with the Technology Promotion Foundation last year is expected to expand the current research policy to exploitation and new actors¹. Additional weaknesses are the lack of medical education and industrial design capabilities.

Domain	Challenge	Assessment of strengths and weaknesses
Resource mobilisation	Justifying resource provision for research activities	Public resources for research are increasing and a 1% of GERD/GDP target is set. The low involvement of the social partners and the lack of public debate discourage the increase of budgetary resources.
	Securing long term investment in research	The sectoral composition of the productive sector explains why there is neither basic research nor long-term investments in RTDI. Efforts of the public sector to support research infrastructure are increasing but still insufficient.
	Dealing with barriers to private R&D investment	The opening up of many calls for proposals to SMEs is increasing potential participation but with still limited response.
	Providing qualified human resources	Two universities were created in the last 15 years and adult education is improving. Youth education levels constitute the main strength of the country. Low S&E and the lack of medical and industrial design skills constitute additional weaknesses.
Knowledge demand	Identifying the drivers of knowledge demand	Knowledge demand is very limited from both the business and the public sector; this is a deeply embedded feature connected with the economic structure and history of the country.
	Co-ordination and channelling knowledge demands	Overall coordination is limited but efforts from the side of the government are undertaken recently to improve it; they are composed of government bills for improved cooperation, not yet implemented.
	Monitoring of demand fulfilment	Monitoring is only internal and ad hoc, there is an almost total lack of systematic tools for assessment and evaluation.
Knowledge production	Ensuring quality and excellence of knowledge production	Knowledge production is limited but improving, thanks to the role of universities, the RPF, the FP opportunities and further international collaboration activities.
	Ensuring exploitability of knowledge	Exploitability of knowledge is very weak. Efforts are undertaken but are insufficient; the absence of efficient intermediary organisations aggravates the situation.
Knowledge circulation	Facilitating circulation between university, PRO and business sectors	Knowledge hardly circulates between research organisations and the business sector; a vicious circle of low demand and lack of targeted supply as well as a climate of mistrust could not be reversed as yet.
	Profiting from international knowledge	Access to international knowledge is easy but mainly exploited by the scientific and not the business community. Transborder mobility is high and support measures are offered to further improve it.
	Enhancing absorptive capacity of knowledge users	The absorptive capacity of the business sector is inevitably low, as BERD and the low S&E level suggest. Youth and adult education, which are the main strengths, are expected to lead to increasing absorptive capacity in the future.

This rather difficult situation, with a vicious circle in the matching of demand and production of research results, is now facing some opportunities: policy makers are in

¹ The decision to “merge” the two independent agencies, supervised by different ministries, was political and addressed the need to give them equal status. In reality the Technology Promotion Foundation is absorbed by the Research Promotion Foundation.

a position to exploit new funding opportunities from the Structural Funds and the FP; they have successfully completed the first steps of international cooperation with joint ventures targeting excellence and can now capture their fruit and even replicate encouraging experiences; they can use the political stability, as a member of the EU, to play a pivotal role in the Eastern Mediterranean; they can exploit the new governance structures to make a significant difference and turn the vicious circle into a virtuous one of increasing R&D results by the academic sectors and their exploitation by the business community.

Public policy needs to seize these opportunities and control their implementation in a hands-on approach. If not, the newly designed structures and measures risk running out of steam without any noticeable results. In addition worries are expressed that increasing national support may crowd out efforts for international funding. National programmes are less competitive and less demanding and limit the potential of international excellence, since the small research community finds it easier to compete nationally rather than in the FP. A very careful design of increasing national funding is necessary to avoid this pitfall.

Domain	Main policy opportunities	Main policy-related risks
Resource mobilisation	EU memberships and funding MIT and Harvard joint ventures A prominent role for R&D in the Eastern Mediterranean.	Public funding is still among the lowest in the EU New incentives do not mobilise sufficient business resources
Knowledge demand	The creation of the National Council of Research and Innovation and the Cypriot Science Council are expected to focus research priorities more than in the past. A more proactive role of the Chamber of Commerce and Industry.	The organisation of the public sector without any institutionalised role of the business community replicates the situation and marginalises the private sector
Knowledge production	International cooperation with top organisations for excellence in research Increased regional cooperation.	As long as demand for knowledge does not increase there will be limited production and even more limited exploitation.
Knowledge circulation	Individual initiatives and pilots Emphasis on the integration of research and technology policy by the reorganised RPF Potential for new design and initiatives by the decided high level coordination mechanism Further emphasis on cross-border cooperation	Unbalanced crossborder cooperation Lack of response from the business sector Inefficient implementation of expected intervention that will lead to new disappointments and lack of confidence from the side of companies

International collaboration is crucial for small countries, which do not have the resources for a stand-alone research policy. In that sense the role of the ERA is crucial for Cyprus as it contributes to the design and implementation of the national R&D policy through the Lisbon agenda, and helps policy making through participation to many ERAnets, the Open Method of Coordination and CREST. The national administration has benefited significantly from these opportunities and has practically designed the national system in compliance with the EU guidelines and opportunities. In the context of the ERA, researchers' mobility is high in Cyprus and further simulated by old and new support schemes.

The FP has been a rich source of funding and moreover it has offered a potential for research collaborations that the Cypriot researchers were lacking in the past. By the same token Eureka is considered as an excellent opportunity for the most advanced companies in Cyprus to improve their competitiveness. The ERA appears less relevant for industrial R&D; structural funds are used for the basic infrastructure (incubators and a planned technology park).

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1 - Introduction and overview of analytical framework

1.1 Scope and methodology of the report in the context of the renewed Lisbon Strategy and the European Research Area

As highlighted by the Lisbon Strategy, knowledge accumulated through investment in R&D, innovation and education is a key driver of long-term growth. Research-related policies aimed at increasing investment in knowledge and strengthening the innovation capacity of the EU economy are at the heart of the Lisbon Strategy. The strategy reflects this in guideline No. 7 of the Integrated Guidelines for Growth and Jobs. This aims to increase and improve investment in research and development (R&D), with a particular focus on the private sector. One task within ERAWATCH is to produce analytical country reports to support the mutual learning process and the monitoring of Member States' efforts.

The main objective is to analyse the performance of national research systems and related policies in a comparable manner. The desired result is an evidence-based and horizontally comparable assessment of strength and weaknesses and policy-related opportunities and risks. A particular consideration in the analysis is given to elements of Europeanisation in the governance of national research systems in the framework of the European Research Area, relaunched with the ERA Green Paper of the Commission in April 2007.

To ensure comparability across countries, a dual level analytical framework has been developed. On the *first level*, the analysis focuses on key processes relevant to system performance in four policy-relevant domains of the research system:

1. Resource mobilisation: the actors and institutions of the research system have to ensure and justify that adequate public and private financial and human resources are most appropriately mobilised for the operation of the system.
2. Knowledge demand: needs for knowledge have to be identified and governance mechanisms have to determine how these requirements can be met, setting priorities for the use of resources.
3. Knowledge production: the creation and development of scientific and technological knowledge is clearly the fundamental role of a research system.
4. Knowledge circulation: ensuring appropriate flows and distribution of knowledge between actors is vital for its further use in economy and society or as the basis for subsequent advances in knowledge production.

These four domains differ in terms of the scope they offer for governance and policy intervention. Governance issues are therefore treated not as a separate domain but as an integral part of each domain analysis.

Figure 1: Domains and generic challenges of research systems

Resource mobilisation	Knowledge demand	Knowledge production	Knowledge circulation
<ul style="list-style-type: none"> • Justifying resource provision • Long term research investment • Barriers to private R&D funding • Qualified human resources 	<ul style="list-style-type: none"> • Identification of knowledge demand drivers • Co-ordination of knowledge demands • Monitoring of demand fulfilment 	<ul style="list-style-type: none"> • Quality and excellence of knowledge production • Exploitability of knowledge production 	<ul style="list-style-type: none"> • Knowledge circulation between university, PRO and business sectors • International knowledge access • Absorptive capacity

On the *second* level, the analysis within each domain is guided by a set of generic "challenges" common to all research systems that reflect conceptions of possible bottlenecks, system failures and market failures (see figure 1). The way in which a specific research system responds to these generic challenges is an important guide for government action. The analytical focus on processes instead of structures is conducive to a dynamic perspective, helps to deal with the considerable institutional diversity observed, and eases the transition from analysis to assessment. Actors, institutions and the interplay between them enter the analysis in terms of how they contribute to system performance in the four domains.

Based on this framework, analysis in each domain proceeds in the following five steps. The first step is to analyse the current situation of the research system with regard to the challenges. The second step in the analysis aims at an evidence-based assessment of the strengths and weaknesses with regard to the challenges. The third step is to analyse recent changes in policy and governance in perspective of the results of the strengths and weaknesses part of the analysis. The fourth step focuses on an evidence-based assessment of policy-related risks and opportunities with respect to the analysis under 3) and in the light of Integrated Guideline 7; and finally the fifth step aims at a brief analysis of the role of the ERA dimension.

This report is based on a synthesis of information from the European Commission's ERAWATCH Research Inventory² and other important publicly available information sources. In order to enable a proper understanding of the research system, the approach taken is mainly qualitative. Quantitative information and indicators are used, where appropriate, to support the analysis.

After an introductory overview of the structure of the national research system and its governance, chapter 2 analyses resource mobilisation for R&D. Chapter 3 looks at knowledge demand. Chapter 4 focuses on knowledge production and chapter 5 deals with knowledge circulation. Each of these chapters contains five main subsections in correspondence with the five steps of the analysis. The report concludes in chapter 6 with an overall assessment of strengths and weaknesses of

² ERAWATCH is a cooperative undertaking between DG Research and DG Joint Research Centre and is implemented by the IPTS. The ERAWATCH Research Inventory is accessible at <http://cordis.europa.eu/erawatch/index.cfm?fuseaction=ri.home>. Other sources are explicitly referenced.

the research system and governance and policy dynamics, opportunities and risks across all four domains in the light of the Lisbon Strategy's goals.

1.2 Overview of the structure of the national research system and its governance

Cyprus demonstrates a very low R&D effort closely tracking its economic structure. The country ranks very low in terms of R&D expenditure, however an increasing trend has been observed over the past years, attributed mainly to a considerable expansion of the research activities of the broader public sector. R&D expenditure in 1992 was only 0.18% of GDP, while in 2005 this figure increased to 0.40% (compared to 1.84% EU average). This share increases only marginally, despite consistent efforts since the accession to the EU. A considerable 67% comes from the government sector, while the business enterprises only contribute about 17% of overall GERD financing. The highest share of GERD was performed by the government sector with a decreasing share from 38% in 2004 to 32% in 2006 and a corresponding increase from 33% to 39% in HERD. Both shares are considerably higher than the EU average (13.5% and 22% correspondingly), whereas BERD accounting for 22% in Cyprus is notably lower (63%). The Private non-profit sector (PNPs) with 7% also sends considerably more than the EU average (data from European Commission (2008), DG Research, RTD Cyprus R&D profile 2008 and Regional Key Figures Database 2008)

The R&D system in Cyprus was developed after the mid 90s. At the core is one organisation responsible for policy design (The Planning Bureau) and one agency responsible for implementation (The Research Promotion Foundation, RPF). The Planning Bureau has a status equivalent to a ministry and has a broader responsibility for economic policy design. Research, innovation and human resources development are important element of its competitiveness division. The Ministry of Education and Culture has never been actively involved in either research or innovation. The Higher Education Authority is responsible for adult education.

The Ministry of Commerce, Industry and Tourism has responsibility for industrial policy, including the promotion of technology and entrepreneurship. Implementation was a task of both the Ministry itself and the Technology Promotion Foundation (TPF). However, an internal appraisal pointed out at a lack of both interest and resources in the Ministry and the TPF to design and implement R&D commercialisation and innovation policy. As a consequence major decisions for changes in governance were decided in 2007:

- The Ministry decided to shift responsibility for incubators to the RPF.
- The TPF was absorbed by the RPF and the name of the consolidated agency is expected to change to reflect the new situation, passing from Research Promotion Foundation to Research and Innovation Promotion Foundation (RIPF). Changes in operational activities are expected to start within 2008.

The observed lack of broader coordination led to an agreement at the level of the Council of Ministers expected to be implemented in 2008. The changes foresee the creation of two new collective bodies that, it is hoped, will improve coordination and scientific quality:

- The National Council for Research and Innovation (NCRI) will be the highest-level organisation with exclusive responsibility for the adoption of long-term strategies in research and innovation. The Council will be chaired by the President of the Republic (the Minister of Finance being his replacement in case of absence) and members will be the Ministers of Commerce-Industry-Tourism, Finance, Education-Culture, Health, Transport-Public Works and Agriculture-Natural Resources-Environment.
- The Cypriot Science Council (CSC) will be an advisory scientific board composed of 10-15 members of qualified scientists, not necessarily all Cypriots. Its mission will be to formulate the proposals for research strategy to the NCRI. The RPF will have responsibility for secretarial support.

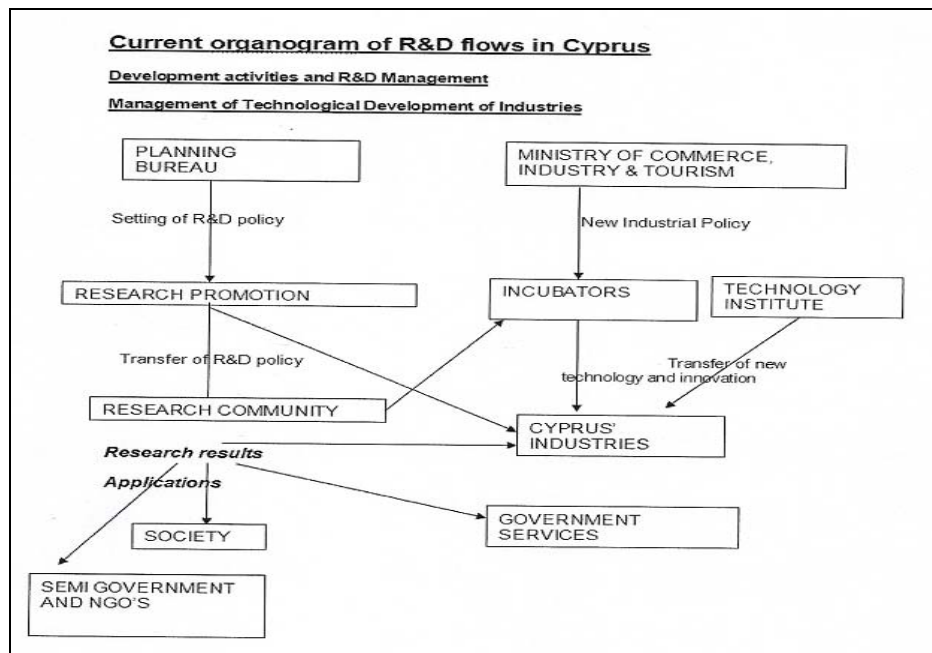
The main research groups are the University of Cyprus, created a decade ago and the Technical University of Cyprus, (TEPAK), which was created in 2004, with the first students enrolling in 2007. There is an Open University with hardly any R&D. Other organisations undertaking research are the Agricultural Research Institute, the Cyprus Institute of Neurology and Genetics, the Metrology Centre etc. Colleges converted recently into universities, such as the European University Cyprus, Frederick University Cyprus and University of Nicosia are offering degrees and undertake some applied research in social sciences and humanities.

The low number of research organisations is a natural outcome of the small size of the country and the structure of the research and innovation system. However, a policy for international top class academic cooperation merits to be mentioned here: the first two recent agreements in this framework include one with Harvard University, which established an already operational Health Services Department on the island and one with MIT to form a research organisation focusing on Energy, Water Resources and the Environment.

All policies are conceived and implemented at the national level. Recently provisions are made to create specific organisations in the South (Limassol), which hosts the newly created Technical University of Cyprus and is expected to host the first Technology Park in the country.

The current system is best described by the following scheme:

Figure 2: Overview of the governance structure of the Cypriot research system



Source: Erawatch Network (2008)

2 - Resource mobilisation

The purpose of this chapter is to analyse and assess how challenges related to the provision of inputs for research activities are addressed by the national research system. Its actors have to ensure and justify that adequate financial and human resources are most appropriately mobilised for the operation of the system. A central issue in this domain is the long time horizon required until the effects of the mobilisation become visible. Increasing system performance in this domain is a focal point of the Lisbon Strategy, with the Barcelona EU overall objective of an R&D investment of 3% of GDP and an appropriate public/private split as orientation, but also highlighting the need for a sufficient supply of qualified researchers.

Four different challenges can be distinguished:

- Justifying resource provision for research activities;
- Securing long term investment in research;
- Dealing with uncertain returns and other barriers to private R&D investment; and
- Providing qualified human resources.

2.1 Analysis of system characteristics

2.1.1 Justifying resource provision for research activities

In the NRP it is clearly stated that the Government made it its key priority to boost investment in physical and human capital. This requires higher capital spending, as well as more expenditure on education and Research and Development (R&D). This attitude is reflected in the policies adopted in the last years:

1. The Government has adopted the Barcelona target and has translated it into a national target of 1% GERD/GDP.
2. The creation of two universities, the University of Cyprus in 1992 and then the Technical University in 2004, highlight a commitment to increase HERD.
3. The participation to the FP has further boosted research activities.
4. The establishment and continuous increase of the financial and human resources of the Research Promotion Foundation (RPF) with the mission to develop, implement and manage all national research programmes. In addition the organisation is trying to streamline its activities and increase transparency by the adoption and publication of its bundle of activities (DESMI) explaining the rationale and complementarity of the whole spectrum of its support mechanisms and programmes.

Despite these efforts GERD, BERD and GBAORD remains very low.

The government is increasingly aware of the relevance of R&D and tries to nurture research activities. However, the social partners, the press and the general public have never been actively involved in the competitiveness debate. For them the priorities are geopolitical tensions and the macroeconomic structure of the economy. An effort to create a public debate was undertaken by the Regional Innovation Strategy for Cyprus (RISC), based on the EU RIS-RITTS concept, which was put into operation from 2003 to 2006. Despite the agreement on a Strategy Document RISC has run out of steam and has never succeeded in launching a broader public debate. The RPF is trying to reverse this lack of interest through an “Annual Researcher’s evening”, pupils’ contests for research and technology as well as information on the merits of innovation to secondary school teachers (in cooperation with the Ministry of Education). Neither RISC nor the Awareness Raising Campaigns by the RPF appear to be succeeding in creating a broader momentum in favour of research as yet.

2.1.2 Securing long term investment in research

Basic research in Cyprus is only 8% of all research activities and is undertaken almost exclusively by the two universities. Most research activities undertaken are applied ones. But the long-term policy goals address the need for change. The challenge for longer-term investments in research is to shift into new areas and help restructure the economy and make production more competitive. The main barrier to secure long-term investment is the lack of an overarching research strategy adopted at an interministerial level.

Despite the lack of a broader strategy the Ministries of Finance and Education (in an effort to increase the budget of the universities), the Planning Bureau and the RPF are undertaking efforts to raise long-term investments. To do that the government is adopting a long-term strategy, which on the one hand guarantees continuity in research grants and at the same time provides for the support of research infrastructure both through the National Framework Programme and through the support to the universities and the newly decided research centres in cooperation with Harvard and MIT.

The main instrument, through which the national policy is applied, is the National Framework Programme for Research and Technological Development, designed and managed by the Research Promotion Foundation. It includes a broad spectrum of support measures through which it supports multi-thematic research projects in pre-

selected fields and provides for the upgrading of existing and the built up of new research infrastructure. This way it offers a long-term prospect through recurring project funding and facilitates the retention of high quality human resources in the Cypriot universities. The Ministry of Commerce, Industry and Tourism supports longer term investments through grants for investment that are partly used by companies for their technological upgrading.

European funding has played a very important role for the mobilisation of the national research effort:

- Participation in the Framework Programmes is satisfactory and improving over time. During the FP5, the Cyprus research community benefitted from €20 million, while the contribution of the government of Cyprus to the budget of the programme was only €10.3 million (Erawatch Network (2008): Research inventory). In FP6 Cyprus has participated with 234 projects with 0,31% in terms of number of projects and with 27.682.471 Euros as 0,17% of the total EC financial contribution to partners in the EU-27 (European Commission 2008). Cyprus, Malta, Slovenia, Greece and Estonia have the highest participation rates per researcher in FP6, EUREKA, COST, ERA-NETs and ERC taken together. (European Commission (2008), Key Figures 2008).
- Recently it was agreed that Structural Funds would be used for the (current and future) incubators and the planned technology park.
- EUREKA is also a mobilising force in the process of being further developed: the RPF, which is the National EUREKA Office for Cyprus and is responsible for all EUREKA related matters, has increased support to stimulate participation.

The national policy is explicitly aiming for the country not to become a full member in international organisations, when the membership is not expected to bring any significant benefits to the country. It is not a member of ESA and belongs to the “*Non-Member States currently involved in CERN programmes*”.

Publicly funded GERD as % of GDP rose from 0.17% to 0.27% from 2001 to 2005, a figure that is below most EU member states and well below the EU 27 average of 0.63%. Overall, the research system is underfunded with visible, though scattered, recent efforts to increase GERD. Universities are trying to combine long-term financial opportunities with peer review, which is targeting excellence and continuity at the same time.

2.1.3 Dealing with uncertain returns and other barriers to business R&D investment

The structure of the business sector in Cyprus is very unfavourable for R&D. There are no big multinationals with headquarters on the island and even the biggest among national companies are effectively SMEs under European criteria. BERD itself is marginal: with 22% of GERD it is the lowest in the Union. The sectors that benefited from public funding are community services, other business activities and real estate activities. The services sectors accounted for 53.8% of BERD, with the IT services and other business activities contributing the largest shares. In the manufacturing sector, pharmaceuticals, food and chemicals industries account for 37% of BERD.

Over the last few years one can observe the improvement of the access to bank financing for SMEs, which was the result of interest rates and capital movement liberalisation. Nonetheless, the problem prevails and it is still rather difficult for SMEs to source the collaterals required by credit institutions.

Venture capital may facilitate access to finance for SMEs not qualified for receiving bank loans. Given the role VC plays in helping to establish and operate companies and their “preference” to invest in the fast-growing technology fields, VC investments facilitate transfer of R&D results to the marketplace and, therefore, intensify the commercial exploitation of existing technological know-how thus enhancing R&D efficiency. The use of VC in Cyprus is however insufficient given the not very favourable environment for such investments: small and very small firms, lack of skilled human capital and generally low potential for med- and high-technology development. The lack of VC means more limited opportunities offered to stimulate the creation and expansion of R&D intensive companies. To tackle this problem, the Government is expected to proceed with further examining concerning promotion of venture capital (National Reform Programme of Cyprus 2005-2008).

Stakeholders are only moderately interested in the topic, focusing into more traditional forms of industrial policy. The Employers’ Association does not include R&D related policy on its agenda. The Chamber of Commerce and Industry has taken a few initiatives trying to raise awareness and convince the authorities to take regulatory measures in favour of the business sector.

This disappointing picture is complemented by the lack of interest of the banking sector in high-risk R&D ventures. The possibility of introducing tax allowances was studied and rejected, as corporate tax is already so low that it would not be a credible incentive to make R&D investments tax free. The conclusion of the internal policy discussions was that it would add to bureaucracy but not really make a difference for BERD.

For this reason the main incentives for business R&D are the bundle of measures supporting in-house R&D and promoting academic-business R&D cooperation. The former are a whole set of measures supporting applied research in companies, development, collaborative research, Eureka participation and patenting. On top companies get assistance for innovation in the form of Innovation Vouchers. At the same time companies are eligible for participation in all thematic and many collaborative actions and human resource support schemes. BERD financed by the government is one of the indicators, which exceed the EU average with 14.3% in Cyprus compared to a 7.2% EU average³. This large share derives more from the low industry-financed GERD than from generous national funding.

Despite some progress applications by companies are still significantly less than those of universities in the calls for funding, where both the academic and business sectors are eligible for support.

³ Data refer to 2005. Value for the EU average is provisional (European Commission (2008), DG Research, RTD Cyprus R&D profile 2008)

2.1.4 Providing qualified human resources

Investment in education and especially in tertiary education is crucial to provide the country with a highly skilled and qualified workforce. As it is represented in the Key Figures 2007 (European Commission 2007), total public expenditure in tertiary education in 2003 amounted to 1.55% of the country's GDP, which is above the EU average of 1.14%. In terms of graduates from tertiary education as a measure of the supply of human resources Cyprus is catching up with the EU concerning population with tertiary education (30.5% in 2006 according to the EIS). However, graduates from science and engineering accounted for only 28% of the European average in 2005. The problem with human capital lies in the combination of the low shares of S&E graduates and the low life-long-learning levels reaching only 74% of the EU. Moreover, the share of the labour force directly employed in R&D is very low. Thus, in 2004, the R&D personnel amounted to 1017 researchers, which is less than 0.2% of total population, while the overall EU share of R&D personnel to its total population were more than 0.45%⁴. In the same period, of the total R&D personnel more than 55% were employed as researchers (data from: European Commission (2007), Key Figures 2007).

One of the deeply rooted problems of the research system in Cyprus arises from the long absence of universities in the country. The first university was only created in 1992 and the second as late as 2004 with students enrolling for the first time in 2007. Hence academic staff and researchers were all trained abroad until very recently. The need to migrate in order to get a university degree (combined with political uncertainty) has contributed to an above average brain drain. Things have changed significantly in the last 10 years but it will take longer for the share of S&E to reach the EU average. An additional barrier for engineers to become researchers is that the public sector offers better remuneration packages to S&E, thus competing with the universities and the business sector for scientific skills.

It is, however, worth mentioning that in recent years Cyprus is becoming a more attractive destination for foreign students. In 2004 Cyprus had the top position of foreign students in tertiary education with 32% compared to 7.6% European average. The same applies in the field of sciences, where the share of foreigners in the Cypriot universities was more than 21% in 2004 (7.6% for the EU as a whole). In the field of engineering, the corresponding percentages for Cyprus and the EU were 8.9% and 5.9% respectively (European Commission (2007), Key Figures 2007).

There is still no medical faculty in Cyprus and this leads to a total absence of researchers and skills in this area. All doctors in Cyprus are trained abroad and are practicing medicine but not undertaking research in the country. Another area where lack of training is observed is industrial design.

Additional training is undertaken in the new universities (upgraded colleges) but their curricula are mainly in disciplines that do not need laboratories (business, psychology, humanities) and are not in a position to fill the gap for S&E and medical professions.

The Ministry of Labour and Social Insurance supports and promotes the work of the Human Resource Development Authority of Cyprus (HRDA), previously called

⁴ Own calculations based on the R&D personnel data from the European Commission (2007), Key Figures 2007, and population data from Eurostat

Industrial Training Authority, provides continuous education and lifelong training in all kinds of human development issues. HRDA is a semi-governmental organisation managed by representatives of employers, unions and the government. As the national agency for training, HRDA does not implement training activities. The training activities that are promoted by HRDA are designed to meet the needs of the economy, the enterprises and the labour force taken as a whole, which are set in the form of guidelines by the HRDA, in co-operation with the Planning Bureau. The Authority has a high profile on the island and is expected to improve its quality further with the introduction of an Appraisal and Certification System of Training Providers for its vocational training centres, structures and the vocational trainers themselves (<http://www.xak.com/main/newsshow.asp?id=58716>).

In its current set of measures the RPF includes a broad set of incentives to train graduates to become researchers. Incentives are offered for placement in research organisations and in industry, there is support for labour mobility and specific awareness-raising events to make pupils, students and the general public more familiar with research as well as to make researchers' careers more attractive.

The following three programmes targeted directly in development of human capital and promotion of research culture fall under the Priority Area "Development of Human Resources in Research" of DESMI 2008:

- "Support for young researchers – PENEK", which is addressed to PhD candidates and aims at improving the active involvement of new researchers in the country's research environment by providing them with financial support in order to get trained in scientific and technological fields of exceptional interest for the Cypriot economy. The programme provides the students with an opportunity (in parallel with their studies) to implement research projects in collaboration with Cypriot research institutions or enterprises.
- "DIDACTOR", the main objective of which is to promote the embedding PhD holders and Post Doc researchers in the country's R&D system in order to achieve in the long term a significant increase in the number of highly educated human resources employed on a full time basis in research. The programme is divided into two actions, namely the "Didaktor in a Research Centre" action and the "Didactor in an Enterprise".
- "Development of Research and Innovative Culture", which aims to promote the research culture among young people at all levels of education, from pupils at the earliest stage of education (action "Schoolchildren in Research Competition - MERA") to University undergraduate and postgraduate students (action "Students in Research Competition") and young researchers ("Research Award - Nikos Symeonides").

Cyprus may be considered a model European country in the way it treats brain drain: national policies consider as brain-drain only those human resources migrating outside the EU and do not try to prevent migration of Cypriot researchers within the Union. Foreign researchers are given incentives to work in Cyprus but emigration of Cypriot researchers is not discouraged as long as their country of destination is a European country. All support programmes are given the possibility to spend 30% of the R&D budget outside the country thus facilitating transborder mobility.

2.2 Assessment of strengths and weaknesses

The above demonstrate the existence of significant structural deficiencies: the size and composition of the productive sector is the main explanation of the very low resource mobilisation all over the post war years. This has created an institutional set up, which is very difficult to reverse, since neither the business associations nor the general public have realised the relevance and potential of R&D for the economy and development.

At the moment the only strength identified is the commitment of the government to enhance research and gradually restructure the economy. As a result of the accession to the EU, the opportunities offered by the FP and the adoption of the Lisbon agenda the government is increasingly focusing on research. This has been translated into increasing budgetary commitments. However, it should be clear that the resources, the design and delivery of the measures as well as the level of coordination are still insufficient.

Main strengths	Main weaknesses
<ul style="list-style-type: none"> Overall economic strength and EU resources allow for more ambitious structural policies Increasing emphasis and public resources for R&D Commitment of the government to address the gaps in R&D 	<ul style="list-style-type: none"> Structure of the productive sector Absence of commitment from the side of the productive sector Low awareness in the public debate Lack of capabilities in medical sciences and industrial design. Lack of focus on competitiveness from the side of the Ministry of Commerce, Industry and Tourism.

2.3 Analysis of recent policy changes

Recent policy changes demonstrate the willingness of the government to spend more on R&D and to channel part of this funding to the business sector. The main recent decisions to improve governance are partly implemented and partly at a stage of implementation. What is most relevant is the need to adopt a long-term strategy, in agreement with all stakeholders.

Challenges	Main policy changes
Justifying resource provision for research activities	<ul style="list-style-type: none"> Increasing budget of the RPF
Securing long term investments in research	<ul style="list-style-type: none"> The creation of the Technical University Increasing support to infrastructure by the RPF The Harvard and MIT joint ventures
Dealing with uncertain returns and other barriers to business R&D investments	<ul style="list-style-type: none"> Increasing incentives to the business sector Opening up more programmes of the RPF to the business sector New governance structure to better serve the interests of the business sector (designed but not implemented yet)
Providing qualified human resources	<ul style="list-style-type: none"> The creation of the Technical University Increasing funding to the Human Resources Development Axis of the RPF Improvement of the HRDA services for vocational training through certification

2.4 Assessment of policy opportunities and risks

The main policy opportunities derive from international cooperation as a means to overcome national barriers and the small size of the economy. The Cypriot government has responded to the Lisbon agenda by setting a target of 1% GERD to GDP. In general the accession to the EU and international collaborations constitute the main opportunity for the country to change the vicious circle of the structure of its economy and the low level of R&D. A newly identified opportunity is a potentially relevant role in joint R&D problems in the Eastern Mediterranean, where Cyprus could play a leading role.

At the same time however there are significant risks: despite visible efforts to create an R&D strategy (RISC) and increase funding opportunities in the business sector, the response of the social partners and the general public is still very limited.

Main policy opportunities	Main policy-related risks
<ul style="list-style-type: none"> • EU memberships and funding • MIT and Harvard joint ventures • A prominent role for R&D in the Eastern Mediterranean. 	<ul style="list-style-type: none"> • New incentives do not mobilise sufficient business resources • Public funding is still among the lowest in the EU

2.5 Summary of the role of the ERA dimension

The role of the ERA is crucial for Cyprus. The size of the country and the research system do not yet allow for the scale for research that can generate either sufficient rewards to specialisation or policy knowledge.

The ERA has contributed to the design and implementation of the national R&D policy through the Lisbon agenda, a guideline taken very seriously by the national administration, but also through the participation to numerous ERAnets and the Open Method of Coordination as well as CREST. The national administration has benefited significantly from these opportunities and has practically designed the national system in compliance with the EU guidelines and opportunities.

The FP has been a rich source of funding; even more than funding it has offered the potential for research collaborations that the Cypriot researchers were lacking in the past. Many national policy decisions and support schemes are adopted in view of an improved participation to the FP or as an emulation of its procedures. By the same token Eureka is considered as an excellent opportunity for improving competitiveness for the most technologically advanced companies in the country.

A very interesting debate is currently under way regarding the complementarity/competition between the national R&D support programmes and the FP: it seems that national research teams prefer applying to the national programmes as they are less competitive and less demanding. However, public policy considers this as a negative feature because it limits the potential for international excellence. The basic issue of this approach is that in a small country, with a small scientific community, increased national spending may contribute to increasing research activities at the cost of quality and internationalisation. Hence, a very careful design of increasing national funding is necessary to avoid this pitfall.

The ERA appears less relevant for industrial R&D; structural funds are used for the basic infrastructure (incubators and a planned technology park) but the Ministry of

Commerce, Industry and Tourism has been less active in exploiting European opportunities and interacting with the EU.

3 - Knowledge demand

The purpose of this chapter is to analyse and assess how research related knowledge demand contributes to the performance of the national research system. It is concerned with the mechanisms to determine the most appropriate use of and targets for resource inputs.

The setting and implementation of priorities can lead to co-ordination problems. Monitoring processes identifying the extent to which demand requirements are met are necessary but difficult to effectively implement due to the characteristics of knowledge outputs. Main challenges in this domain are therefore:

- Identifying the drivers of knowledge demand;
- Co-ordinating and channelling knowledge demands; and
- Monitoring demand fulfilment

Responses to these challenges are of key importance for the more effective and efficient public expenditure on R&D targeted in IG7 of the Lisbon Strategy.

3.1 Analysis of system characteristics

3.1.1 Identifying the drivers of knowledge demand

In the country with the lowest BERD in the EU, knowledge demand is inevitably low and dominated by the public sector.

The strategy of the business sector is to buy knowledge incorporated in new vintages of machinery. As a consequence the most valuable support mechanism for the business sector is the annual call for proposals for the technological upgrade of companies implemented by the Ministry of Commerce, Industry and Tourism in the context of its investment promotion strategy. Demand for human skills is covered by the local universities and the adult education programmes.

Demand is also low because the sectoral structure of the economy is dominated by the service sector (tourism and financial services) with manufacturing representing only a fraction. ICT, food industries, water and energy and construction are the main sources of demand for R&D services.

During 2003, public support for research activities in enterprises was limited with only three services sectors receiving funding. The sectors that benefited from public funding were community services, other business activities and real estate activities. Moreover, during 2003, the service sectors accounted for 53.8% of BERD with the IT services and other business activities contributing the largest shares. Similarly in the manufacturing sector, the pharmaceuticals, food and chemicals industries account for 37% of BERD.

With regard to scientific specialisation⁵, Cyprus presents a high specialisation in some sectors but this can be partly attributed to its small size and does not suggest a real strength. During the period 2001-03 Cyprus specialised in several social sciences fields, namely psychology, education and social sciences, but also in a number of natural sciences like physics, mathematics and computer sciences. In terms of technological specialisation, during 2001-2003 Cyprus specialised in a limited number of sectors such as instruments, chemicals, petroleum and textiles. In addition, over the period between 1992-94 and 2001-03, Cyprus became under – specialised in several sectors including food, machinery, plastics, basic metals and non-mineral products (Erawatch Network, 2006).

The Cypriot Chamber of Commerce and Industry is taking a proactive approach trying to sensitise its members by providing training, which covers a wide spectrum of business-related areas. In addition the Chamber organises and finances workshops on new approaches to competitiveness like cluster building and utilisation of creativity services.

Social demand is also limited. As the public debate on the role of R&D remains rudimentary there are no broader requests for a more active role of research for the community. Public procurement, defence, the health and the educational sectors that constitute a pool of demand in other countries have never been used as an active element leading to higher demand for new knowledge.

Processes for identifying the drivers of knowledge demand: This situation has led to an element of fatalism. Policy makers take low demand as an inherent element of the system and do not make any systematic efforts to capture it and use the results for evidence-based policy. Neither foresight exercises nor any technology assessments were ever undertaken. The RISC that was accomplished in 2006 identified mainly horizontal needs and needs for improving physical infrastructure (incubators and a technology park), as well as clustering. The agro-food sector and ICT were identified as important opportunities for the future.

3.1.2 Co-ordinating and channelling knowledge demands

The very basic level of demand is creating additional challenges for knowledge demand priorities. There are no expressed needs, so policies have to be designed so as to anticipate latent demand rather than plan on how to cover expressed and unsatisfied needs. The task of the public service is a lot more challenging than in countries where stakeholders are more actively involved.

Coordination in the implementation mechanisms in Cyprus relies mainly on the Planning Bureau, which is trying to improve efficiency and coordination as a result of the Lisbon strategy and the OMC. But there is no broader coordination, since the Ministries of Industry, Commerce and Tourism and the Ministry of Education are practically absent. Coordination is expected to improve once the implementation of the new system of governance mentioned above starts (the planned National Council for Research and Innovation and the Cypriot Science Council).

Policy at all levels suffers from a lack of explicit national priorities since nobody takes responsibility to eliminate redundant research topics and focus the very limited

⁵ The conclusions are taken from the Erawatch Network (2006) and should be read with caution, since the very small numbers of Cypriot research may lead to biases and misinterpretations.

resources of the country in only a few areas. An effort was made in the past to play this role through the activation of a Permanent Interservice Committee to collect information from all the competent ministries, which unfortunately did not take up the task.

As an executive agency the RPF is obligated to set priorities at a practical level, although its administration considers (and rightly so) that the responsibility for national priorities should be entrusted to a policy design body and not an implementation agency. Hence the priorities of the RPF are adopted de facto by a combination of an open consultation process, reports from its own employees and Internet search. In this context the Foundation has identified a set of thematic priorities, which form the backbone of its research grants: Materials-nanotechnologies and nanosciences; energy; natural sciences; engineering applications; ICT; natural environment; urban environment; agriculture, animal breeding, fisheries and aquaculture; social and economic sustainability; public health, biomedicine and biotechnology; food biotechnology; education; economics; sociology and humanities. These priorities were used for its own bundle of measures (DESMI, analysed in Section 4 hereafter). An overview of this priority setting suggests that there is practically no prioritisation in the research agenda. All areas are covered.

An alternative way to identify priorities is by getting ex post success rates in international competitive programmes. When looking at the response rates and success rates of applications to both the EU and the national framework programmes respectively it appears that ICT is the area mostly demanded by Cypriot researchers.

From a different point of view, priorities are also reported at a high political level, identifying energy, the environment and in particular water resources as the real future challenges for the country. The two joint ventures with Harvard and MIT reported previously were clear political decisions taken at the level of the Council of Ministers; the former in health services was seen as a potential for creating knowledge that would lead to unique competitive advantages within the South-Eastern Mediterranean, the latter as serving the most urgent needs of the national economy.

While the representatives of the business sector recognise the increasing opening up and opportunities for SMEs to participate in more programmes, the main complaints of the business sector are the bureaucracy (such as lengthy reporting) associated with incentives (including the RPF's programmes), the time consuming procedures (specifically for the incubators and the technology park), the limited ex post evaluation and the lack of transparency. The latter is associated with the lack of a clear, long-term binding strategy paper that would give the business sector a perspective of the rules of the game. An additional problem is that the business sector is only supported by the RPF. The Ministry of Commerce, Industry and Tourism, the natural ally of the business community, has different priorities and does not dedicate the necessary resources to meet the challenge to increase R&D. A future smoother functioning after the merger of the RPF with the TPF mentioned above may improve the situation.

3.1.3 Monitoring demand fulfilment

There is no explicit monitoring of demand fulfilment. In interviews with officials in the Planning Bureau, the Ministry and the Chamber all interviewees were unanimous that

a more focused monitoring process with early feedback for financial support would be highly beneficial.

There are no evaluations of either measures or organisations, with the exception of one institutional evaluation of the RPF completed in 2007. The results of the external evaluation were delayed and the RPF board considered them of limited value for their internal organisations. The results of this evaluation were not published.

The Planning Bureau and the RPF undertake internal discussions and informal consultations to assess their own performance and the role of public policy for demand fulfilment.

The two universities and the research centres are not formally assessed. TEPAK is at any rate too young to be evaluated. But Cyprus has joined the Bologna process; hence assessments will be incorporated into the system in the future.

3.2 Assessment of strengths and weaknesses

The situation in terms of knowledge demand is very disappointing. There are more weaknesses than strengths and these are associated with the overall economic structure of the country as well as the lack of a vision of research benefits from the side of the public sector. While it is clear that some initial steps were made, towards creating a set of support measures in view of future demand, policy is ad hoc, internal and not based on any systematic tools that would generate evidence-based policy. The low level of demand has created an element of fatalism and has triggered a vicious circle, which is very difficult to break.

Main strengths	Main weaknesses
<ul style="list-style-type: none"> Internal commitment in the Planning Bureau and the RPF to design priorities to anticipate latent demand The political commitment to energy, environment and water resources 	<ul style="list-style-type: none"> The structure of the business sector does not support knowledge demand Lack of systematic tools for priority setting Lack of evaluations, foresight exercises and technology assessments Insufficient awareness of the public sector and social demand for the potential benefits of research results for social innovation.

3.3 Analysis of recent policy changes

No major policy changes were undertaken recently. Knowledge demand was and remains very low both from the side of the business and the public sector. R&D policy remains supply driven. A few internal rather than external and visible changes are associated with the increasing responsibilities and efforts of the RPF. The planned and anticipated changes in governance and the merger of research and technology policy to one executive agency may lead to effective changes, once they are implemented.

Challenges	Main policy changes
Identifying the drivers of knowledge demand	<ul style="list-style-type: none"> The reorganisation of the RPF will give it a better overview of the drivers of knowledge demand
Co-ordinating and channelling knowledge demands	<ul style="list-style-type: none"> The newly decided coordination mechanisms will improve the exchange of knowledge and synergies The merger of the RPF with the TPF may in the future improve coordination
Monitoring demand fulfilment	<ul style="list-style-type: none"> No changes were made in the last years

3.4 Assessment of policy opportunities and risks

Opportunities are rising because the low level of demand is well recognised by all actors. The public sector demonstrated a will to better coordinate policies through the new governance structures. The Cypriot Chamber of Commerce and Industry has also undertaken some initial steps towards requesting the public sector to undertake more active policies towards the needs of the business sector and has expressed the will to participate more actively to priority setting. An additional opportunity is the leading role Cyprus could play in the Eastern Mediterranean R&D cooperation. This can be achieved with the successful exploitation of the international cooperation with top Universities, which will raise the country's R&D profile. At the same time, the increased S&E graduation levels may help stimulate demand for knowledge.

However, the role of the business community as a whole remains marginal and not institutionalised. As long as this remains the case all progress risks to go into fulfilling the intrinsic knowledge demand of the academic system and not be translated into benefits for the economy and society.

Main policy opportunities	Main policy-related risks
<ul style="list-style-type: none"> The creation of the National Council of Research and Innovation and the Cypriot Science Council are expected to focus research priorities more than in the past A more proactive role of the Chamber The potential leading role within the South-Eastern Mediterranean as a result of US-Cyprus cooperation with top universities New graduates of the Engineering School of the University of Cyprus and future graduates of the recently established Technological University as well as a proactive role of the two universities in public-private cooperation 	<ul style="list-style-type: none"> The organisation of the public sector without any institutionalised role of the business community replicates the situation and marginalises the private sector. Difficulties to raise the public profile of S&T

3.5 Summary of the role of the ERA dimension

Cyprus is participating to few ERAnets and had declared its interest to join some of the OMC groups of CREST. While all these mechanisms are of interest and constitute a good background for policy learning, the very small number of people

working in research policy in the country is limiting the potential to actively participate and benefit from these exercises.

4 - Knowledge production

The purpose of this chapter is to analyse and assess how the research system fulfils its fundamental role to create and develop excellent and useful scientific and technological knowledge. A response to knowledge demand has to balance two main generic challenges:

- On the one hand, ensuring knowledge quality and excellence is the basis for scientific and technological advance. It requires considerable prior knowledge accumulation and specialisation as well as openness to new scientific opportunities, which often emerge at the frontiers of scientific disciplines. Quality assurance processes are here mainly the task of scientific actors due to the expertise required, but subject to corresponding institutional rigidities.
- On the other hand there is a high interest in producing new knowledge, which is useful for economic and other problem solving purposes. Spillovers, which are non-appropriable for economic knowledge producers as well as the lack of possibilities and incentives for scientific actors to link to social demands, lead to a corresponding exploitability challenge.

Both challenges are addressed in the research-related Integrated Guideline and in the ERA green paper.

4.1 Analysis of system characteristics

4.1.1 Improving quality and excellence of knowledge production

The two universities are the main producers of scientific knowledge. The main knowledge producer is the University of Cyprus, established in 1989 and accepted the first students in 1992. The university grows systematically: Research is carried out in physics, chemistry, computer sciences and other academic subjects. It is probably the largest R&D actor in Cyprus. In addition to the four Schools and 13 departments, which function at the University of Cyprus, an Engineering School with 4 departments is also created. The School of Engineering accepted its first students in 2003, in the departments of Electrical and Computer Engineering, Mechanical and Production Engineering, and Civil and Environmental Engineering. The establishment of a department of Biology and a Law School have also been approved, while studies for the operation in the near future of a Medical School and a School of Fine Arts have been undertaken. At the same time, expansion of the postgraduate programmes in all the departments is in place. Recently, the University of Cyprus established the Centre of Scientific Research, Evaluation and Development (CSRED), in order to upgrade the areas of Further Education, Evaluation and Development of human resources.

The Technical University of Cyprus (TEPAK) was created in 2004 with 100% state finance and is now fully operational with the first students entering in 2007. The target size is 7-8000 students by the end of a decade. It is an organisation, which was created with the aim to include several scattered public research centres and be

further enriched with additional priority areas. It is now operating with 5 faculties and 10 departments and has a modern mandate, offering teaching, research and services to the Community. Despite its recent creation TEPAK is already active in research participating both in the EU FP (with 3 successful applications in the order of 350,000 €) and national competitive programmes. The Engineering and Business faculties are the most active and successful ones.

The research activities of TEPAK aim at forging strong links with the business sector. The infrastructure of the organisation is acting as a pilot for sustainability, as it was decided to aim to achieve the highest possible energy efficiency and water management and recycling in all the buildings that will be refurbished for the use by TEPAK. A team is built composed of university professor, local industry and foreign consultants to create the necessary pool of knowledge and then use it for other government buildings, changes in regulation and potentially export of technology and construction services. At the same time the Agricultural Department is working on research for agricultural production in rainless conditions and the Department of the Environment on wind energy.

The *Agricultural Research Institute* (ARI) is a department of the *Ministry of Agriculture, Natural Resources and Environment*. It was established in 1962 as a cooperative project between the government of Cyprus and the UNDP and was entrusted to the government of Cyprus in 1967. It is the main channel in its field for the development and promotion of innovative practices with substantial contributions in applied research in the fields of new plant and animal production. The Ministry's Forestry Department, the Geological Survey Department and the Department of Fisheries and Marine Research are additional research organisations.

The Ministry of Health supports and promotes the work of the Cyprus Institute of Neurology and Genetics, which was established in 1990, following a donation by the United States, through the Cyprus office of UNHCR. The Institute was established in the context of an independent non-profit foundation, the Cyprus Foundation for Muscular Dystrophy Research, so as to ensure its necessary administrative and scientific flexibility and dynamism to confront these illnesses in co-operation with university, government and non-government physicians and other scientists. It carries out applied and to a lesser extent basic research in the field of genetics diagnosis and genetic diseases. Additional research facilities are the State General Laboratory, which is the main and the older institute in Cyprus in chemistry and microbiology sectors and the Bank of Cyprus Oncology Centre.

Another way the government tries to promote excellence in Cyprus is through the agreements with foreign establishments of high reputation: The Cypriot Research and Educational Foundation (KEEI) was created with the aim to promote research and education in Cyprus and abroad. It is a prestigious organisation chaired by the former president of the French Academy and a board composed of scientists of international reputation. The Cyprus Institute (CI) is a limited liability company, which was created to help implement the targets of KEEI, is a multidisciplinary organisation aiming at becoming a centre of excellence for the broader area of the Eastern Mediterranean. The Institute is expected to create seven research centres, of which the first was inaugurated in December 2007 and is a centre for Energy, Environment and Water (EKEPEN). The centre will be supported by the MIT Lab for Energy and Environment (LFEE). A five-year agreement is signed and the RPF will pay €3m

(4,75 million US \$) to MIT for that. Further agreements for implementation between the RPF and the CI are expected very soon.

Bibliometric analysis demonstrates that Cyprus ranks ahead of Luxembourg and Malta. The scientific publications in relation to R&D show a relation very close to the EU average, indicating an acceptable quality of research results. But because of its small size Cyprus contributes only very small shares to worldwide publication output. In 2004, its share in the total world number of peer reviewed scientific articles was only 0.03%, while the EU total share reached 38.1%. Nevertheless progress is rapid, as measured by its average annual growth rates, in the period 2000-2004, Cyprus with the annual growth reaching 8.7% was well above the EU average (-0.8%).

In terms of specialisation bibliometric analysis, based both on publications and citations, shows a consistent specialisation in engineering, physics, economics and computer sciences⁶; specialisation was positive in agricultural sciences and biotechnology in the early '90s but turned negative in the 21st century. By contrast a negative specialisation turned into positive in mathematics, psychology and social sciences (Erawatch Network, 2006). However, these results need to be interpreted very carefully, because due to the small size of the scientific community small changes in absolute amounts may reflect significant shifts in specialisations changes.

4.1.2 Improving exploitability of knowledge production

The Department of the Registrar of Companies and Official Receiver, established in the beginning of the 20th century, provides services of registration of trademarks, patents and industrial designs thus playing a principal role in the protection of Intellectual Property in Cyprus. It also registers and protects Patents granted by the EPO and acts as receiving office of European (EPO) and International (PCT) applications for Patents⁷. The standardisation procedures in Cyprus since 2005 have been allocated to the Cyprus Organization for Standardization (CYS) established by the government to undertake the standardisation activities that were previously under the jurisdiction of the Ministry of Commerce, Industry and Tourism. CYS is a full member of international organizations for standardisation such as ISO and IEC and represents Cyprus at European Standardization Organizations such as CEN, CENELEC and ETSI. In 2007, the largest shares of all standards voted in the public concern sectors such as electronic engineering and chemistry and chemical engineering. The number of European standards issued by the European organisations for standardisation has notably decreased from more than 8000 in 2001 to less than 1600 in 2007 (CYS: Annual Report 2007)

Concerning publicly funded research, only in case of patents, an employee inventor is entitled to a material remuneration. Professor's privileges as such do not exist in Cyprus (DG Research (2005)). Institutional ownership is designed expected to lead to the general improvement of the institutions' technology transfer capability.

The specific characteristics of the system indicate already that knowledge exploitation is limited. Patenting in the EPO is very low and with 10-15 patents granted per year it rates Cyprus only at 10-13% of the European average; with 1%

⁶ The bibliometric references are taken from the Erawatch Network (2006) and should be read with caution, since the very small numbers of Cypriot research may lead to biases and misinterpretations.

⁷ For a review of the Cyprus IPR system see European Commission (2005)

this is worse for the USPTO and it is virtually 0 in terms of Triadic patenting. Worse than that, this performance is deteriorating instead of improving (EIS, 2007).

In terms of patents four sectors demonstrate a relative specialisation equally in the beginning of the '90s and the 21st century, notably wood and publishing, textile, petroleum and chemicals. Food, plastics, machinery and basic metals show a specialisation in recent years only (Erawatch Network, 2006). These patents, as in the case of the bibliometric indicators, need to be interpreted very carefully, because due to the small size of the scientific community small changes in absolute amounts may reflect significant shifts in specialisation changes.

In order to reduce barriers and create incentives for patenting, the RPF has recently launched a measure called "patent". The action "*patent*" (*evresitehnia*) motivates individuals, research organisations and enterprises to file patent applications with the aim of raising the profile of IPR in Cyprus. It offers the possibility to patent significant research results that arise from research programmes managed and/or funded by the RPF, the EU or any other organisation funding research. The process requires an application by the interested inventor for the RPF to cover part of the patent cost, after the filing in the first instance IPR office (as selected by the inventor) has been completed. The process and anticipated cost are described in the application. The programme is applicable only for research results of the last three years. In case the inventor commercialises the invention the amount of the support will be returned to the RPF.

This situation is difficult to tackle, because there are neither systematic university-industry linkages, nor efficient intermediary organisations or drives of knowledge production for social purposes. The government, however, seemed to have identified the problem and has begun adopting measures for remedy. The action called "Thematic Innovation Networks", also proposed by the RISC action plan, has been included in the current RPF Framework Programme (2008-2010). It is directly aiming at the creation of cooperation networks between enterprises, research organisations and intermediate bodies. The successful implementation of this measure may contribute to better collaboration of public academic institutes with commercial organisations.

4.2 Assessment of strengths and weaknesses

While the system of knowledge production is weak overall, it is improving in recent years. The old and the new university combined produce more knowledge than in the past and the decision to generously fund cooperation with world-class universities may further improve results. A scheme that supports patenting is now established and may increase patenting. Cooperation with leading academic institutions (Harvard and MIT) is expected to significantly improve the country's research profile.

But weaknesses continue to be more important than strengths. While all strengths are concentrated in knowledge production, weaknesses dominate both in knowledge production and knowledge exploitation. Specialisation is not visible except in very few sectors and, with the exception of ICT, they are of a rather traditional nature. International patenting is low and further decreasing. There are no policies or intermediary organisations expected to reverse this situation and society itself is not requesting any change in that respect.

Main strengths	Main weaknesses
<ul style="list-style-type: none"> Increasing role of universities A new scheme for incentives supporting patenting International cooperation with top organisations such as Harvard University and MIT 	<ul style="list-style-type: none"> Limited specialisation in internationally growing sectors Very low share of patentable research results Very low share of international patenting No intermediary organisations No social requests for exploiting research results

4.3 Analysis of recent policy changes

Policy, which is supply-driven, has introduced a few changes to cope with challenges for improving knowledge production. The creation of the Technical University is the most prominent among them and is expected to make a difference within the next decade. Emphasis of policy on supporting FP is expected to increase competence and nurture excellence. At the same time the already mentioned cooperation with Harvard and MIT is presumed to improve the quantity and quality of research results and specialisation in knowledge areas relevant for the country and the broader region.

Changes aiming at the improvement of commercial exploitation of R&D results are adopted in the form of support for patenting. Possibly the merger of the RPF with the TPF may tackle the crucial problem of the lack of intermediary organisations helping to sensitise the business sector and share risks and benefits with it.

Challenges	Main policy changes
Improving quality and excellence of knowledge production	<ul style="list-style-type: none"> Creation of the Technical University Support of EU FP successful research teams International cooperation with Harvard and MIT
Ensuring exploitability of knowledge production	<ul style="list-style-type: none"> "Patent" scheme of the RPF Exploitability of results being one of the selection criteria of all research grants of the RPF

4.4 Assessment of policy opportunities and risks

Opportunities are limited at the moment. The two areas where policy can make a difference, if current targets are successful, relate to international cooperation. The quality of results could significantly improve when the first two joint ventures (Harvard and MIT) become fully operational; if more such joint ventures follow, then the landscape may change. At the same time the opportunity of a leading role in Eastern Mediterranean can help the exploitation of research results.

The risks are associated with the limited demand for knowledge. No matter how effective the knowledge production will become it risks to run out of steam, or to be abandoned as irrelevant for national well being, if demand does not increase and exploitation is done outside the country.

Main policy opportunities	Main policy-related risks
<ul style="list-style-type: none"> • International cooperation with top organisations for excellence in research • Increased regional cooperation with the MEDA countries 	<ul style="list-style-type: none"> • As long as demand for knowledge does not increase there will be limited production and even more limited exploitation. • Research results may be appropriated by research networks and businesses outside the country

4.5 Summary of the role of the ERA dimension

The FP is the most recognised instrument for promoting excellence in Cyprus. It is a benchmark both for researchers and policy makers, who reward success in applications to the EU. The international cooperation is a stimulus for the system and is also an incentive for diaspora scientists to repatriate.

5 - Knowledge circulation

The purpose of this chapter is to analyse and assess how the research system ensures appropriate flows and sharing of the knowledge produced. This is vital for its further use in economy and society or as the basis for subsequent advances in knowledge production. Knowledge circulation is expected to happen naturally to some extent, due to the mobility of knowledge holders, e.g. university graduates who continue working in industry, and the comparatively low cost of the reproduction of knowledge once it is codified. However, there remain three challenges related to specific barriers to this circulation, which need to be addressed by the research system in this domain:

- Facilitating knowledge circulation between university, PRO and business sectors to overcome institutional barriers;
- Profiting from access to international knowledge by reducing barriers and increasing openness; and
- Enhancing absorptive capacity of knowledge users to mediate limited firm expertise and learning capabilities.

Effective knowledge sharing is one of the main axes of the ERA green paper and significant elements of IGL 7 relate to knowledge circulation. To be effectively addressed, these require a good knowledge of the system responses to these challenges.

5.1 Analysis of system characteristics

5.1.1 Facilitating knowledge circulation between university, PRO and business sectors

In Cyprus one can observe the frequent phenomenon of parallel and independent developments of the business and the academic sector. The business structure and the recently promoted research activities in the country have not built bridges to each other yet. The market has not generated any interaction and it is a challenge for

policy to do so. Linking the two was identified as a RISC priority and addressed both for the RPF and the Ministry of Commerce, Industry and Tourism.

The RPF is encouraging interaction both explicitly and implicitly. The explicit support takes shape in the measure “Mobility”, where young researchers preparing their PhD are encouraged and supported to work in a company. Implicitly the RPF encourages university-industry cooperation in many of its programmes (such as the thematic priorities), where the lead partner is a research organisation but business companies are encouraged to form consortia and cooperate with the lead partner. In some of the calls for proposals the RPF foresees the creation of consortia.

In addition the Ministry of Commerce, Industry and Tourism has adopted two main measures to support academic spin offs. Both were adopted as a response to the RISC recommendations:

1. The first was the creation of incubators. A call for proposals was launched and four incubators were selected and financed in 2003. The initial enthusiasm was followed by complaints in the implementation: there was bureaucracy for financing the management of the incubators, the tenants did not find the expected support in their growth phase and the Ministry did not see the expected success. The business sector complains for lack of interest, strategy and continuity from the side of the Ministry. The system ran out of steam (even extreme cases of fraud and intervention of justice were reported). In order to concentrate resources for RTDI the Ministry decided to transfer responsibility for the incubators to the RPF, which is now in a process of studying the current situation and studying how to best reform it and assure effective operations.
2. The second was the planned Technology Park of Limassol. The Park was announced already five years ago and the first land expropriations have taken place. However, significant delays in the feasibility study and disagreements on the scale of the park have delayed its implementation.

More imaginative measures including reduced income taxation for researchers moving from academia to industry are now studied.

The universities themselves have research officers trying to create links to the business sector, as indicated in the initial effort of the Technical University's programme.

The business sector is less proactive. HERD financed by the business sector ranges between 1-2% depending on the year, this being less than 1/3 of the EU average, whereas GOVERD financed by the business sector is 0% compared to 6-8% of the EU average.

However, several efforts were recently undertaken by the Chamber of Commerce and Industry, which is increasingly interested in soft investments. The Chamber takes an active stance in creating an open forum as a pilot for the interaction of companies and university professors (20 pioneers from each side expressing their strengths and needs to identify common areas of interest), a Business Angels event in cooperation with the UK (5 local projects two UK business angels), a cluster event in cooperation with Italy (60 participants and presentations based on the model of Veneto), participation in the Clusters Academy in Austria, a plan for an extensive presentation of the capabilities of TEPAK. The Chamber considers that after these pilots the state should institutionalise successful pilots, but this has not been the case as yet.

Clusters were mentioned in the framework of the RISC action plan. The RPF framework programme (DESMI 2008) foresees now the allocation and provision of funds for the creation of Thematic Networks linking enterprises, research organisations and intermediate bodies. The RPF support also the development of “liaison offices” directed to improve the interaction between academic institutions and businesses. The core role of the “liaison offices” will be to facilitate the creation of networks between research organisations and business enterprises, the transfer of technology and innovation and the exploitation of research results (Erawatch Network, 2008).

5.1.2 Profiting from access to international knowledge

Because of the small size of the country and its scientific community Cyprus has emphasised access to international knowledge through bilateral and multilateral cooperation. This again was almost exclusively an initiative of the public sector, as there is hardly any FDI active in R&D. There are discussions for special income tax treatment for researchers coming from abroad, but no specific plans are in view for the adoption of such a law.

Support to European cooperation is the most important one: There are schemes supporting researchers to prepare and submit proposals to FP 7, there are matching funds for successful applicants. There are also specific incentives for civil servants in public research centres (e.g. Agrolab, Chemical Lab, Metrology) in case they succeed in FP applications. There are additional support funds for Eureka and Eurostars (Art. 169).

Bilateral cooperation supported by the RPF is institutionalised with Greece, France, Italy, Slovenia, Romania and Egypt. A Memorandum of Understanding with the UK offers incentives for research collaboration but is not institutionalised. Discussions with China did not conclude in an agreement. The selection of countries to cooperate follows political agendas rather than criteria of research complementarity. With this in mind the plans for future bilateral agreements envisage Russia and Hungary. In addition there is a political will to open up to the Eastern Mediterranean countries (for which Egypt is a pilot), like Jordan and Syria, to address the common problems of the area, namely energy, water and specific environmental issues.

Despite the small scale of the country and the limited national funding for research national teams have scored fairly well in the FPs (ICT, energy and Marie Curie fellowships), with the exception of health and the food sector, where progress is expected in the future. The lack of a Medical School in the country reduces the research potential as already noted above.

Cyprus is a model of openness of research organisations and national programmes to European and international researchers. 30% of grants received in a research proposal to the RPF can be sent to collaborating research teams outside Cyprus.

5.1.3 Absorptive capacity of knowledge users

All standard indicators suggest that absorptive capacity is very limited in Cyprus. BERD, the low share of S&E and the limited exploitability analysed above suggest it. There is one strong element that may help improve the situation in the future: the share of Youth Education Attainment Level (83.7% in 2006 according to the EIS 2007) is above the EU average (77.8%) and is increasing further. Participation in life-

long learning, one of the fundamental elements of absorptive capacity building, though still lagging behind the EU average is also hopefully catching up (from 5.9 % in 2005 to 7.1% in 2006).

The fact that the public tertiary education system in Cyprus counts less than two decades of existence has affected negatively the overall research environment in the island. The absence of Universities has largely contributed to a significant brain drain. However, recently the population having a tertiary education, has reached higher levels that the EU average.

Thus, in 2006, highly qualified S&T workers accounted for almost 19% of the total labour force in the country, which is above the EU average level (15.4%). Contrary to the Member States with the highest R&D intensities, where the highly qualified S&T human resources were mostly in the older age groups, more than 41% of the Cypriot workers of that category were in the youngest age group of 25-34 years (Key Figures 2007, European Commission).

Over the last years the role of higher and tertiary education has been widened in the country due to the EU intention to promote lifelong learning. To this end, the Open University has been established and launched its operations in 2006. The University offers undergraduate and graduate courses to those who were not able to do so in the past and runs training and vocational programmes. It also provides open and distance-learning offers to the individuals who already hold a university degree, the possibility to further their studies or even study different subjects. The Community Lifelong Learning Programme, which covers the period 2007-2013 and focuses on different stages of education and training, if successfully promoted may stimulate learning opportunities in the island and therefore contribute to better absorptive capacity of its population.

The number of programmes, which are addressed to SMEs, has increased significantly over the past years. These are partly programmes designed exclusively for SMEs and partly designed for both SMEs and research laboratories to apply individually or in cooperation. The problem remains that companies are not familiar with research activities and they are not willing to make the necessary back-office work for getting research grants. The absence of effective intermediary organisations further aggravates the problem. Overall the business sector complains against the bureaucracy and its delays.

The well-known vicious circle of underinvestment in research is very lucid in the case of Cyprus. While the government considers the business mentality as risk averse and short-term, the business sector itself is very critical to public policy and the way it tries to tackle the improvement of absorptive capacity. From its perspective the business sector (represented by the Chamber since the Industrial Federation is less preoccupied with RTDI) suggests that only limited efforts are made from the side of the public sector to really tackle technological challenges in companies. The criticism includes the bureaucratic approach, timing and emphasis on reporting for all the measures launched, which discourage firms to apply for support and improve their absorptive capacities. In particular the way incubators and support to their tenants is designed is considered as a failure, since newly created companies are left without any state intervention at the seed stage. The role of the associations is seen as a proactive approach trying to sensitise its members and point at specific initiatives to the state on how to stimulate knowledge demand.

A final instance of criticism relates to the request to the Ministry of Commerce, Industry and Tourism to fund infrastructure for Industrial Design, which was not fulfilled; a call was launched but the funding and means were inappropriate. The issue of evaluation and openness in association with the business sector is considered an important element for future success.

5.2 Assessment of strengths and weaknesses

Again weaknesses are more than strengths. The general impression is one of a country where the market has not generated economies of scope and opportunities for firms to sensitise them in the merits of technology and act as an incentive for them to invest in internal capabilities. The basic aggregates, like BERD and S&E as a share of the population demonstrate that very clearly. Public policy only partly tried to address that with incentives to industry to undertake research (which by definition improves absorptive capacity) and the building of an infrastructure of incubators and a technology park, expected to support NTBFs that would be the leverage for industrial restructuring. This policy was not well implemented and undermined the confidence of the business sector to similar policy initiatives.

Strengths include a well educated youth and measures supporting mobility and university-industry cooperation, which are gaining momentum both in terms of increasing budgets and improving management after experiences gained in the first calls for proposals. Transborder cooperation stimulated by both the FP and national programmes appears more successful.

Main strengths	Main weaknesses
<ul style="list-style-type: none"> Youth education attainment level Mobility and cooperation support measures Access to international knowledge Transborder mobility 	<ul style="list-style-type: none"> No intermediaries Neither natural clusters nor policy to create them BERD and S&E that would facilitate absorptive capacity are low Inefficient implementation of incubators and the planned technology park

5.3 Analysis of recent policy changes

Cypriot policy addresses knowledge circulation through the creation of new mechanisms, which recently materialised in the creation and functioning of the Technical University of Cyprus. The university has a mandate to work with the business sector and the community and despite its very recent start there are encouraging signs of its operations. In addition the government has realised the failure of the incubators scheme in its current form of management and has shifted responsibilities in an effort to increase its impact in terms of contribution to knowledge demand and knowledge circulation by supporting the modernisation of the business tissue.

Access to international knowledge is more successful. In addition to the traditional support for FP success the RPF has offered incentives for companies to join Eureka and Eurostars. The support and priority of company cooperation in bilateral research programmes is an effort that remains underutilised.

Challenges	Main policy changes
Facilitating knowledge circulation between university, PRO and business sectors	<ul style="list-style-type: none"> • The creation of the Technical University and its research policy • Transferring responsibility for the incubators to the RPF
Profiting from access to international knowledge	<ul style="list-style-type: none"> • Support to Eureka and Eurostars • Emphasis on business cooperation by the bilateral programmes
Absorptive capacity of knowledge users	<ul style="list-style-type: none"> • Increasing access of the business sector to the support mechanisms of the RPF

5.4 Assessment of policy opportunities and risks

The numerous changes currently planned represent a double-edged sword. On the one hand expectations are increased but on the other, if they do not materialise, they will create a further disappointment and substantiate the existing lack of trust between the main actors of the system. Expectations from the new coordination mechanism and the new, enriched structure of the RPF are high but it is not at all easy for them to reverse a stagnant and deeply rooted situation characterised by lack of interaction. At the same time the increasing support to crossborder participation risks leading to knowledge transfer from academic research in Cyprus abroad and not vice-versa, creating an unbalanced flow.

An opportunity can be seen in many individual efforts to test pilots from the RPF, the Chamber and the universities. These are expected to open up windows of opportunity that can institutionalise these experiments that will form good practices and create permanent support mechanisms in the future.

Main policy opportunities	Main policy-related risks
<ul style="list-style-type: none"> • Individual initiatives and pilots • Emphasis on the integration of research and technology policy by the reorganised RPF • Potential for new design and initiatives by the decided high level coordination mechanism • Further emphasis on cross-border cooperation • Operation of new dynamic universities as mean to attract foreign students and highly-qualified human resources • Promotion of lifelong learning through the Open University and Community Lifelong Learning Programmes 	<ul style="list-style-type: none"> • Unbalanced crossborder cooperation • Lack of response from the business sector • Inefficient implementation of expected intervention that will lead to new disappointments and lack of confidence from the side of companies

5.5 Summary of the role of the ERA dimension

The increase of international cooperation is a strategic element of national policy and the best way to pursue excellence. The internationalisation opportunities offered by the EU FP have contributed to opening up the system but in an unbalanced way, since it is almost exclusively the universities and research organisations that have been successful. Eureka constitutes the best opportunity for companies, whereas the

country is not a member of either ESA or CERN. In CERN however it has few projects of concrete collaboration.

6 - Overall assessment and conclusions

6.1 Strengths and weaknesses of research system and governance

The R&D system and its governance is characterised by major weaknesses compared with the EU average but with a strong similarity with peer countries. It is characterised by a well-known vicious circle of low demand and inadequate supply of research results. There are increasing efforts to stimulate research but for the time being they are concentrated in the support of the supply sector, since researchers respond to incentives faster than the business community. The lack of emphasis on R&D policy by the Ministry of Commerce, Industry and Tourism was and remains a major barrier.

The involvement of the social partners and the lack of public debate constitute a major weakness but there is an element of optimism seen in the redesign of governance, which was decided in 2007-2008; it is expected to produce visible results in the near future.

The real barrier is the structure of the productive sector, which is not favourable to basic research and long-term investments. Public resources for research are increasing and a 1% of GERD/GDP target is set. This remains low compared to the EU average but comparable with peer countries. The opening up of many calls for proposals to SMEs is increasing potential participation but with limited response so far. Infrastructure in the form of incubators and technology parks is implemented slowly and with limited efficiency. Efforts to support research infrastructure are increasing but still insufficient.

The lack of human resources is addressed by the creation of universities and increasing programmes for life-long learning and its certification. The lack of medical and industrial design skills constitute a major weakness. Youth education levels are the main strength of the country.

Overall coordination is limited and constitutes a main policy problem. Some efforts are undertaken recently, with the political commitment to R&D for energy, environment and water resources. In addition there is internal commitment of the Planning Bureau and the RPF to assign priorities to anticipate latent demand. Monitoring is only internal and ad hoc, there is an almost total lack of systematic tools for priority setting, evaluations, foresight exercises and technology assessments.

Positive signs for the knowledge production come from the universities and international cooperation, whereas exploitability of knowledge is much weaker than knowledge production. The limited specialisation in internationally growing sectors lies behind this features. Knowledge does not circulate between research organisations and the business sector; a vicious circle of low demand and lack of targeted supply as well as a climate of mistrust could not be reversed as yet. Neither natural clusters, nor policy to create them, nor specialised efficient intermediaries exist to act as catalysts against this situation.

Domain	Challenge	Assessment of strengths and weaknesses
Resource mobilisation	Justifying resource provision for research activities	Public resources for research are increasing and a 1% of GERD/GDP is set. This remains low compared to the EU average but comparable with peer countries. The low involvement of the social partners and the lack of public debate constitute a major weakness.
	Securing long term investment in research	The structure of the productive sector is not favourable to basic research and long-term investments. Efforts to support research infrastructure are increasing but still insufficient.
	Dealing with barriers to private R&D investment	The opening up of many calls for proposals to SMEs is increasing potential participation but with limited response. Infrastructure in the form of incubators and technology parks is implemented slowly and with limited efficiency. The lack of emphasis on R&D policy by the Ministry of Commerce, Industry and Tourism was and remains a major barrier.
	Providing qualified human resources	Youth education levels are the main strength of the country. The lack of human resources is addressed by the creation of universities and increasing programmes for life-long learning and its certification. The lack of medical and industrial design skills constitute a weakness.
Knowledge demand	Identifying the drivers of knowledge demand	Knowledge demand is very limited and is not significantly improving over time despite increasing supply measures. This comes as no surprise and is determined by the sectoral specialisation of the economy not favouring knowledge demand. Insufficient awareness of the public sector and social demand for the potential benefits of research results for social innovation aggravates the situation.
	Co-ordination and channelling knowledge demands	Overall coordination is limited and constitutes a main policy problem. Some efforts are undertaken recently, with the political commitment to energy, environment and water resources. In addition there is internal commitment in the Planning Bureau and the RPF to design priorities to anticipate latent demand.
	Monitoring of demand fulfilment	Monitoring is only internal and ad hoc, there is an almost total lack of systematic tools for priority setting, evaluations, foresight exercises and technology assessments.
Knowledge production	Ensuring quality and excellence of knowledge production	Knowledge production is limited, as expected from the size of the country and the research community. There is however an increasing role of universities and research organisations and increased funding for knowledge production. Positive signs come also from a commitment to excellence and international cooperation via the FP, international cooperation with top educational organisations from the US and bilateral research cooperation agreements. In the medium term it is expected that these efforts will improve knowledge production in terms of quantity and quality.
	Ensuring exploitability of knowledge	Exploitability of knowledge is much weaker than knowledge production. The limited specialisation in internationally growing sectors lies behind this features. A new scheme for incentives supporting patenting, a very low share of patentable research results and international patenting and the lack of social requests for exploiting research results are evidence of this weakness. The absence of efficient intermediary organisations aggravates the situation.

Domain	Challenge	Assessment of strengths and weaknesses
Knowledge circulation	Facilitating circulation between university, PRO and business sectors	Knowledge does not circulate between research organisations and the business sector; a vicious circle of low demand and lack of targeted supply as well as a climate of mistrust could not be reversed as yet. Neither natural clusters nor policy to create them, nor specialised efficient intermediaries exist to act as catalysts against this situation. The inefficient implementation of incubators and the planned technology park are reinforcing instead of reversing this vicious circle.
	Profiting from international knowledge	Access to international knowledge is good for the scientific community. Transborder mobility is high and mobility and cooperation support measures are offered to further improve it
	Enhancing absorptive capacity of knowledge users	BERD and S&E that would facilitate absorptive capacity are low. The youth education attainment level and improving life-long learning are the main strengths expected to improve absorptive capacities in the future.

6.2 Policy dynamics, opportunities and risks from the perspective of the Lisbon agenda

Policy opportunities arise mainly from three areas: the expectations and potential of change arising from the recently redesigned governance, the slow but visible change in the attitude of the Chamber of Commerce and Industry towards the role of R&D for the business sector and last but not least the opportunities offered by international cooperation.

The creation of the National Council of Research and Innovation and the Cypriot Science Council are expected to focus on research priorities more than in the past. Besides, the concentration of responsibilities for research and technology in one organisation is expected to have significant scale and scope effects. Thus the new institutional set up can redesign policy, address the deficiencies arising from the lack of a clear long-term strategy and generate a new climate of confidence leading to a virtuous circle.

At the same time the more proactive role of the Chamber of Commerce and Industry, with individual initiatives and pilots that started in the last years, is able to (simultaneously) mobilise its members and suggest new ways of policy making that are better tailored to the needs of the business sector.

Opportunities offered in the international field include the EU memberships and funding, which is already a strength of the system but creates new opportunities as it develops further, the role Cyprus can play for regional R&D cooperation in the Eastern Mediterranean and concrete joint ventures with top organisations for excellence in research (like those with MIT and Harvard universities), which, if successful, can attract more international excellent organisations into the country.

Domain	Main policy opportunities	Main policy-related risks
Resource mobilisation	EU memberships and funding MIT and Harvard joint ventures A prominent role for R&D in the Eastern Mediterranean.	Public funding is still among the lowest in the EU New incentives do not mobilise sufficient business resources
Knowledge demand	The creation of the National Council of Research and Innovation and the Cypriot Science Council are expected to focus research priorities more than in the past. A more proactive role of the Chamber of Commerce and Industry. Leading role in R&D within the South-Eastern Mediterranean New graduates of Engineering School of the University of Cyprus and future graduates of recently established Technological University.	The organisation of the public sector without any institutionalised role of the business community replicates the situation and marginalises the private sector
Knowledge production	International cooperation with top organisations for excellence in research Increased regional cooperation.	As long as demand for knowledge does not increase there will be limited production and even more limited exploitation.
Knowledge circulation	Individual initiatives and pilots Emphasis on the integration of research and technology policy by the reorganised RPF Potential for new design and initiatives by the decided high level coordination mechanism Further emphasis on cross-border cooperation Operation of new dynamic universities as mean to attract foreign students and highly-qualified human resources Promotion of lifelong learning through the Open University and Community Lifelong Learning Programmes	Unbalanced crossborder cooperation Lack of response from the business sector Inefficient implementation of expected intervention that will lead to new disappointments and lack of confidence from the side of companies

6.3 System and policy dynamics from the perspective of the ERA

International collaboration is crucial for small countries, which do not have the resources for a stand-alone research policy. In that sense the role of the ERA is crucial for Cyprus. The size of the country does not allow any scale for research, which can generate either sufficient reward to specialisation or policy knowledge.

The ERA has contributed to the design and implementation of the national R&D policy through the Lisbon agenda, which is a guideline taken very seriously by the national administration, but also through the participation to many ERAnets, the Open Method of Coordination and CREST. Cyprus is participating to few ERAnets and had declared its interest to join some of the OMC groups of CREST. While all these mechanisms are of interest and constitute a good background for policy

learning, the very small number of people working in research policy in the country is limiting the potential to actively participate and benefit from these exercises. Nevertheless, the national administration has benefited significantly from these opportunities and has practically designed the national system in compliance with the EU guidelines and opportunities. In the context of the ERA researchers mobility is high in Cyprus and further simulated by support schemes.

The FP has been a rich source of funding and more than funding it has offered a potential for research collaborations that the Cypriot researchers were lacking in the past. The FP is the most recognised instrument for promoting excellence in Cyprus. It is a benchmark both for researchers and policy makers, who reward success in applications to the EU. The international cooperation is a stimulus for the system and is also an incentive for diaspora scientists to repatriate. Many national policy decisions and support schemes are adopted in view of a better participation to the FP or as an imitation to its procedures. By the same token Eureka is considered as an excellent opportunity for improving competitiveness for the most advanced companies in Cyprus.

A very interesting debate regarding the role of the FP is currently under way regarding its complementarity/competition with national R&D support programmes: it seems that national research teams prefer applying to the national programmes as they are less competitive and less demanding. However, public policy considers this as a negative feature because it limits the potential of international excellence. The basic point of this approach is that in a small country, with a small scientific community, increased national spending may contribute to increasing research activities at the cost of quality and internationalisation. This should not be interpreted as a suggestion for reducing national funding; there is undoubtedly a need for conducting research that is motivated by national concerns. A very careful design of increasing national funding is necessary to assure the support of national needs without reducing the drive to compete for international funding and cooperation.

The ERA appears less relevant for industrial R&D; structural funds are used for the basic infrastructure (incubators and a planned technology park) but the Ministry of Commerce, Industry and Tourism has been less active in exploiting European opportunities and interacting with the EU.

The increase of international cooperation beyond the EU (and stimulated by the ERA) is a strategic element of national policy and the best way to pursue excellence. The internationalisation opportunities offered by the EU have contributed to opening up the system but in an unbalanced way, since it is almost exclusively the universities and research organisations that have been successful.

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List of Abbreviations

ARI	Agriculture Research Institute
BERD	Business Enterprise Expenditure on R&D
CERN	European Council for Nuclear research
CI	Cyprus Institute
CSC	Cyprus Scientific Council
CSRED	Centre of Scientific Research Evaluation Development
CYS	Cyprus Organisation for Standardisation
EIS	European Innovation Scoreboard
EPO	European Patent Office
ERA	European Research Area
ESA	European Space Agency
KEEI	Cypriot Research and Education Foundation
FP	Framework Programme
ICT	Information Communication Technology
GBAORD	Government Budget Appropriations or Outlays on R&D
GERD	Gross Domestic Expenditure on R&D
GOVERD	Government Intramural Expenditure on R&D
HEI	Higher Education Institutions
HERD	Higher Education Expenditure on R&D
HRDA	Human Resource Development Authority of Cyprus
OECD	Organisation for Economic Co-operation and Development

PNP	Private non-profit
R&D	Research and Development
RIPF	Research and Innovation Promotion Foundation
RPF	Research Promotion Foundation
RTDI	Research Technology Development Innovation
S&E	Science and Engineering
SME	Small and Medium Sized Enterprise
TEPAK	Technological University of Cyprus

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Abstract

The main objective of ERAWATCH country reports 2008 is to characterise and assess the performance of national research systems and related policies in a structured manner that is comparable across countries. The reports are produced for each EU Member State to support the mutual learning process and the monitoring of Member States' efforts by DG Research in the context of the Lisbon Strategy and the European Research Area. In order to do so, the system analysis focuses on key processes relevant for system performance. Four policy-relevant domains of the research system are distinguished, namely resource mobilisation, knowledge demand, knowledge production and knowledge circulation. The reports are based on a synthesis of information from the ERAWATCH Research Inventory and other important available information sources. This report encompasses an analysis of the research system and policies in Cyprus.

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